The big picture

? Subtopic question(s)

During this subtopic, you will be working towards answering the following subtopic questions:

- How do different research methods contribute to the understanding of causal elements of human behaviour?
- When can we say something causes something else?
- How do ethical frameworks guide research in psychology?

The guiding questions in each section help to guide you towards answering the subtopic question(s) at the end of the subtopic. The subtopic questions require you to pull together your knowledge and skills from different sections, to see the bigger picture and to build your conceptual understanding.

A university student notices that their Psych 100 lecture is better attended the day after the university basketball team's win than the day after a loss or no game. Amazed by the insight, the student runs back to their room to write a well-articulated essay outlining their behavioural theory. They call it the 'Winning Theory.'

Their theory puts forward the belief that attendance in university classes is based upon a student's internal feelings of engagement with the broader university community. Their hypothesis is that when a sports team is victorious, student engagement increases through positive association, leading to increased class attendance.

The following week, the student collected data on attendance in their psychology lecture. They collected data on the day after the university's athletic team's win and on a day after there was no game (**Figure 1**).

Overview (/study/ap new/sid-540-cid-763690/

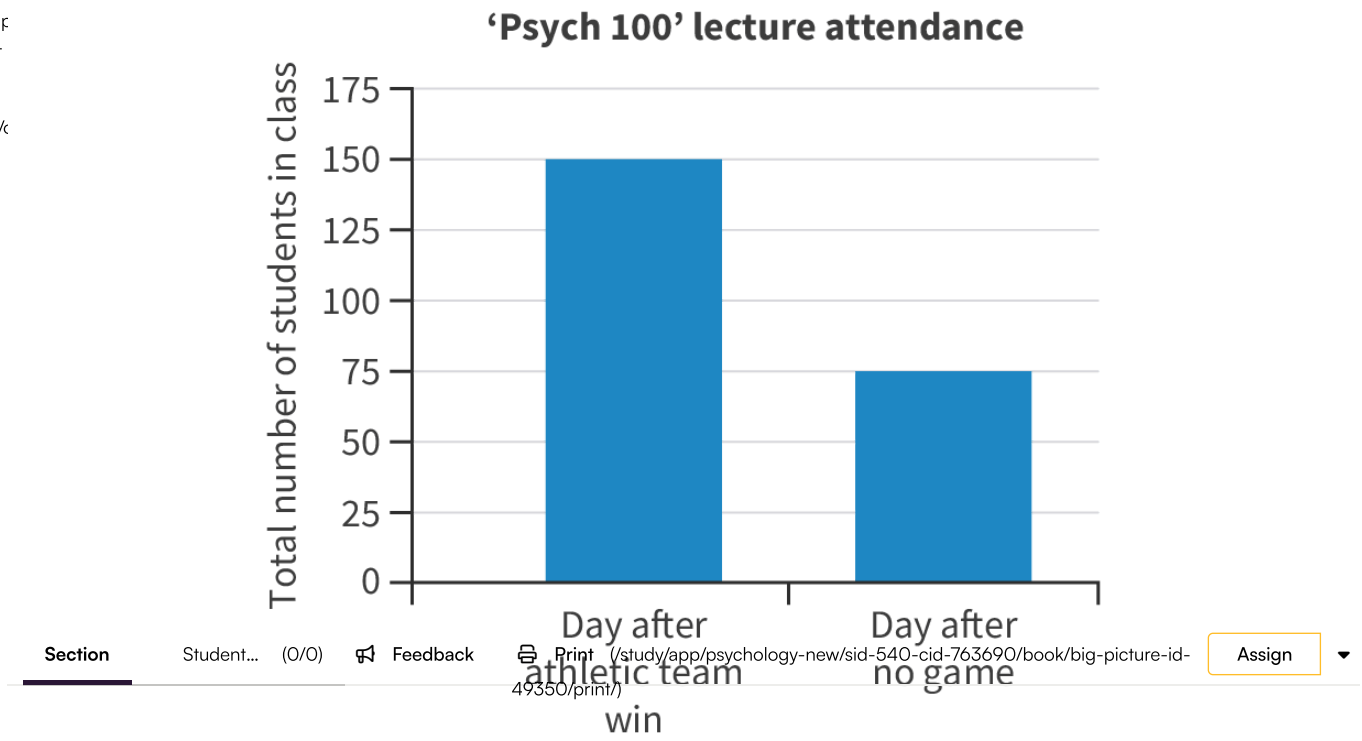

Figure 1. Bar chart showing data on class attendance the day after a university athletic team’s win and the day after no game.

More information for figure 1

Bar chart with title Psych 100 lecture attendance and two bars. The vertical axis is labelled Total number of students in class. The bar labelled Day after athletic team win shows that 150 students were in class that day. The bar labelled Day after no game shows that 75 students were in class that day.

Based on the data, the student concluded that universities should do all they can to promote athletic victories, which will increase cognitive engagement, class attendance and student performance.

Has this student proven their theory and hypothesis?

Your answer is likely to be ‘maybe, but probably not.’ However, before further engaging with this question, you must understand how psychological theories and hypotheses are validated.

This subtopic will provide you with the skills and knowledge necessary to understand the role of different research approaches and methodologies in validating or invalidating psychological findings, conclusions and theories.

Making connections

The content of this foundational topic has many conceptual connections with the entirety of the course. Therefore, you should aim to finish this topic with a confident understanding of each of the guiding questions. In addition, you may find it helpful to return to this topic while working on your class practicals.

Previous section(/study/app/psychology-new/sid-540-cid-763690/book/sensitive-content-id-50835/review/) Next section (/study/app/psycholog

Student view

Psychology as a science

A-2: Causality

Teacher instructions

Goal

To discuss how experimental methodology contributes to establishing causality.

Facilitation guidance

It is very important to impress upon students that psychology uses the scientific method for knowledge construction. Students need to understand the scientific method alongside the 'habits of mind' that it requires and encourages.

This section introduces the concept of correlation vs. causation, and understanding the difference between the two is an important takeaway for students. The concept is then discussed in greater detail in **section 1.1.4** (/study/app/psychology-new/sid-540-cid-763690/book/what-is-the-difference-between-causation-and-correlation-id-49354/).

? Guiding question(s)

In this subtopic, you will think about the question, '**How do different research methods contribute to the understanding of causal elements of human behaviour?**' This section will help you to make an informed response by working through the following guiding question:

- What makes something a science?

One major concept within this section is the difference between causality and correlation. Another is that there are many research methods that psychologists utilise in order to develop and refine scientific theories. Each has its own strengths and limitations.

> Keep the guiding question in mind as you progress through this section. The guiding question(s) build into the subtopic question(s). You will return to the subtopic question(s) at the end of each subtopic. The subtopic question(s) require you to pull together your knowledge and skills from different sections, to see the bigger picture and to build your conceptual understanding.

What makes something a science?

Given the claim, '*You should wait 30 minutes or more before swimming after you eat*,' which of the following pieces of evidence would be the most valid in support?

A. Your grandmother told you.
B. You know someone who once went swimming 10 minutes after they ate, and they got a leg cramp.
C. A laboratory experiment found that muscles have serious difficulty contracting within 30 minutes of eating.

Option C is the most valid form of evidence to support the claim. The question, of course, is why? Why do we give such a high level of validity and power to scientific evidence?

Overview (/study/app/psychology-new/sid-540-cid-763690/c

What is science?

Karl Popper (https://plato.stanford.edu/entries/popper/), a significantly influential 20th-century Austrian philosopher of science, defined science through his Falsification Principle (**Video 1**). This principle states that a theory is scientific if, and only if, it can be falsified (proved to be false). If a theory or claim cannot be falsified, Popper would argue that it is not scientific but rather philosophical.

Video 1. Karl Popper's Falsification Theory.

Given this information, is the theory put forth by the student in the example from **section 1.1.0** (/study/app/psychology-new/sid-540-cid-763690/book/big-picture-id-49350/) scientific?

While falsifiability of claims isn't the *only* way to establish whether a discipline is scientific, it is a widely accepted framework. Other elements that make something a science include:

- the use of experiments and the scientific method for knowledge construction
- taking a scientific perspective towards problems that the discipline seeks to solve (**Figure 1**).

Taking a scientific stance means viewing problems through the framework of using data to prove or disprove claims.

Student view

Overview (/study/ap new/sid-540-cid-763690/c

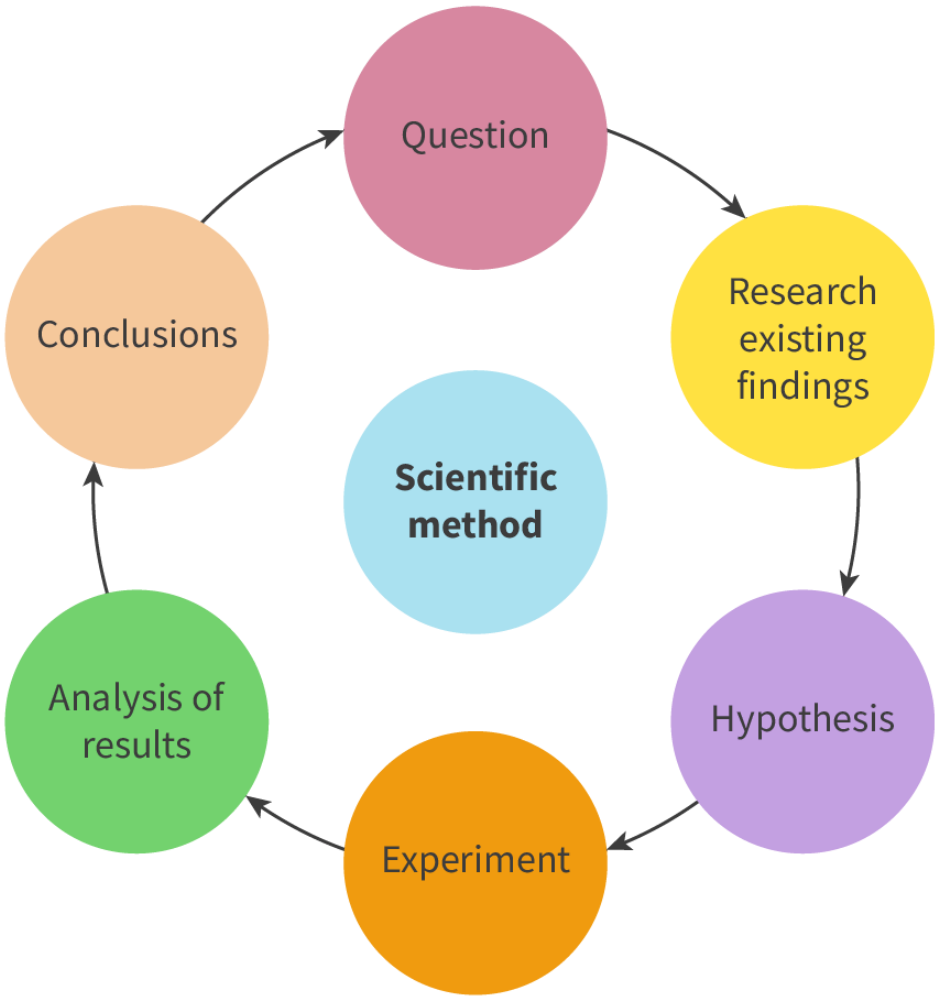

Figure 1. Use of the scientific method in psychology is what makes psychology a science.

Why does this matter?

The goal of psychology is to enhance individual and collective well-being. This means understanding the following:

1. What factors contribute to a given human behaviour?
2. Which of these factors are controllable or changeable?
3. What are the most appropriate and effective mechanisms for creating change regarding these factors?

The scope of psychological investigations includes everything from the most effective way to study for an exam to legal rulings, preventing suicide and the best way to raise a child. That means the stakes are high for developing and ensuring valid, reliable psychological findings and theories.

Perspective lens

Biological, cognitive and sociocultural approaches

These 'perspective lens' boxes will appear throughout this book. Their purpose is to highlight connections between the IB DP Psychology syllabus content and the three main perspectives (also referred to as approaches) in psychology:

- biological
- cognitive
- sociocultural

Student view

Overview (/study/app/psychology-new/sid-540-cid-763690/)

Each of these three perspectives provides a framework through which psychologists and researchers examine human behaviour. Take, for example, the behaviour of human attraction and how it might be examined differently from these three perspectives.

- Examining human attraction from a **biological** perspective might lead to questions about, and investigations into, the relationship between hormones and attraction or the role of dopamine in romantic relationships.
- Examining human attraction from a **cognitive** perspective might lead to questions about, and investigations into, the impact of past relationships on current perceptions of attraction or how first impressions impact perceptions of attractiveness.
- Examining human attraction from a **sociocultural** perspective might lead to questions about, and investigations into, changing concepts of attractiveness over time or the difference in beauty standards across cultures.

Reflection questions

1. Why is it useful to examine a given behaviour from one of the three major psychological perspectives?
2. Consider a behaviour other than human attraction and develop three different research questions, one from each perspective, that would investigate an aspect of that behaviour.

It is crucial that psychological findings are considered valid and epistemologically powerful because the implications of the findings and theories are so important. That is not to say that psychological theories should not be critiqued or falsified as new evidence emerges. As Popper points out, the goal of a scientist should be falsification because the pursuit of falsification brings increased knowledge.

Theory of knowledge

What is quality evidence?

What is it about the scientific method that makes scientific evidence more persuasive? Why do the methodologies employed by the natural sciences, such as experiment, inductive research and replication, carry such a high level of epistemological weight?

Reflection questions

1. Do scientific methods of knowledge construction elicit more valid knowledge than non-scientific methods of knowledge construction?
2. In what ways might scientific methods of knowledge construction be limited?

The following research methods are used by psychologists for knowledge construction:

- true experiment
- quasi-experiment
- survey
- case study
- naturalistic observation
- interview

These methods will be covered in greater detail in **section 1.1.2** (/study/app/psychology-new/sid-540-cid-763690/book/what-are-the-tools-of-the-psychologist-id-49352/), including a discussion of each method's strengths and limitations. However, the research method that most legitimises psychology as a scientific discipline is the true experiment.

Student view

Overview (/study/app/psychology-new/sid-540-cid-763690/c

There are different types of experiments. It is likely that, when you hear the word 'experiment,' you think of a 'true experiment.' The true experiment is of particular importance and value to all scientists (including psychologists) because it is the only research method that can establish a true causal relationship between two variables.

True experiments do this by isolating the independent variable and the dependent variable. Then, scientists measure whether the independent variable has a causal effect on the dependent variable. They do this by creating an experiment in which participants are randomly assigned to either the control condition or the experimental condition. The independent variable is then changed in the experimental condition but not in the control condition, and the dependent variable is measured and analysed for significance. Through this research methodology, scientists can establish causation.

Concept

Causality

Causality explores the connections between events. Reflecting on its nature helps us understand how and why events are linked.

Reflection questions

1. What does it mean for something to *cause* something else?
2. Is this definition context-dependent?

Causation vs. correlation

'Correlation' means the *relationship* between two variables, whereas causation is a direct *causal* link between two variables. For example, the variables of height (independent variable) and success at basketball (dependent variable) are correlated. There is a relationship between being very tall and being successful at basketball. Evidence exists to support this correlational relationship. The average height of an NBA basketball player is 198 cm (6'6"). This is in stark contrast with the male global average height of 170 cm (5'7").

Does this mean that being very tall *causes* you to be good at basketball?

Of course not.

There are many other factors that contribute to basketball skill and success. These factors that may also contribute to an outcome are referred to as confounding variables. You cannot say that being tall causes someone to be good at basketball because too many confounding variables contribute to the outcome of basketball excellence. The hypothesis that '*being tall causes someone to be good at basketball*' is indeed scientific because it is falsifiable and, therefore, qualifies as a scientific claim based on Popper's framework.

While this particular example of correlation vs. causation is clear, scientists often mistake correlation for causation. This is why laboratory experiments are such powerful research tools.

It must be said that laboratory experiments involving humans are much more complex than laboratory experiments involving non-human animals or phenomena. Therefore, truly eliminating all confounding variables from a given laboratory experiment on humans is incredibly challenging.

Student view

Overview (/study/app/psychology-new/sid-540-cid-763690/c

Nonetheless, laboratory experiments remain the gold standard for establishing causality between two variables. The use of laboratory experiments, alongside a scientific approach to thinking about psychological phenomena and behaviour, is what makes psychology a science.

Teacher instructions

Goal

To plan an experiment and apply their knowledge of the scientific method.

Facilitation guidance

The goal of this activity is for students to practise structuring an experiment and considering possible confounding variables that could affect the results. This is very early in the course, and therefore, you should not expect your students to structure a perfect laboratory experiment. This is simply an activity to get them to begin their journey towards fluency in psychological research. The emphasis here is getting students to consider as many confounds as possible and brainstorm possible ways to minimise those confounds.

This activity could be done individually or in small groups.

Activity

IB learner profile attribute: Thinker

Approaches to learning: Thinking skills

Time required to complete activity: 30 minutes

Activity type: Individual/Group

Application of knowledge: Designing a laboratory experiment

Concept application: Measurement

Your task is to design a laboratory experiment to test a hypothesis that, ‘listening to classical music while reading a psychology text results in greater retention of information.’

Your design must outline a brief description of the structure and procedure of your laboratory experiment, and answer the following questions:

1. What is the dependent variable? How will you define and measure this variable?
2. What possible confounding variables exist that could contribute to how well someone recalls information from a text? This should be a list and can be in bullet-point form.
3. Is there any way you could structure your experiment or select your participants to minimise one or more of the confounding variables in your list?
4. An experiment is the only research method that is said to be able to establish true cause and effect. Explain why this is.

Learning outcomes

By the end of this section, you should be able to:

- Discuss how experimental methodology contributes to establishing causality.

Student view

Overview (/study/app/psychology-new/sid-540-cid-763690/c

3 section questions

Question 1

SL HL Difficulty:

This Austrian philosopher believed a claim is only scientific if it can be falsified.

Karl Popper ✓

Accepted answers
Karl Popper

Also accepted
Popper, Carl Popper, Karl Popper

Explanation
Karl Popper believed that, for a claim to be considered scientific, it must be falsifiable. For example, the claim, 'my cat talks to other animals when no humans are watching' is not falsifiable because the statement does not allow for measurement and verification or falsification.

Question 2

SL HL Difficulty:

This is the only research method that can establish causation.

1 True experiment ✓

2 Quasi-experiment

3 Case study

4 Survey

Explanation
Because true experiments attempt to isolate two variables and randomly assign participants to conditions, they can establish causation.

Question 3

SL HL Difficulty:

This is the variable that is measured during an experiment.

Dependent ✓

Accepted answers
Dependent

Also accepted
Dependent variable, Dependant, Dependant variable

Explanation
An experiment has an independent and a dependent variable. The dependent variable is measured, while the independent variable changes between two conditions.

Student view

Previous section(/study/app/psychology-new/sid-540-cid-763690/book/big-picture-id-49350/review/) Next section (/study/app/psychology-new

What are the tools of the psychologist?

A-4: Measurement C-4-1: Differentiate between the different types of research methods.

C-4-2: Identify the appropriate selection of research methodology to investigate a psychological question.

C-4-3: Describe the advantages and disadvantages of different research methodologies.

Teacher instructions

Learning outcomes

- Differentiate between the different types of research methods.
- Identify the appropriate selection of research methodology to investigate a psychological question.
- Describe the advantages and disadvantages of different research methodologies.
- Discuss how different research methodologies influence measurement.

Facilitation guidance

This section contains important foundational knowledge for your students, including an understanding of the strengths and limitations of different research methodologies, an understanding of qualitative vs. quantitative research and data, as well as methodological-based critical thinking.

? Guiding question(s)

In this subtopic, you are thinking about the question, '**How do different research methods contribute to the understanding of causal elements of human behaviour?**' This section will help you make an informed response by working through the following guiding question:

- What research methodologies do psychologists employ?

By the end of this section, you should clearly understand the strengths and limitations of different research methods and the type of data these methods produce.

> Keep the guiding question in mind as you progress through this section. The guiding question(s) build into the subtopic question(s). You will return to the subtopic question(s) at the end of each subtopic. The subtopic question(s) require you to pull together your knowledge and skills from different sections, to see the bigger picture and to build your conceptual understanding.

Research methods

Psychologists and neuroscientists employ a variety of research methodologies. They are outlined in the following tables. **Table 1** identifies quantitative research methods, while **Table 2** provides details of qualitative research methods. Both tables include examples of strengths and limitations.

Perspective lens

Biological, cognitive and sociocultural approaches

Overview (/study/app/psychology-new/sid-540-cid-763690/c

The approach through which a researcher examines behaviour determines the questions of investigation that are asked. Different research methods therefore have different degrees of usefulness and applicability in each of the three main perspectives (approaches).

Reflection question

1. Use **Table 1** to consider which research methods would be most useful from each of the three perspectives: biological, cognitive and sociocultural. For example, why would naturalistic observation be more useful for examining behaviour from a sociocultural perspective than from a biological perspective?

These methods create different types of data: quantitative data or qualitative data. As you will explore further in **section 1.1.3** (/study/app/psychology-new/sid-540-cid-763690/book/how-can-we-know-if-a-psychological-theory-or-claim-is-valid-id-49353/), both types of data can be useful in the process of validating or falsifying a psychological claim or theory. It is important, therefore, to understand which type of research method creates which type of data so that you can fully comprehend the value and limitations of that data.

Table 1. Quantitative research methods.

Research method	Strengths and limitations
True experiment A controlled experiment where researchers manipulate an independent variable to observe its impact on a dependent variable, using random allocation of participants to conditions to ensure causation. Laboratory-based true experiments seek to reduce as many confounding variables as possible. You will learn more about true experiments in subtopic 5.3 (/study/app/psychology-new/sid-540-cid-763690/book/the-big-picture-id-49515/).	**Strengths** • Can establish causation between two variables • Reduces confounding variables • Easily replicated **Limitations** • Can lack ecological validity due to the artificial nature of the laboratory setting • Limited generalisability due to the specificity of the investigation • Due to participant effects, results may be artificial (participants may behave differently in a laboratory setting) • May lead to false reductionist conclusions • Unknown confounding variables may affect the results • Participant bias may create confounds
Quasi-experiment A research method that resembles a true experiment but lacks random assignment of participants to different conditions. In a true experiment, researchers randomly assign participants to different conditions. In a quasi-experiment, researchers often have limited control over participant assignment, meaning it is unable to establish a cause-and-effect relationship. You will learn more about quasi-experiments in subtopic 5.3 (/study/app/psychology-new/sid-540-cid-763690/book/the-big-picture-id-49515/).	**Strengths** • Can investigate relationships between variables that would otherwise be ethically impermissible or too challenging • Can investigate unique populations • High ecological validity **Limitations** • Cannot establish a cause-and-effect relationship • Unknown confounds can affect the results • Can be difficult to replicate in other populations

Student view

Overview (/study/ap new/sid-540-cid-763690/c

Research method	Strengths and limitations
Survey A standardised set of questions that is given to participants in a research study. You will learn more about surveys in subtopic 4.3 (/study/app/psychology-new/sid-540-cid-763690/book/the-big-picture-id-49147/).	**Strengths** • Can collect a lot of data • Easy to conduct • Easy to replicate • Easy to do across different populations • Cheap to execute **Limitations** • Cannot establish cause-and-effect relationship • Responder bias can affect results

Meta-analysis
 	
A study of studies. The researcher(s) will gather a large collection of studies with the same or very similar aims for the purpose of establishing more comprehensive and precise insight.
 	
In doing so, the researchers will establish criteria for inclusion of certain studies in the meta-analysis. Generally, researchers conducting a meta-analysis will not include studies that are considered poorly constructed or exceptionally biased in some way.
	Strengths
	
	• Can increase the validity of a psychological finding by combining many findings
	  ◦ Increased statistical power
	  ◦ Increased generalisability
	  ◦ Increased methodological rigour
	• Can invalidate the validity of a psychological claim by combining many findings
	• Establishes an emphasis on methodological validity by removing poorly constructed studies
	• Can help researchers identify patterns and possible future research avenues
	
	Limitations
	
	• Built-in limitations and biases of the original studies remain in the meta-analysis
	• Limited to investigating research questions that have already been investigated
	• Cannot establish a cause-and-effect relationship between two variables

Table 2. Qualitative research methods.

Research method	Strengths and limitations
Case study An in-depth investigation into a single case or example. Case studies in psychology usually focus on an individual. However, they could also include investigations into an institution or business. Case studies can use both qualitative and quantitative research methods.	**Strengths** • Allows for in-depth investigation of rare or exceptional phenomena • High ecological validity **Limitations** • Can lack generalisability due to the specificity of the case • Not easily replicated

Student view

Overview (/study/ap new/sid-540-cid-763690/c

Research method	Strengths and limitations
Observation There are different types of observation that are detailed in section 3.3.1 (/study/app/psychology-new/sid-540-cid-763690/book/how-are-observations-used-to-investigate-human-behaviour-id-50503/). These include: • naturalistic observation • controlled observation • overt observation • covert observation • participant observation • non-participant observation Generally speaking, observations involve a researcher observing participants either secretly (covert observation) or openly (overt observation), looking for certain behaviours. The researcher then takes notes regarding the type and frequency of behaviours they observe. Observations can occur in a natural setting (naturalistic observation) or they can occur in a controlled laboratory setting (controlled observation). In some cases, the researcher will even participate in the group in which they are observing (participant observation).	**Strengths** • High ecological validity (naturalistic observations) as a result of the natural context and covert nature • Focused on observable behaviour **Limitations** • Overt observations can result in participant effects • Participant observations can introduce researcher bias • Observer effect • Limited generalisability • Time consuming • Descriptive rather than explanatory
Interview The researcher asks questions of participants. The type of interview can vary: • Structured interviews give the respondent the least freedom in their answers. • Semi-structured interviews give the respondent a medium amount of freedom in their answers. • Focus groups are where a small group of participants engage in a discussion led by a researcher to gather diverse opinions and insights on a particular topic. You will learn more about interviews in subtopic 2.4 (/study/app/psychology-new/sid-540-cid-763690/book/the-big-picture-id-49465/).	**Strengths** • In-depth data • Allow for nuanced exploration of complex issues • Detailed qualitative data • Participant centred **Limitations** • Time consuming • Possible interviewer bias • Difficult to standardise • Limited to verbal responses

Table 3 summarises the research methods used in psychology.

Table 3. Research methods in Psychology.

Quantitative research methods	Qualitative research methods	Can be either or both quantitative and qualitative
true experiment	interview	case study
quasi-experiment	survey (narrative response)	observation
survey	qualitative observation	survey
quantitative observation		

Student view

Overview (/study/app/psychology-new/sid-540-cid-763690/c

Concept

Measurement

Measurement is central to psychological research, yet quantifying human behaviour poses unique challenges. Exploring how research methods align with Karl Popper's definition of science offers insights into the scientific rigour of psychology.

Reflection questions

1. How do the different research methods in psychology align the discipline with Karl Popper's definition of science?
2. Why is measuring human behaviour challenging?

Teacher instructions

Goal

To apply knowledge of different research methods to investigate a specific aim.

Secondary goal

To appreciate the strengths and limitations of different research methodologies relative to the aims of an investigation.

Facilitation guidance

For this activity, students are purposely prompted with the phrase, 'quality level of your school' so that they must wrestle with operationally defining 'quality' and how they will apply a research method to get at an element of that word as they define it.

You should ensure that students know this nuance and complexity and use it as a springboard for critical thinking about research method strengths and limitations. In particular, connect this activity to the concept of measurement and the question, 'How is measurement influenced by different research methodologies?'

The activity in this section can help your students apply their knowledge and skills. You are also encouraged to design and implement similar activities to ensure all students are proficient in this regard.

Activity

IB learner profile attribute: Knowledgeable

Approaches to learning: Thinking skills

Time required to complete activity: 30—40 minutes

Activity type: Individual

Application of knowledge: Research methods

You are working as part of a research team to investigate the quality level of your school. You and your team must design two different investigations using two different research methods. Report your choices and rationale using the following framework:

Research method 1

- Aim of investigation (what do you hope to achieve):
- (**Concept application: measurement**) Why this research method is best suited to meet your aim:
- Short (2—4 sentences) description of your procedure:

Student view

Overview (/study/ap new/sid-540-cid-763690/c

Research method 2

- Aim of investigation (what do you hope to achieve):
- (**Concept application: measurement**) Why this research method is best suited to meet your aim:
- Short (2—4 sentences) description of your procedure:

Learning outcomes

By the end of this section, you should be able to:

- Differentiate between the different types of research methods.
- Identify the appropriate selection of research methodology to investigate a psychological question.
- Describe the advantages and disadvantages of different research methodologies.
- Discuss how different research methodologies influence measurement.

3 section questions

Question 1

SL HL Difficulty:

An interview is an example of a 1 qualitative ✓ research method because it creates non-numerical data.

Accepted answers and explanation

#1 qualitative

General explanation

Qualitative data is non-numerical and captured via language-based descriptions of a participant's behaviour or testimony.

Question 2

SL HL Difficulty:

Because participants are not randomly allocated to the experimental and control conditions, a 1 quasi ✓ -experiment cannot establish cause and effect.

Accepted answers and explanation

#1 quasi

General explanation

A quasi-experiment is a research method that resembles a true experiment but lacks random assignment of participants to different conditions. In a true experiment, researchers randomly assign participants to different conditions. In a quasi-experiment, researchers often have limited control over participant assignment, meaning it is unable to establish a cause-and-effect relationship.

Question 3

SL HL Difficulty:

Which of the following is a disadvantage of the survey research method?

1 It cannot establish a cause-and-effect relationship. ✓

Student view

Overview (/study/app/psychology-new/sid-540-cid-763690/c

2 The amount of data that can be collected is limited.

3 It is hard to conduct and, therefore, expensive.

4 It is difficult to replicate in other populations.

Explanation

Surveys are a popular research method for certain types of aims because they are easy and inexpensive to conduct, can collect a lot of data, and are easy to replicate.

However, they do not establish cause and effect as they do not isolate variables, randomly allocate participants or have a control condition.

Previous section(/study/app/psychology-new/sid-540-cid-763690/book/psychology-as-a-science-id-49351/review/) Next section (/study/app/psy

Student view

How can you know if a psychological theory or claim is valid?

A-1: Bias C-4-2: Identify the appropriate selection of research methodology to investigate a psychological question.

C-4-3: Describe the advantages and disadvantages of different research methodologies. C-4-11: Identify the steps to ensuring credibility in research.

Teacher instructions

Learning outcomes

- Select the appropriate research methodology to investigate a psychological question.
- Describe the advantages and disadvantages of different research methodologies.
- Discuss how research triangulation can reduce bias.
- Identify the steps to ensuring credibility in research.

Facilitation guidance

This section focuses on the concepts of replication and triangulation, and the strengths that both bring to the research and theoretical process.

This section will focus on two main types of triangulation:

- Data triangulation: the use of a variety of data sources, including time, space and persons, in a study.
- Methodological triangulation: the use of multiple methods to study a situation or phenomenon (for example, qualitative and quantitative data).

Your goal should be to have students appreciate the value of data triangulation and replication, and the use of a variety of research methods to strengthen (or refute) a psychological theory. Activities that require the identification of a research methodology for an authentic context and subsequent investigation design are of particular importance.

? Guiding question(s)

In this subtopic, you are thinking about the question, '**How do different research methods contribute to the understanding of causal elements of human behaviour?**' This section will help you to make an informed response by working through the following guiding question:

- What is the role of research triangulation in psychology?

By the end of this section, you should understand how researchers use the practice of triangulation to reduce bias and strengthen evidence in support of psychological claims and theories.

> Keep the guiding question in mind as you progress through this section. The guiding question(s) build into the subtopic question(s). You will return to the subtopic question(s) at the end of each subtopic. The subtopic question(s) require you to pull together your knowledge and skills from different sections, to see the bigger picture and to build your conceptual understanding.

Overview (/study/app/psychology-new/sid-540-cid-763690/c

Increasing the validity of results

After learning about the many limitations of research methods used by psychologists and cognitive scientists, you may wonder how psychological theories and claims are ever validated.

It is challenging but psychological researchers take the following steps (when possible) to increase the validity (accuracy) of their results.

Randomness

Psychologists use random sampling and random assignment to reduce confounds and biases that could result from choosing participants from one group of people or purposefully assigning participants to each experimental condition. Randomness does not eliminate sampling or assignment biases, but it drastically reduces them.

Blindness

When research is carried out blind, researchers do not know the true aim of the investigation. For example, a researcher assigned to observe the behaviour of sixth-grade students during a physical education lesson would be ‘blind’ if they only knew the behaviours they should be looking for and not the aim or hypothesis of the investigation. Participants are often also ‘blind,’ meaning they do not know the aim or hypothesis of the investigation. When both the researcher and the participant are ignorant of the true aim and hypothesis, the investigation is said to be double blind.

Large sample size

If you flip a coin three times in a row and get all heads, you may be tempted to conclude that the coin does not have a tails side! Of course, if you were to flip the coin 1000 times, there would be an even distribution of heads and tails, and you would no longer be tempted to come to your previously false conclusion. This demonstrates the relationship between large numbers and statistical validity. If all other factors are the same, a research study with 100 participants is more valid than one with 10 participants. As the number of participants increases, so too does the study’s statistical power.

Internal validity

This term refers to the extent that a measurement conducted within a study accurately measures or assesses what it claims to measure. Internal validity can be increased by engaging in some of the practices mentioned above: controlling for confounds, blinding researchers and participants, standardising procedures and taking additional steps to minimise elements that could reduce the strength or clarity of relationship between the independent and dependent variables.

Content validity

Content validity refers to the extent to which an investigation or tool measures all appropriate components of a given phenomenon. An example of this might be a tool that measures stress responses of high school students but only focuses on behavioural elements (such as changes in sleep or eating patterns) and does not address affective (mood) elements. Another example would be a test designed to measure "intelligence" that only asks math questions may not actually be measuring "intelligence" broadly but instead measuring math skills. A test with higher construct validity would include questions that address a wide variety of intelligence typesIt is important to ensure that any measurement tool or investigation measures the full scope of the phenomenon.

Student view

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Construct Validity

Construct validity refers to the extent to which an investigation or study actually measures the underlying theory that it claims to measure. For example an investigation into school stress should be compared with other measures of stress and there should be a pattern. For example the instrument you design to measure school stress should be supported by other well established measurement tools. Additionally, your investigation should align with existing knowledge or patterns of school stress.

Face validity

Face validity refers to the extent to which an investigation seems (on the surface) to measure what it is claiming to measure. For example, an investigation on teenage stress should ask questions about stressors and stress responses; it should not ask questions about favourite foods or holiday destinations. Increasing face validity can increase the extent to which participants feel the investigation or measurement tool is valid.

External validity

External validity is also sometimes referred to as 'ecological validity' and describes the extent to which a research finding may be applied to a different setting, such as the 'real' world or a different population. True laboratory experiments can have varying degrees of external validity; a true experiment does not by default have low ecological validity. For example, the laboratory experiment you designed in **section 1.1.1** (/study/app/psychology-new/sid-540-cid-763690/book/psychology-as-a-science-id-49351/) may indeed have had a high degree of external validity depending on your procedure and method of measuring the dependent variable.

Transparency and replicability

While some investigations, such as case studies, cannot be replicated, it is important that researchers are fully transparent about the structure of their investigation. They should do this by including the design, methodology, participants and results. This serves two purposes:

1. It allows other researchers to attempt to replicate the findings and, therefore, validate them further.
2. It allows other researchers to identify any possible bias or confounds that may have contributed to the results.

International mindedness

Part of being internationally minded is being sensitive to and open-minded towards different cultural approaches to societal structures, behaviours and norms. Included in this are cultural attitudes and practices around mental health. Reflect on the ways psychologists need to consider cultural differences when conducting research.

- What should psychologists from one culture be sensitive to when conducting research in another?
- What are the advantages of cross-cultural research and what might be some disadvantages?

Establishing reliability in research

Clearly it is important to have a high level of validity in psychological research. However, it is also important to have a high degree of reliability. Firstly, it is important to understand the difference between validity and reliability. Validity refers to the accuracy of a thing, while reliability refers to the consistency. For example, if you were to play a game of darts and aim for the bullseye, your throwing ability would be valid if you hit the bullseye on one of your throws. If all

Student view

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three of your throws hit the bullseye, you would be both a valid and a reliable thrower. It is important to understand that, as with playing darts, research can be reliable without being valid. For example, if you were to aim for the bullseye but miss wide left every throw and therefore land on the number '11', you would be reliably invalid.

Psychologists have a collection of techniques and approaches to research that can help increase the reliability of their findings. Some of these techniques are outlined in **Table 1**.

Table 1. Techniques and approaches to research that serve to increase reliability.

Technique	Used primarily for quantitative or qualitative research?	Definition	How this technique serves to increase reliability	Example
Test retest reliability	Quantitative	Test retest reliability is the practice of administering the same test to the same participants at different times.	This technique seeks to gather data at different points in time in order to identify whether the results are consistent and therefore reliable.	When administering a survey, researchers may require participants to take the survey a second time, two weeks after the first, in order to see if participant responses are consistent.
Parallel reliability	Quantitative	Parallel reliability is the practice of using two different versions of an assessment or data gathering tool that measure the same construct.	By using parallel reliability, researchers can verify that alternative forms of an assessment or data gathering tool yield similar results.	A researcher could design two versions of a maths test to administer to participants. They might do this if, for example, they were investigating the impact of background music on maths performance.
Interrater reliability	Qualitative	Interrater reliability is the practice of having two or more researchers code or analyse the same data.	By having two or more researchers code or analyse the same data, individual bias and subjectivity can be reduced. If two or more researchers agree with the coding or analysis, that creates reliability.	After conducting interviews with participants, two or more researchers could analyse the transcript and each conduct independent thematic analysis. They would then compare their conclusions in order to establish reliability.
Member checking	Qualitative	Member checking is the practice of sharing the results of thematic analysis with the participant(s) for the purpose of seeking participant verification that the conclusions reached align with the participant's beliefs.	Checking with the participants whether or not the results of thematic analysis align with their own beliefs and feelings is a way of ensuring that the analysis and interpretation conducted by the researcher(s) is accurate.	Researchers would show members of a focus group the results of their thematic analysis and ask each member to verify that the analysis accurately represents the attitudes, beliefs and feelings expressed during the focus group.

Student view

Overview (/study/ap new/sid-540-cid-763690/c

Technique	Used primarily for quantitative or qualitative research?	Definition	How this technique serves to increase reliability	Example
Triangulation	Triangulation can be quantitative or qualitative or both. That is the point of triangulation.	Triangulation refers to the use of multiple research methods or data sources (the same research method investigating the same aim) to increase the reliability of a finding.	Triangulation strengthens reliability by cross-verifying findings through different approaches.	Social learning theory could be triangulated by various research methods. For example, a survey could ask participants how they acquired or learned a certain behaviour, while an observation of school children could identify social learning in real time. A laboratory experiment (such as Bandura's famous 'Bobo doll' experiment) could also establish social learning theory at work in behaviour.

The role of triangulation in validating research claims and theories

Indeed, individual research methods and individual studies should not carry much evidential weight. Human behaviour is much too complex to draw conclusions based on the findings of a single study, no matter how credible. One way that psychological scientists validate scientific claims and theories is through the use of triangulation.

There are two main types of triangulation:

- Data triangulation uses a variety of data sources, including time, space and persons, in a study.
- Methodological triangulation uses multiple methods to study a situation or phenomenon (for example, qualitative and quantitative data).

Each method of triangulation has different advantages. However, both serve the same purpose: to combine the methodological and statistical power of individual investigations to strengthen an overall theory or claim. Think of individual investigations as individual bricks of a house. Alone, they are not that useful, but combining the bricks in the right way results in a strong and stable home (**Figure 1**).

Student view

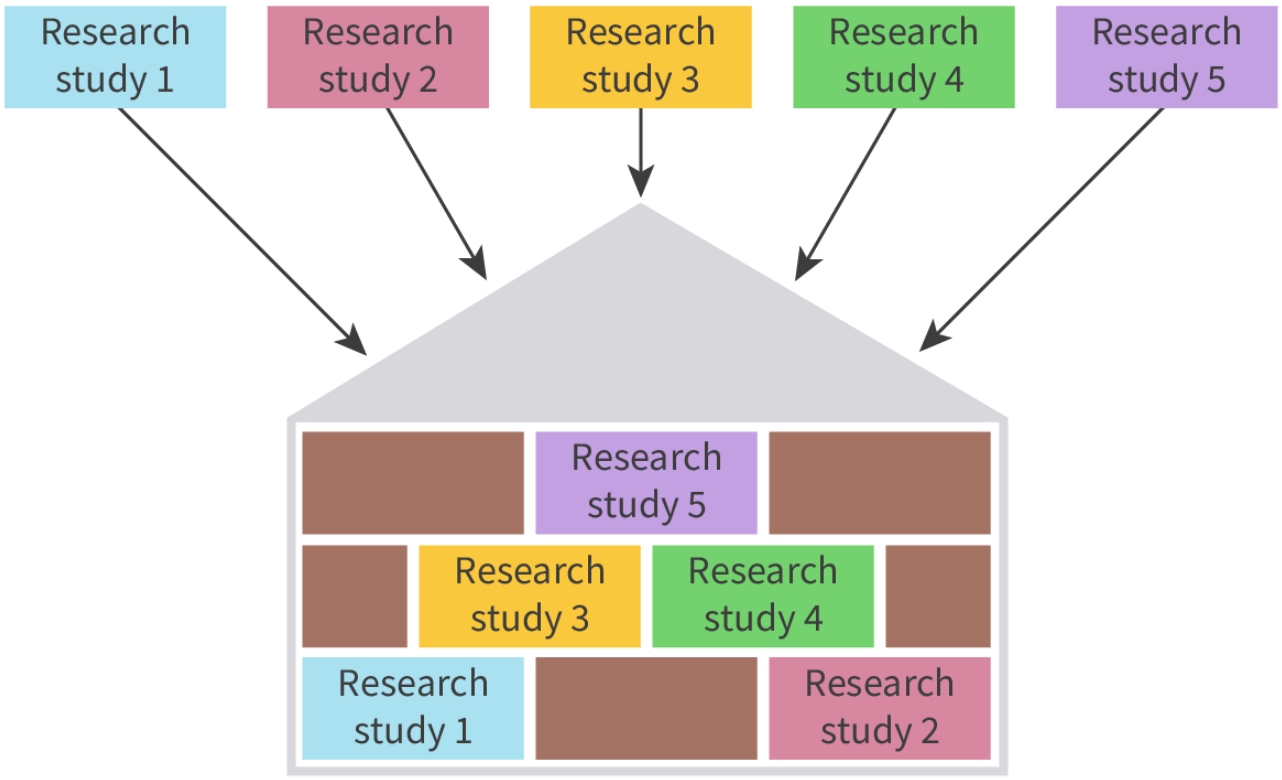

Figure 1. Triangulation combines the power of individual research investigations.

Social cognitive theory: an example of triangulation

Social cognitive theory is a theory of learning developed by many psychologists, most famously Albert Bandura of Stanford University (you will learn more about this theory in **section 4.1.1** (/study/app/psychology-new/sid-540-cid-763690/book/can-your-environment-affect-your-behaviour-id-49127/)). The theory states that humans develop much learning and knowledge through observation and social interaction.

Cognitive theories (theories regarding human thoughts and behaviour) are challenging to validate because human cognition (thoughts) is not observable. Triangulation is often used to strengthen cognitive theories because it combines research methods.

The following research methods and practices have triangulated the validity of social cognitive theory:

- **Naturalistic observations**: Researchers such as Odden and Rochat (https://doi.org/10.53841/bpsecp.2004.21.2.39) (2004) utilised the research method of overt naturalistic observation to observe the enculturation of Samoan children on the island of Samoa. Specifically, they found that Samoan children learn the following three key cultural skills via social cognitive theory: household chores, fishing and knowledge of the complex *matai* (chief) system. This research provided evidence for the ecological validity of social cognitive theory because it showed learning occurring in a real world context, as described by the theory.
- **Experiments**: Albert Bandura and his colleagues at Stanford University conducted a series of experiments in the early 1960s (https://psychclassics.yorku.ca/Bandura/bobo.htm) with the aim of identifying the influence of observed violence towards an inflatable doll on children's subsequent play styles with the doll. To achieve this, children in the experimental condition watched an adult model act violently and aggressively towards the doll. They then entered the same room and were encouraged to play. Bandura found that children exposed to violent play were much more likely to engage in violent play with the doll themselves. Children in the control condition viewed an adult model playing in the room in a non-violent way. These children were significantly less likely to engage in violent play. Bandura concluded that humans can learn violence through social cognition.

Bandura's 'bobo doll experiments' had a high degree of internal validity because they set out to measure the effect of an aggressive model on the play behaviour of children who observed that model. However, these experiments are often criticised for lacking a high level of external validity. This is because the experiments occurred under highly strange and artificial circumstances. It is not normal for a child to be brought to an unfamiliar environment where they are then required to observe a strange grown-up oddly beat up a doll, before being placed in that very same room to then play with the same doll themselves.

- **Surveys**: Researchers Li and Hua (https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2021.810181/full) (2022) of Beijing International University used surveys to investigate the role of social learning on online purchasing. Their survey results indicated that online purchasing is influenced by social cognition. Their research had a high level of face validity due to the very purposeful and relevant construction of their survey questions.

Over the past 60 years, many different observations, experiments, surveys and interviews have been conducted to investigate social cognitive theory and the extent to which it can explain human learning and behaviour. This vast triangulation of diverse findings, investigations and research methods has strengthened the overall validity of social cognitive theory as an explanatory model of learning and behaviour.

Thus, social cognitive theory has been validated not only by research triangulation (different research methods) but also by data triangulation. As a result, it is one of the most established and valid psychological theories today.

Teacher instructions

Goal

To practise selecting and applying evidence in support of a claim.

Facilitation guidance

Selecting evidence in support of claims is a crucial skill in psychology and life. The point of the activity is to get students to appreciate the strengths and limitations of different research methodologies relative to psychological findings and theories, and see that, in isolation, there is 'something missing.' Consequently, the power of triangulation provides increased validation of psychological findings and theories. Ensure that you lead your students through a debrief conversation that elicits this understanding.

Question 2 is designed to jump-start this conversation by asking students to think purposefully and critically about what each method offers. Question 3 is designed to help students understand the value of triangulation. Each of these findings alone is not as strong as the combined findings.

Activity

IB learner profile attribute: Thinker/Knowledgeable/Reflective

Approaches to learning: Thinking skills

Time required to complete activity: 20 minutes

Activity type: Individual

Application of knowledge: Selecting evidence

Concept application: Causality (understanding triangulation)

Which of the following findings and corresponding research methods would best support the following claim?

Overview (/study/app/psychology-new/sid-540-cid-763690/c

Listening to classical music increases high school students' visual—spatial intelligence.

1. A survey in which students said they felt more creative in art class when their teacher played Mozart
2. A repeated measures design experiment in which high school students' visual—spatial IQ scores were higher while listening to classical music than when not
3. A naturalistic observation in which a researcher noted that, while classical music was played in the art classroom, students created more sophisticated and higher-quality drawings
4. A survey of students showing a correlation between high grades in both maths and art classes, and time spent listening to classical music while studying

This activity will help you to apply an appropriate research finding to a given claim.

Reflection questions

1. Why did you choose the selected option?
2. If you could adjust any of the options above, what would you do?
3. For the purpose of triangulation, which two research options could you use to validate the claim?

Triangulation and reduction of bias

Psychological conclusions that are biased may not be valid. Triangulation contributes to the reduction of bias.

Bias in research can take many forms. There can be bias on the part of the researcher or participants, or even bias built into the research design or sample method. Triangulation can reduce the bias of a finding by corroborating results and using different methods. For example, if you conducted a survey with the aim of identifying which school was the best in your city and your results found that your school was the best, someone would be rational in questioning whether or not those results suffer from research bias in some way. However, if three other groups of researchers conducted a similar investigation and found the same results, the validity of your original claim increases and the accusation of bias reduces.

Concept

Bias

Bias can influence psychological research, impacting the validity of findings. Understanding how methods like research triangulation help minimise bias is essential to ensuring more accurate and reliable results.

Reflection question

1. Why does research triangulation contribute to reducing bias in psychological findings?

Teacher instructions

Goal

To practise critical thinking skills by identifying possible bias inherent in different research methods.

Concept

Bias

Facilitation guidance

Student view

Your students have not yet learned much about the different types of bias that can be present in research, such as sampling bias, responder bias, researcher bias, confirmation bias, p-hacking or the social desirability effect.

Overview (/study/app/psychology-new/sid-540-cid-763690/c

Ideally, this activity will elicit these biases from your students themselves and then lead to a discussion about the types of biases and confounds that can affect the validity of a research finding. The point is for students to refine and reflect on how different research methods and methodological triangulation can increase the validity of a finding.

The activity asks your students to create a T-chart, a two-column table used to organise data.

Activity

IB learner profile attribute: Knowledgeable/Reflective

Approaches to learning: Thinking skills

Time required to complete activity: 15—20 minutes

Activity type: Pairs

Understanding bias

Your task is to identify possible biases that could be present in different research methods and discuss how methodological triangulation can reduce bias. To complete the activity, use your knowledge about the strengths and limitations of different research methods. Follow these steps:

1. (**Concept application: bias**) Create a T-chart identifying one research method and possible associated biases during an investigation.
2. Choose two of your stated biases. Identify and explain a research method that would eliminate each bias.

Reflection questions

1. Why is methodological triangulation necessary in psychology?
2. Can you think of an example where methodological triangulation is not necessary to validate a psychological claim or theory?

Learning outcomes

By the end of this section, you should be able to:

- Identify the appropriate selection of research methodology to investigate a psychological question.
- Describe the advantages and disadvantages of different research methodologies.
- Discuss how research triangulation can reduce bias.
- Identify the steps to ensuring credible research.

3 section questions

Question 1

SL HL Difficulty:

What is the name for the condition that is used as a standard of comparison and does not receive exposure to the treatment of the independent variable?

Control ✓

Student view

Accepted answers

Control

Also accepted

Overview (/study/ap new/sid-540- cid- 763690/

Control condition, Controlled, Control group, control group, Controlled group, grupo control

Explanation

The control condition does not receive the independent variable. It is used as a standard of comparison to the experimental condition to determine the statistical significance of the effect of the independent variable on the dependent variable.

Question 2

SL HL Difficulty:

What term means that neither the researcher nor the participant knows a study's true aim or hypothesis?

Double blind ✓

Accepted answers

Double blind

Also accepted

Double-blind, Double blinded, Double-blind study, Double blind study, Double-blinded study, Double blinded study

Explanation

In the context of psychological research, the term 'blind' refers to 'not knowing.' Thus, when neither the researcher nor the participant knows the study's true aim or hypothesis, the study is said to be double blind.

Question 3

SL HL Difficulty:

Which type of triangulation leverages different research methods and findings to strengthen a psychological theory or claim?

Method ✓

Accepted answers

Method

Also accepted

Method triangulation, Methods, Methods triangulation, methodological, methodological triangulation, Methodological triangulation, data and methodological, Methodological, Methodological Triangulation

Explanation

Method triangulation uses different research methods and their findings to strengthen or refute a psychological claim or theory.

Previous section(/study/app/psychology-new/sid-540-cid-763690/book/what-are-the-tools-of-the-psychologist-id-49352/review/) Next section

Student view

1.1 Research methodology

What is the difference between causation and correlation?

Guiding question(s)

In this subtopic, you are thinking about the question, '**When can we say something causes something else?**' This section will help you to make an informed response by working through the following guiding question:

- What is the difference between correlation and causation, and why must psychologists be aware of spurious correlations?

By the end of this section, you should understand the difference between correlation and causation. You should also be aware of the dangers of spurious correlations in psychological research.

Keep the guiding question in mind as you progress through this section. The guiding question(s) build into the subtopic question(s). You will return to the subtopic question(s) at the end of each subtopic. The subtopic question(s) require you to pull together your knowledge and skills from different sections, to see the bigger picture and to build your conceptual understanding.

Correlation

Does studying for an exam cause you to do well in that exam? It seems that the obvious answer to this question is 'yes.' This implies that the *more* you study, the *better* you will do in an exam. Is this also true?

Consider the fictional data in **Table 1** from a psychology class at a university in Spain.

Table 1. Fictional data showing hours spent studying and exam results.

Student	Total hours spent studying	Grade in final exam
A	11	77
B	20	100
C	19	100

Student	Total hours spent studying	Grade in final exam
D	15	92
E	12	77
F	11	77
G	20	100
H	15	80
I	15	77
J	8	77
K	12	77
L	7	77
M	6	77
N	16	84
O	10	77

Your intuition may lead you to answer ‘yes.’ However, our intuitions can often be wrong in analysing causal relationships, even with something as seemingly straightforward as studying and exam achievement.

In order to remove the ‘guesswork’ from analysing a relationship between two variables, researchers use statistical tests, including calculating the correlation coefficient. The word ‘correlation’ means relationship. Therefore, a correlation coefficient is a statistical measure of the strength of a relationship between two variables. This number is expressed as a two-digit decimal. The formula for calculating the correlation coefficient is complex, but there are online calculators and formulas within spreadsheets that researchers use.

The correlation coefficient of the data contained in **Table 1** is 0.837. Rounded up and expressed as a two-digit decimal, it results in a correlation coefficient of 0.84. Generally speaking, this number represents a strong positive correlation. In the context of research, the word 'positive' does not mean 'good,' but instead refers to the fact that as one variable increases, so too does the other. A negative correlation indicates that as one variable increases in value, the other decreases (**Figure 1**).

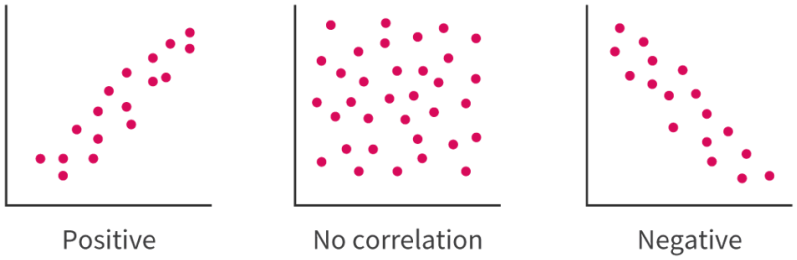

Figure 1. Positive correlation, no correlation and negative correlation data on scatterplots.

More information for figure 1

Three unlabelled scatterplot diagrams with example data points. The points on the diagram showing positive correlation trend upwards from left to right. The points on the diagram showing no correlation are evenly scattered. The points on the diagram showing negative correlation trend downwards from left to right.

The coefficients listed in **Table 2** generally indicate the strength of a relationship between two variables.

Table 2. Generalised strength of relationships relative to correlation coefficients.

Positive correlation coefficients and corresponding strength of relationship	
Strength of relationship	**Correlation coefficient**
no correlation	0—0.2
weak correlation	0.3—0.4
moderate correlation	0.4—0.5
strong correlation	0.5—1.0

Concept

Causality

A common human error is to mistake correlation for causation. Researchers and psychologists are even susceptible to making this error, as they often neglect to account for possible confounding variables (variables that may affect the outcome of an investigation or study).

Reflection questions

1. What confounding variables could affect the relationship between time spent studying and a student's final exam score?
2. What is the danger of failing to identify a false correlation?

Given the information in **Tables 1 and 2**, would it be valid to claim that the longer a student studies for their final exam, the higher their exam score will be? It may be tempting to answer 'yes' to this question. However, before coming to a conclusion, consider the questions posed in the Concept box as well as those in the following activity. These questions are important in understanding the challenge of establishing causality in psychology due to the possibility of spurious correlations.

Activity

IB learner profile attribute: Reflective

Approaches to learning: Thinking skills

Time required to complete activity: 15 minutes

Activity type: Individual

Understanding correlation

Concept application: Causality

As discussed in previous sections, only true experiments can establish a causal relationship between two variables. Other research methods build a case towards causality, but in and of themselves do not demonstrate it. It can be hard to appreciate this distinction, especially when it seems as if two variables *must* be related. For example, height is strongly correlated with individual success in basketball. Does that mean that being tall *causes* someone to be good at basketball?

Examine the collection of comically correlated variables collected and displayed by Tyler Vigen (https://www.tylervigen.com/spurious-correlations). These variables have incredibly strong correlation coefficients. However, they in no way *cause* one another. Researchers call this 'spurious correlation.'
The examples on Vigen's website are obviously not causally linked. However, in psychological research where much is unknown, spurious correlations are harder to identify.

Reflection questions

1. Why must psychologists be on the lookout for spurious correlations?
2. What are some strengths and limitations of using correlation coefficients to make claims about causality?
3. What methods or practices can researchers use to reduce the existence of spurious correlations becoming psychological theory?

If correlation coefficients are not enough on their own to validate a psychological claim or theory, how are they validated?

As you learned in **section 1.1.3** (https://app.kognity.com/study/app/psychology-new/sid-540-cid-763690/book/how-can-we-know-if-a-psychological-theory-or-claim-is-valid-id-49353/), triangulation plays a major role in validating claims and theories. A correlation coefficient may not be enough to validate a theory of final exam achievement on its own. However, if researchers combine this finding with other research methods, such as interviews or surveys, that indicate students feel more prepared the longer they study, this triangulates and strengthens support for the original correlation-based conclusion.

Causality

In spite of the many sensational causal headlines, such as 'drinking coffee causes you to live longer' or 'using your smartphone before bed causes insomnia,' it is actually quite challenging to prove that one thing causes another.

Establishing causation within psychology is difficult for various reasons.

Firstly, humans are complex. Not only does our biology affect our thoughts and behaviour, but so too do our environments. In addition, those two words – 'biology' and 'environment' – encompass vastly complicated and nuanced subsets of phenomena and factors, all of which act on our minds and bodies simultaneously.

In short, many known and unknown confounding variables can affect the outcome of any psychological investigation. Thus, coming to stark causal conclusions is not something psychological researchers often do. However, this does not mean we are incapable of understanding factors that *contribute to* a given behaviour. Psychologists utilise the various research methods and triangulation to strengthen claims and theory regarding human behaviour.

Perspective lens

Sociocultural approach

The sociocultural perspective focuses on examining behaviour through the lens of social interactions (social) and environmental factors (culture). Given that humans are such complex social animals, it can often be challenging to establish causation within a sociocultural context.

Reflection question

1. What complicates the examination of human behaviour from a sociocultural perspective?

To answer this question, consider the behaviour of 'academic achievement.' What sociocultural factors could be examined? What confounding variables might interfere with the analysis of the factors you have identified?

Statistical significance and causality

Statistical significance is a statistical measurement that calculates whether the results of an experiment are likely due to an effect of one variable on another or due to chance. Different inferential statistical tests are used to determine significance, and the results of these tests are most frequently expressed as a p value.

Britta Hölzel of Harvard University conducted an experiment (https://www.sciencedirect.com/science/article/abs/pii/S092549271000288X) in 2010, investigating the effect of a mindfulness-based stress reduction programme (MBSR) (independent variable) on neurogenesis (dependent variable) in different brain regions. She compared neuron growth across brain regions, including the cerebellum (P = 0.0018) and the temporal–parietal junction (P= 0.036). These p values of 0.0018 and 0.036 indicate that there is only a 0.18% and 3.6% chance that neuron growth in these regions was due to chance as opposed to the influence of the independent variable – in this case, the MBSR programme.

Hölzel and her team, therefore, concluded that, 'The results suggest that participation in MBSR is associated with changes in grey matter concentration in brain regions involved in learning and memory processes, emotion regulation, self-referential processing, and perspective taking.' Source: Hölzel et al. (2011)[1]

Making connections

The process of neuroplasticity and the role of environmental factors on brain development

A content learning outcome from the biological approach focuses on the process of neuroplasticity and the role of environmental factors on brain development. The Hölzel et al. (2011) study (https://www.sciencedirect.com/science/article/abs/pii/S092549271000288X) discussed here is a clear example of the environment (the act of meditating) impacting brain development (neurogenesis). The study also demonstrates neuroplasticity by showing that neurons can be stimulated to develop in response to cognitive stimuli (meditation).

Notice that, in spite of the very tiny possibility that these results were due to chance, Hölzel et al. still use the word 'suggest' instead of 'cause' when discussing the effect of MBSR on changes in grey matter. This language use indicates the level of precision that psychology researchers strive for and their hesitancy to state that one thing 'causes' another.

Figure 2. Hölzel et al. (2011) found a statistically significant relationship between participation in a MBSR programme and neuron growth in different regions of the brain associated with learning, memory and emotional processing. However, they stopped short of saying that the MBSR programme causes neural growth.

Credit: RuslanDashinsky, Getty Images

Activity

IB learner profile attribute: Inquirers

Approaches to learning: Research skills

Time required to complete activity: 20—30 minutes

Activity type: Pairs

Data analysis and causation

Your research team is investigating the relationship between dorm size and university satisfaction levels of first-year university students. The data you have gathered is shown in **Table 3**.

Table 3. Data showing dorm size and average satisfaction ratings for first-year studer

Dorm	Room size (in square feet)	Avg. first-year student overall 'satisfaction' ratir dorm. (5 is the highest)
R	125	3

Dorm	Room size (in square feet)	Avg. first-year student overall 'satisfaction' ratir dorm. (5 is the highest)
S	125	4
T	145	4
U	120	3
V	140	5
W	150	4
X	110	2
Y	160	5
Z	130	3

Plot the data in **Table 3** on a graph, ensuring that you correctly label the *x*- and *y*-axes according to the dependent and independent variables.

To estimate your data's correlation coefficient, use The New Statistics correlation coefficient tool (https://esci.thenewstatistics.com/esci-correlation.html) (you can adjust the sliders) or the Pearson Correlation Coefficient Calculator Tool (https://www.socscistatistics.com/tests/pearson/default2.aspx).

Reflection questions

1. What is the independent variable in this investigation?
2. What is the dependent variable in this investigation?
3. Which research method are you using?
4. Is the data positively correlated, negatively correlated, or is there no correlation?
5. What is your estimate of the correlation coefficient?
6. **(Concept application: causality)** Can you conclude that the university should allocate funds to build larger student dorm rooms in order to increase university satisfaction?

Learning outcomes

By the end of this section, you should be able to:

- Discuss the role of external variables in drawing conclusions about causality.
- Discuss how causality differs from correlation and the importance of distinguishing between the two within psychological research.
- Analyse and interpret different types of data tables, graphs and results.

[1] Hölzel BK et al. (2011) 'Mindfulness practice leads to increases in regional brain gray matter density,' Psychiatry Research: Neuroimaging, Volume 191, Pages 36–43, Copyright Elsevier.

How is quantitative data transformed into credible evidence for a psychological theory or claim?

Guiding question(s)

In this subtopic, you are thinking about the question, '**When can we say something causes something else?**' This section will help you to make an informed response by working through the following guiding question:

- How is quantitative data transformed into credible evidence for a theory or claim?

Keep the guiding question in mind as you progress through this section. The guiding question(s) build into the subtopic question(s). You will return to the subtopic question(s) at the end of each subtopic. The subtopic question(s) require you to pull together your knowledge and skills from different sections, to see the bigger picture and to build your conceptual understanding.

You may be familiar with the saying, 'There are three kinds of lies: lies, bad lies and statistics.' This saying illustrates the challenge of data interpretation and the possible problem of data manipulation.

Once a team of researchers has collected data from their participants, they need to describe their data and choose a statistical test to determine its significance. In reality, these two tasks go hand in hand because the type of data that a research investigation generates determines, to a large extent, the type of descriptive and analytical tests available for use.

Quantitative data collection and analysis

Researchers who use a research method that generates quantitative data must apply two types of statistical analyses (**Figure 1**).

1. They must first describe the data set using a descriptive statistical analysis.
2. They must then determine the significance of the data set using an inferential statistical analysis.

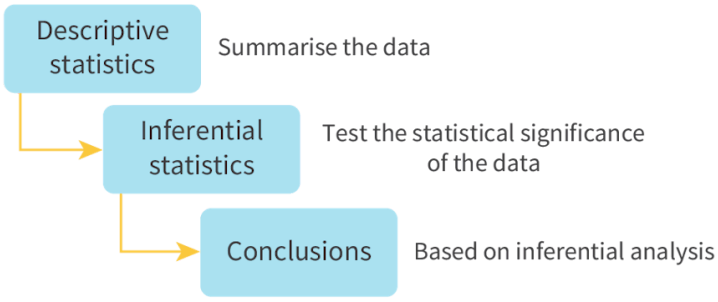

Figure 1. Quantitative statistical analysis.

Descriptive statistics don't tell the researchers anything about causation – they simply describe the data. Inferential statistical tests are necessary to establish a causal relationship between two variables. Inferential statistics determine the probability that a relationship measured between two variables is due to chance rather than causality.

The type of descriptive and inferential statistical tests that could be applied by researchers is determined by the type of data created, which itself is determined by the level of measurement of the dependent variable of an investigation. Each level of measurement adds something new to the data:

- **Nominal data** adds categories to otherwise unsorted data.
- **Ordinal data**, such as **likert scales,** adds rank order to data that is otherwise categorical.
- **Interval data** adds precise values and magnitudes so that the distance between scores can be measured (and still ranked, if need be).
- **Ratio data** adds absolute zero, so meaningful fractions and ratios can be constructed.

To a large extent, the data's level of measurement determines how the data will be analysed. For example, a simple experiment measuring whether participants 'did' or 'did not' comply with a request from an authoritative researcher is nominal data. It is possible to say how many participants did or did not, but it is impossible to determine a mean or 'average' compliance rate.

Descriptive statistics

Descriptive statistics are largely meant to describe and summarise the data, by measuring its central tendency and dispersion. The mean, median and mode are key measures of central tendency (**Table 1**).

The choice of which descriptive statistic to use depends on the level of measurement, with different statistics suitable for the nominal, ordinal, interval and ratio levels of data respectively.

Table 1. Measures of central tendency.

Measure of central tendency	Use and limitations
Mean The sum of values is divided by the total number of values.	• The most commonly used measure of central tendency because of its precision and usefulness for inferential statistics. • The mean can be affected by outliers (extreme bits of d which can 'pull' the mean one way or the other and dis the distribution.
Median The middle value in a data set.	• The preferred measure for skewed distributions, since t middle value cannot be 'pulled' by outliers to distort the distribution. • For small data sets, the precision of the median is limite
Mode The most frequently occurring value in a data set.	• The only descriptive measure suitable for nominal data. • Limited as it does not fully capture all data, just the mos frequently occurring.

Measures of central tendency are often used to provide an initial comparison between an experiment's conditions. It is important to note that each measure indicates something different about the data.

Concept

Measurement

Accurate measurement and analysis are vital in psychology to interpret human behaviour meaningfully.

Reflection questions

1. Why must psychologists and psychological researchers have a clear and comprehensive understanding of statistical measurements and analysis?
2. How can misunderstanding statistical measurements lead to misunderstanding human behaviour?

Consider the fictional data set of 1000 IB DP Psychology exam scores from the 'Neverland' school district in **Table 2**.

Table 2. Fictional data set of 1000 scores on the IB DP Psychology exam for students from Neverland School District.

Score (maximum score of 7)	Number of students achieving score
1	200
2	50
3	150
4	100
5	50
6	200
7	250

When all three descriptive statistics are applied to this dataset, you get the following results:

- **Mean** = 4.3 (the mathematical average of all exam scores)
- **Median** = 4.5 (the midpoint between all scores)
- **Mode** = 7 (the most frequently occurring score)

The more 'normal' the distribution of values in a dataset, the more similar the mean, median and mode. However, when data is skewed in one direction or the other, the mean, median and mode are pulled along accordingly (see **Figure 2**).

It is important to appreciate the effect that each measure of central tendency has on our perception of the data set. In **Table 2**, the mean indicates a very different achievement level than the mode. If a teacher wanted to emphasise their excellence, which measure of central tendency would they choose to share with the community?

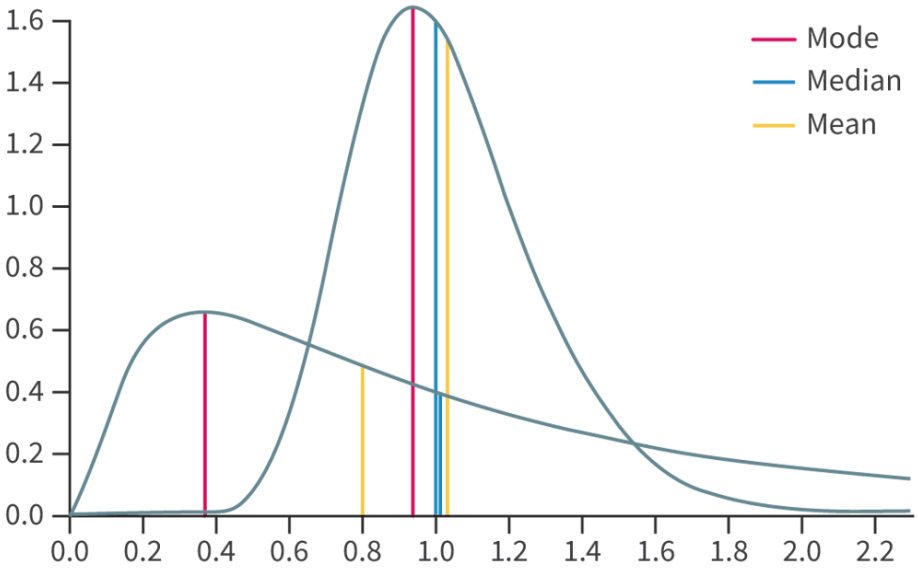

Figure 2. Similar and different central tendencies in two different data sets. The more normal the distribution of a data set, the more aligned the measures of central tendency will be.

Source: Adapted from Cmglee (2011) (https://commons.wikimedia.org/wiki/File:Comparison_mean_median_mode.svg)[1]

More information for figure 2

Graph with two lines representing different data distributions. Each distribution is labelled with its mode, median and mean. The line showing the first distribution is relatively symmetrical and its peak is close to its centre. The mode is near the middle of the curve, at its highest point. The median and mean are both close to the mode but slightly to its right. The line showing the second distribution is asymmetrical. The left-hand side of the distribution rises steeply and the right-hand side tails off slowly. The mode, mean and median are more widely spaced than in the first distribution. The mode is towards the left-hand end of the curve, where the curve is at its highest point. The mean is further to the right, about a third of the distance along the horizontal axis. The median is even further to the right, about halfway along the axis.

Activity

IB learner profile attribute: Reflective

Approaches to learning: Research skills

Time required to complete activity: 15 minutes

Activity type: Individual

Applying statistical analysis

Concept application: Measurement

Your task is to apply descriptive statistics to the following fictional data set, then answer the reflection questions that follow. This data comes from the experimental condition and represents the results of an investigation into the effect of Bollywood dance music (IV) on the time it takes to complete a mini-crossword puzzle (DV).

Each number represents the time it took each individual participant to complete the mini-crossword puzzle, measured in seconds:

25, 35, 50, 45, 40, 55, 35, 60, 30, 55, 20, 35, 50, 45, 35

1. Calculate the mean for the data set.
2. Calculate the mode for the data set.
3. Calculate the median for the data set.

Reflection questions

1. Which descriptive statistic is the *best* choice to represent the data? Why?
2. Would any descriptive statistic be a poor choice to represent the data? Why?
3. Can you conclude from this data that Bollywood dance music increases performance on a mini-crossword puzzle?

While the data of a research investigation certainly influences the choice of statistical measurement, researchers may also select statistics that shape how others view their results. Therefore, it is important to understand that descriptive statistics only provide part of the story of a research investigation, which is why inferential statistics are needed.

Inferential statistics

Inferential statistics allow researchers to make inferences about the relationship between independent and dependent variables within a given population.

Analysis of data using inferential statistics breaks down the interpretation into two possibilities:

1. The population has a relationship, and the sample reflects this relationship.
2. The population has no relationship, and the sample reflects sampling error.

Inferential statistics allow psychological researchers to infer causal patterns in a sample and determine whether those patterns are valid for the population.

Inferential significance testing finds the probability of a sample generating a set of data *if* the null hypothesis was true. This probability is widely known as the p value, and it varies from study to study. Most psychological research aims for $p < 0.05$, meaning a probability of less than 5% that the null hypothesis could have resulted in the collected data. Some studies aim for $p < 0.01$ or lower, especially for drug trials and psychological interventions that might carry risks to individuals.

Some of the most commonly used tests of inferential statistics are described in **Table 3**. Parametric tests are appropriate for data sets that both resemble the normal distribution and use the interval level of data for the dependent variable. Non-parametric tests are more appropriate for any data not meeting those requirements.

Table 3. Inferential statistical tests.

Parametric Tests	Non-Parametric Tests
Independent samples T-test This test compares the mean scores for two separate groups of participants for interval-level data.	**Mann—Whitney U test** This test compares the mean scores for two sepa groups of participants for ordinal or interval-level data. It works by ranking the data and comparing ranks.
Paired-samples T-test This test compares the mean scores for participants in matched pairs or repeated measures designs for interval-level data.	**Chi-squared test** This test compares observed values for nominal c ordinal data to the expected values if the null hypothesis were true.

Statistics, peer review and credibility

Statistics can be manipulated to deceive. Certain data can be omitted to ensure a significant p value, or a descriptive statistic can be chosen to describe a data set that implies a false reality.

Since researchers deal in statistics and statistics are so easily manipulated, peer review is crucial. Institutional structures incentivise researchers to publish their results, which opens them up to critical analysis of their statistical calculations and invites other researchers to attempt to replicate a finding for the purpose of triangulation or refutation.

As you will learn, peer review does not fully prevent some researchers from using statistics as a tool to mislead and misrepresent their findings. However, it does provide a certain level of transparency that contributes to the overall credibility of scientific knowledge.

Activity

IB learner profile attribute: Knowledgeable

Approaches to learning: Research skills

Time required to complete activity: 30—45 minutes

Activity type: Individual/Pairs

Understanding how to calculate a p value and determine statistical significance

Concept application: Measurement

Your task is to use the provided hypothesis and data set to calculate the p value and therefore determine statistical significance so that you can make a determination whether or not the experimental hypothesis (H1) should be accepted or rejected.

Scenario: A team of researchers is sent out to investigate whether a mindfulness programme can help reduce student stress levels compared to no intervention. Stress levels were measured on a scale where higher scores indicate greater stress.

There were 10 total participants gathered through volunteer sampling at the researchers' university. A repeated measures design was used as the 10 participants had their stress levels measured before and after the three-week mindfulness programme.

The researchers' experimental hypothesis was, 'The mindfulness programme will reduce student stress levels.'

Their null hypothesis was, 'The mindfulness programme will not reduce student stress levels.'

Their data was as follows:

Participant	Stress level before mindfulness programme	Stress level after mindfulness programme	Chan stress
1	45	44	1
2	50	48	2
3	47	47	0
4	55	53	2
5	43	45	−2
6	60	58	2
7	58	56	2
8	53	51	2
9	57	55	2

Participant	Stress level before mindfulness programme	Stress level after mindfulness programme	Chan stress
10	49	49	0

Reflection questions

1. What inferential statistical test listed in **Table 3** would be most appropriate and why?
2. Use an online inferential statistical calculator (https://www.socscistatistics.com/), such as the one linked here, to calculate the p value using your chosen inferential test.
    - Remember to identify if the test is 'one tailed' (the H1 predicts a direction) or 'two tailed' (the H1 does not predict a direction). In this example, you must use a 'one tailed' test because the H1 predicts that stress levels will be reduced.
3. Given your p value, should the researchers accept or reject their experimental hypothesis?

Learning outcomes

By the end of this section, you should be able to:

- Discuss the role of external variables in drawing conclusions about causality.
- Identify the steps to ensuring credibility in research.
- Identify and discuss how data is represented and analysed in different forms based on the design of the study and the nature of the data.
- Analyse and interpret different types of data tables, graphs and results.

[1] Adapted from Cmglee (2011) (https://commons.wikimedia.org/wiki/File:Comparison_mean_median_mode.s

How can visual representations of data inform psychological understanding?

Guiding question(s)

In this subtopic, you are thinking about the question, '**When can we say something causes something else?**' This section will help you to make an informed response by working through the following guiding question:

- How can visual representations of data aid in psychological understanding?

By the end of this section, you should be able to identify and discuss how data is represented and analysed in different forms based on the study's design and the data's nature.

Keep the guiding question in mind as you progress through this section. The guiding question(s) build into the subtopic question(s). You will return to the subtopic question(s) at the end of each subtopic. The subtopic question(s) require you to pull together your knowledge and skills from different sections, to see the bigger picture and to build your conceptual understanding.

Why is it useful to represent data visually?

Researchers aim to create knowledge, insight and understanding that advances their area of expertise. This includes sharing their results clearly and understandably. Experimental psychologist Steven Pinker said that humans are visual creatures. Visual representations of data and statistical analyses aid understanding.

Data is often presented visually in a table or graph. The general guidelines suggest that a reader should be able to understand a study's results by looking at a table or graph alone without the supporting text. Therefore, graphs and tables offer a quick summary and analysis of the results by presenting descriptive and inferential statistics in graphical or tabular form (**Figure 1**).

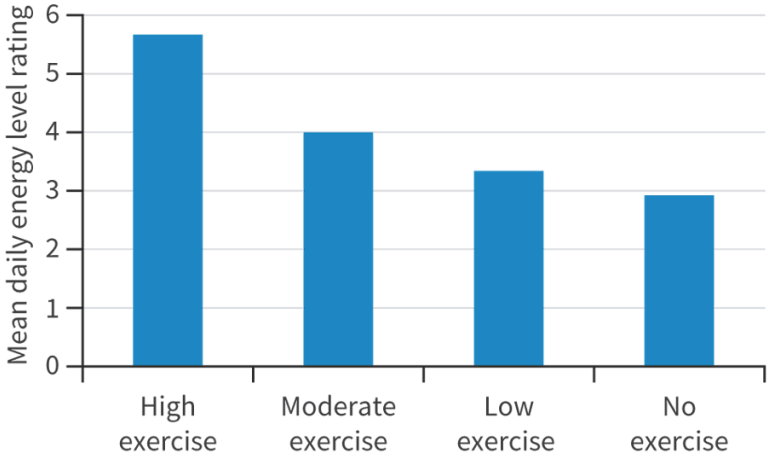

Figure 1. Graphs are valued for their efficiency and clarity in presenting results.

More information for figure 1

Bar chart showing four vertical bars. The vertical axis is labelled Mean daily energy level rating. The bars are labelled with categories which state different amounts of exercise in descending order: High exercise, Moderate exercise, Low exercise and No exercise. The bars are in descending order of height, making it visually clear that the bars representing lower levels of exercise also indicate lower mean daily energy ratings.

Measures of dispersion

Measures of dispersion, also known as measures of variability, measure a data set's spread (**Table 1**). In other words, they indicate how widely the data is dispersed around the central tendency. A data set could be interpreted in numerous ways if it is widely dispersed. Wide dispersal could indicate that measurement was unreliable or that the variable under study was affected by wide-ranging participant differences. Narrow dispersal could indicate the opposite.

For example, assume that Schools A and B receive their exam scores, and each is pleased to discover that students in both schools earned a mean exam score of 5.8 out of a maximum of 7. However, the data is dispersed differently for each school. School A's scores range from 2 to 7, and School B's scores range from 5 to 7. On its own, the mean suggests the two schools are similar, but the dispersion says something different:

- Nobody in School B scored less than 5, which might suggest that its teaching methods are highly reliable, that its students are more consistently able, or something else.
- By contrast, the dispersion of School A's data set might suggest that its students are not being prepared in a consistent way, or

that the school population is characterised by a wide range of abilities, or something else.

Table 1. Measures of dispersion.

Measure of dispersion	Discussion
Range The difference between the highest and the lowest values in a data set. The range indicates how high and how low the data goes, and how far it extends from the central tendency.	Like the mean, the range can be distorted by outl For example, a school's exam scores could range 2 to 7, but it could be that only one student score and everyone else scored 5 or higher. In such cas the range can be misleading.
Standard deviation This indicates how much scores differ from the central tendency (the mean), on average (**Figure 2**). Mathematically speaking, it is the square root of the mean of the squares of each score's deviation or difference from the distribution's mean.	The standard deviation is the most commonly used measure of dispersion, valued for its sensitivity to the average distance of each individual score to the mea Large standard deviations indicate large variability of results.
Interquartile range This is used for skewed distributions that might be distorted by extreme scores. Essentially, it chops off the data's top and bottom quartiles and measures the remaining data's range (between the upper and lower quartiles).	The interquartile range is particularly useful for data outliers because it eliminates them at both ends. Arguably, this provides a more accurate measure of dispersion for skewed data.

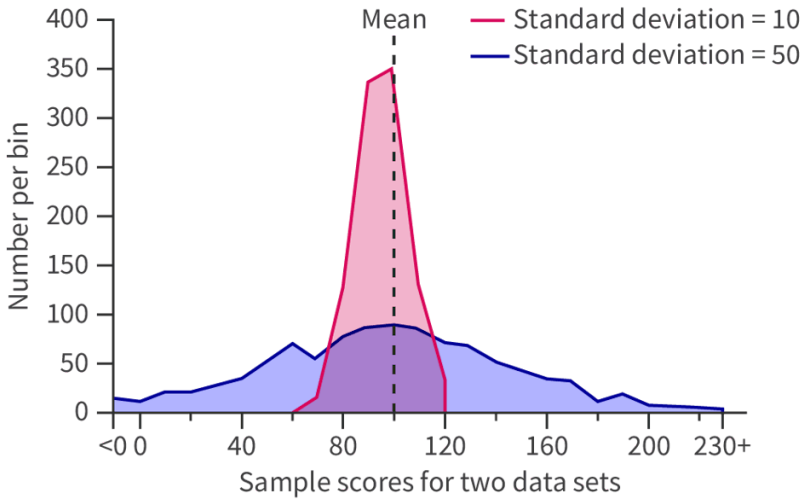

Figure 2. Two samples with the same mean but different standard deviations. This is a clear example of how means can be misleading.

More information for figure 2

Line graph showing two sets of data. The horizontal axis is labelled Sample scores for two datasets and the vertical axis is labelled Number per bin. Both curves are roughly symmetrical with a peak in the middle, and they both have the same mean sample score of 90, which is close to their peak. One curve has a standard deviation of 10 and the other has a standard deviation of 50. The dataset with a standard deviation of 10 is tall and thin, with a maximum number per bin of 350 and sample scores that range from 60 to 120. The dataset with a standard deviation of 50 is broad and relatively flat, with a maximum number per bin of less than 100 and sample scores that range from less than 0 to more than 230.

Box-and-whisker plots, also known as box plots (**Figure 3**), are often used to visually represent measures of dispersion in a research investigation. They are an excellent example of the power of visual data representation to aid understanding.

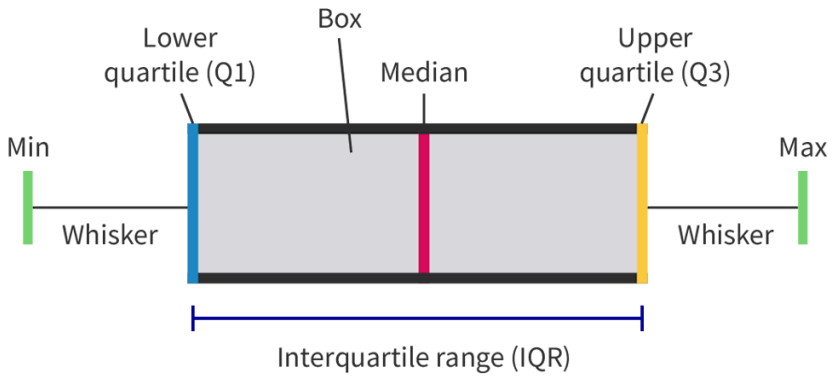

Figure 3. A box-and-whisker plot (also known as a box plot) is a visual representation of measures of dispersion.

More information for figure 3

A labelled diagram showing what the parts of a box and whisker plot represent. The box is a rectangle in the centre of the diagram. The location of its left-hand side shows the lower quartile, or Q1. The location of its right-hand side shows the upper quartile, or Q3. Its length from left to right represents the interquartile range, or IQR. A vertical line inside the box shows the value of the median. There are two horizontal lines on either side of the box, which are the whiskers. The whisker on the left-hand side goes from minimum to lower quartile. The whisker on the right-hand side goes from upper quartile to maximum.

Tables

Tables are almost essential in the presentation of results from psychological research. Almost every published study has a table of some kind, usually summarising and analysing the data by presenting the following:

- measure(s) of central tendency
- measure(s) of dispersion
- p values for each group and/or variable.

Since they include the most relevant statistics and values for the variables under study, tables function like a one-off summary of the results in their entirety (**Table 2**). While a data table might be surrounded by paragraphs interpreting and analysing the data it presents, a table is meant to stand independently without further explanation.

Table 2. Means and standard deviations of fictional short-term memory (STM) scores at base after learning a memory strategy (repeated measures design).

	Baseline STM		Post-STM	
Participant condition	Mean	Standard deviation	Mean	Standard devi
Memory strategy	6.8	3.2	7.4	1.9
Control (no strategy)	7.0	1.3	6.7	2.7

The data is presented in a table, making it immediately clear that the memory strategy appears to have increased short-term memory (STM) capability. Importantly, the standard deviation is lower for the post-test than the baseline test, suggesting that the memory strategy had a consistent effect on STM in the experimental group.

Graphing data

Just like tables, graphs are valued for their efficiency and clarity in presenting the results of a study. However, graphs are more visual than tables. Each type of graph is suitable for different purposes:

- Histograms are appropriate for graphing the *frequency* of values in a distribution, such as how many students scored 0, 1, 2, 3, 4, 5, 6, or 7 on IB DP Psychology.
- Line graphs are used for *quantitative* variables, such as scores on a test, and typically plot a measure of central tendency.
- Bar graphs are used for *categorical* variables (qualities such as gender, grade level and verbal categories) and typically plot a measure of central tendency.
- Scatterplots graph *relationships* between two variables, such as gender and age, by plotting individual data points.

Histograms

The most important thing to appreciate about a histogram is that it graphs data's frequency distribution. It looks like a bar graph, but unlike a bar graph, there are no spaces between the bars of a histogram. This is because the data is continuous. The widths of the bars can also vary. Therefore, it is the area of the bar (height × width) that indicates the frequency of occurrences. When the bar widths are the same, the bar's height indicates the frequency (**Figure 4**).

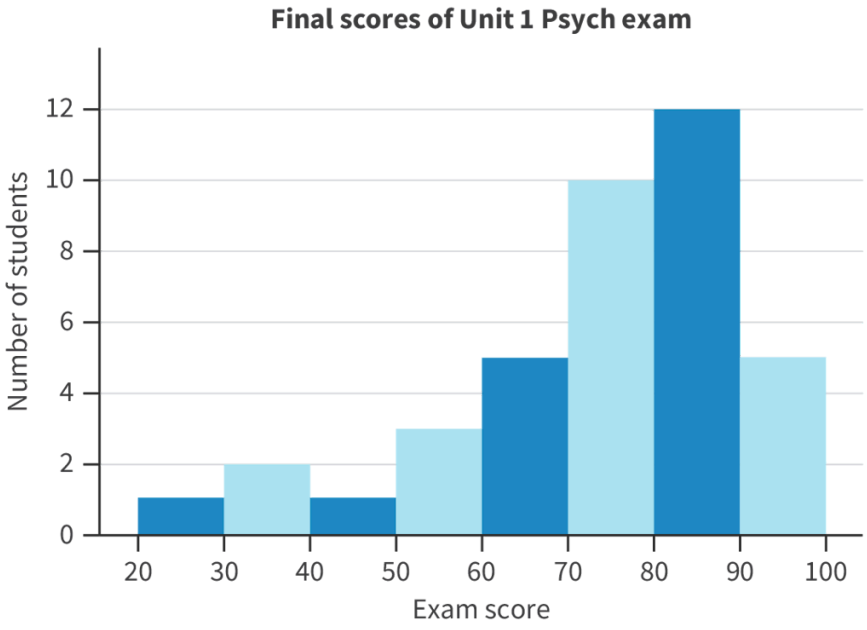

Figure 4. A histogram showing exam scores.

More information for figure 4

Histogram with title Final scores of Unit 1 Psych exam. The vertical axis is labelled Number of students and the horizontal axis is labelled Exam score. Values are represented by equal-width vertical bars with no gaps in between.

Line graphs

Line graphs show relationships between quantitative variables, and they are especially useful when the independent variable has only a few possible values (**Figure 5**). A scatterplot may be more appropriate for variables with a higher number of values. The points on a line graph represent the mean score for groups at each level of the independent variable; the points *do not* represent individual scores.

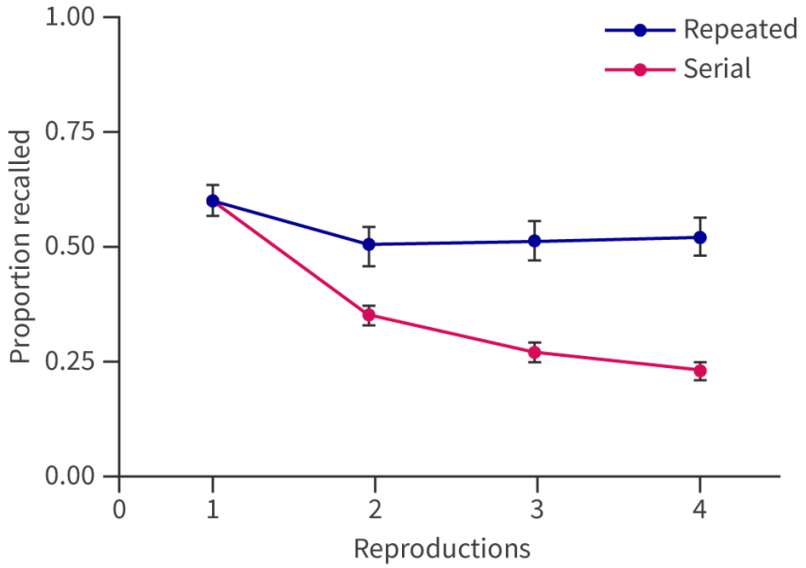

Figure 5. A line graph showing how passing information on from one individual to the next (serial reproduction) distorts memory.

More information for figure 5

Line graph with horizontal axis labelled Reproductions and vertical axis labelled Proportion recalled. The graph has two lines. One line shows repeated reproductions, for which the proportion recalled drops slightly then remains stable. The other line shows serial reproductions, for which the proportion recalled drops more rapidly and continues to fall. Each plotted point on each line is drawn with a vertical error bar.

Bar graphs

Truthfully, the same data that goes on a bar graph could easily go on a line graph, and vice versa, but data presentation conventions prefer bar graphs for categorical variables and line graphs for quantitative variables. For example, the bar graph in **Figure 6** presents the mean speed estimates for each categorical variable. There is

no sense in using a line graph because there is nothing between each category (between 'contacted' and 'hit', for example), which is why researchers prefer bar graphs for categorical data.

Like line graphs, bar graphs show the mean values for each level of the independent variable for each group in the study. Again, such graphs *do not* show individual data.

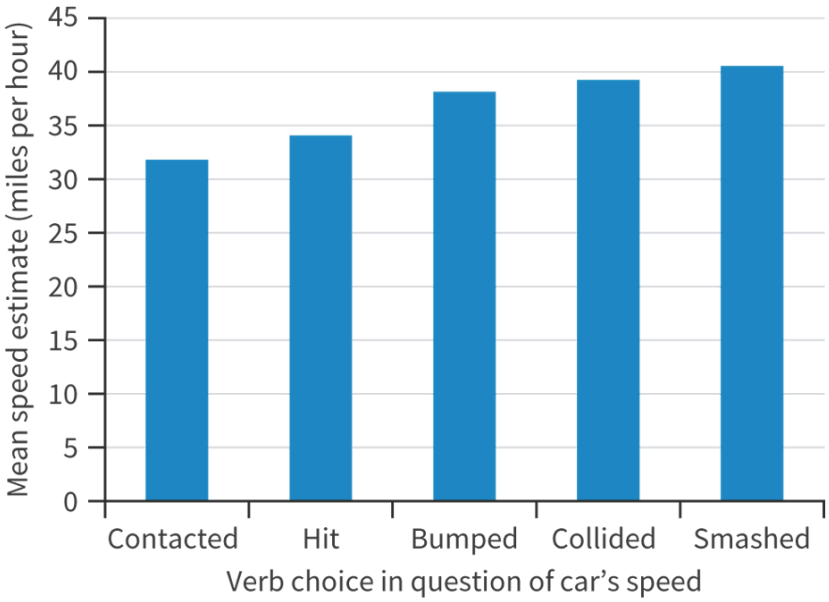

Figure 6. A bar graph showing how verb choice affects memory of a car accident.

Source: Data from Loftus and Palmer (1974) (https://www.sciencedirect.com/science/article/abs/pii/S0022537174800113).[1]

More information for figure 6

Bar chart with vertical axis labelled Mean speed estimate in miles per hour and horizontal axis labelled Verb choice in question of car's speed. The bars are presented in ascending order of height, so that the leftmost bar shows the lowest speed estimate. From left to right, the bars are labelled Contacted, Hit, Bumped, Collided and Smashed.

Concept

Measurement

Measurement and visual representations of data are closely connected, with charts and graphs serving as powerful tools to convey findings.

Reflection questions

1. What is the relationship between measurement and visual representations of data?

2. How could visual representations of data be used to misrepresent the significance of a finding?

Scatterplots

A scatterplot is the most appropriate graphing technique when the independent variable has many levels. The big difference between a scatterplot and other graphs is that it shows individual scores, arranged as points on a graph.

Measures of central tendency are not included on a scatterplot, but it is often possible to see patterns in the data by simply looking at how all the points are concentrated and/or dispersed around the graph.

The fictional data in **Figure 7** could represent correlations between STM scores before and after a memory strategy, such as chunking (in which long strings of information, like MTVFBICIAIRS, are broken into chunks, like MTV-FBI-CIA-IRS, for easier encoding and recall), for each participant. The scatterplot shows a general trend of STM improvement, even if the improvements were rather limited for participants with lower baseline STM scores.

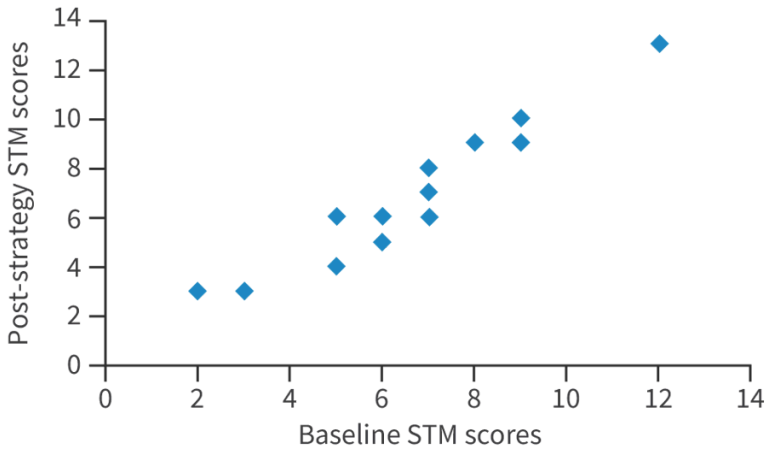

Figure 7. A scatterplot showing fictional data for short-term memory (STM).

More information for figure 7

Scatterplot with horizontal axis labelled Baseline STM scores and vertical axis labelled Post-strategy STM scores. The points trend from bottom left to top right, showing a positive correlation between baseline short-term memory scores and post-strategy scores.

Scatterplots are a common tool for graphing correlations. Although scatterplots do not show the mean or standard deviation, some researchers add a line of best fit (also known as a regression line) to the scatterplot. This is a straight line that best 'fits' the data on a scatterplot.

Activity

IB learner profile attribute: Reflective

Approaches to learning: Research skills

Time required to complete activity: 60 minutes

Activity type: Group

Applying the skills of a researcher

Concept application: Measurement

Your task is to work in a small group of two or three students to design a short survey (use an online form or survey generator — it's easy!) for students in your school to complete. In doing so, you should have a clear aim in mind — what are you trying to gather data about?

Limit your survey to 10 questions, given that some students in your school community may be asked to complete multiple surveys.

Part 1: Plan and design your survey

1. What is the aim of your investigation?
2. What type of questions will your survey include?

- Multiple-choice
- Likert scale
- Yes/No
- Fill in the blank

  You need to think purposefully about your survey's format because the form affects your data collection, representation and analysis.

1. Create your survey.
2. When your classmates have completed your survey and you have gathered all your data, complete **Part 2**.

Part 2: Interpreting and analysing data

1. Design a table to display your data.
2. Report your data in graph form. Which type of graph will best represent your data?

- Line
- Bar
- Histogram
- Scatterplot

Part 3: Reflection questions

1. What was challenging about designing your questions?
2. What was challenging about graphing your data?
3. Can you draw any conclusions based on your results?
4. What were the strengths and limitations of your measurement method?
5. Is there anything you would do differently? Why?

Learning outcomes

By the end of this section, you should be able to:

- Identify and discuss how data is represented and analysed in different forms based on the design of the study and the nature of the data.
- Analyse and interpret different types of data tables, graphs and results.

[1] Loftus and Palmer (1974) (https://doi.org/10.1016/S0022-5371(74)80011-3), 'Reconstruction of automobile destruction: An example of the interaction between language and memory,' *Journal of Verbal Learning and Verbal Behavior*, Volume 13, Pages 585–589, © Elsevier.

1.1 Research methodology

How is qualitative data transformed into credible evidence for a psychological theory or claim?

Guiding question(s)

In this subtopic, you are thinking about the question, '**When can we say something causes something else?**' This section will help you make an informed response by working through the following guiding question:

- How is qualitative data transformed into credible evidence for a psychological theory or claim?

By the end of this section, you should be able to identify and discuss how researchers analyse qualitative data for the purpose of supporting a hypothesis, psychological theory or claim.

Keep the guiding question in mind as you progress through this section. The guiding question(s) build into the subtopic question(s). You will return to the subtopic question(s) at the end of each subtopic. The subtopic question(s) require you to pull together your knowledge and skills from different sections, to see the bigger picture and to build your conceptual understanding.

Qualitative data collection and analysis

Qualitative research generates linguistic data as opposed to numerical. These methods include:

- interviews
- observations
- surveys with short responses.

There are different analysis techniques available for qualitative data, including:

- **thematic analysis** – researchers analyse the responses of participants and annotate transcripts to organise those responses into different themes and sub-themes (by developing

a coding scheme). Participants' direct quotes (evidence) support the themes.

- **inductive content analysis** – researchers systematically categorise and interpret textual data by identifying patterns, themes and relationships without preconceived categories.
- **narrative analysis** – researchers identify the 'story' within each transcript to see interrelations among themes.
- **interpretive approach** (phenomenological) – researchers interpret the 'sense' of participant accounts and reflections.

The focus here is on thematic analysis, which can be either very similar to inductive content analysis or very different depending on how it is used. According to Vaismoradi et al. (2013) (http://onlinelibrary.wiley.com/doi/10.1111/nhs.12048/full), the terms 'inductive content analysis' and 'thematic analysis' are often used interchangeably. However, despite the many similarities in the two approaches, there is a key difference: inductive content analysis focuses on quantifying data by measuring frequencies of categories and themes.

The common theme across these overlapping qualitative analysis techniques is interpretivism, which stands in contrast to the positivism of more quantitative approaches. The basic idea is that the usual scientific methods for investigating the natural world may not be appropriate for human psychology with all of its social elements. Therefore, the *interpretation* of the human experience becomes just as important as quantification or causality.

The process of qualitative analysis can be subjective, although efforts are usually made to make it as objective as possible without losing the subjective experience of the participants, which is at the heart of qualitative research. While quantitative results are always open to re-interpretation and analysis, it is a larger issue with qualitative research, because the researcher's interpretation can have a major effect on the interpretation of results.

For that reason, many qualitative studies deliberately address issues of reflexivity and credibility, and qualitative results are often triangulated against the results of other studies or against alternative interpretations of the same or similar data. The process of qualitative data analysis is subjective by nature.

HL Extension

Culture

Culture plays a significant role in qualitative research because researcher bias could emerge in regard to the interpretation of participant behaviour and/or responses. For example, if the researcher is not culturally fluent in

the nuances of communication, both verbal and non-verbal, they may not know what to 'look for,' nor the proper questions to ask and how to ask them, in the most culturally appropriate way possible.

Reflexivity and credibility

Researchers work with statistics, which can be easily manipulated. As such, it is crucial that they practise reflexivity, reflecting on their own bias and potential impact on the collection or interpretation of data.

Some key elements of reflexivity are:

- **self-awareness** – researchers should acknowledge their cultural, social and personal backgrounds, and how these may affect their perspectives and interpretations of data.
- **impact on research process** – researchers should consider how their presence, behaviour and choices during the research process might influence the participants and the data collected. This includes interactions during interviews, observations and other data-gathering activities.
- **bias and subjectivity** – researchers should recognise and critically examine their own biases and subjectivities and, where identified, take steps to reduce their impact on the data and analysis.
- **iterative process** – reflexivity should be an ongoing, iterative process that occurs throughout the research project, from the formulation of research questions and design to data collection, analysis and reporting.

Activity

IB learner profile attribute: Reflective

Approaches to learning: Research skills

Time required to complete activity: 30 minutes

Activity type: Pairs

Reflecting on reflexivity

Concept application: Bias

1. Individually or in a small group, design a research question: What do you and your fictional research team want to investigate? What do you want to know?
2. Write three to five interview questions that will provide insight or answers to your research question.
3. Answer the following reflection questions.

Reflection questions

1. In what way might your cultural, social or personal background have influenced the creation of your interview questions?
2. In what way might your cultural, social or personal background influence the interpretation of your participants' answers?
3. What steps could you and your research team take to reduce the extent to which your presence or response to participants' answers influences subsequent answers?
4. Identify any existing bias or thoughts regarding the 'answer' to your research question. How might these biases or preconceptions influence your interpretations of the participants' responses?

Thematic analysis

Thematic analysis takes raw verbal data, codes it and turns it into meaningful themes, which the researcher interprets and analyses (**Figure 1**). These themes include extracts of verbatim data to support and evidence the analysis (Braun and Clarke, 2008) (https://www.tandfonline.com/doi/abs/10.1191/1478088706qp063oa).[1]

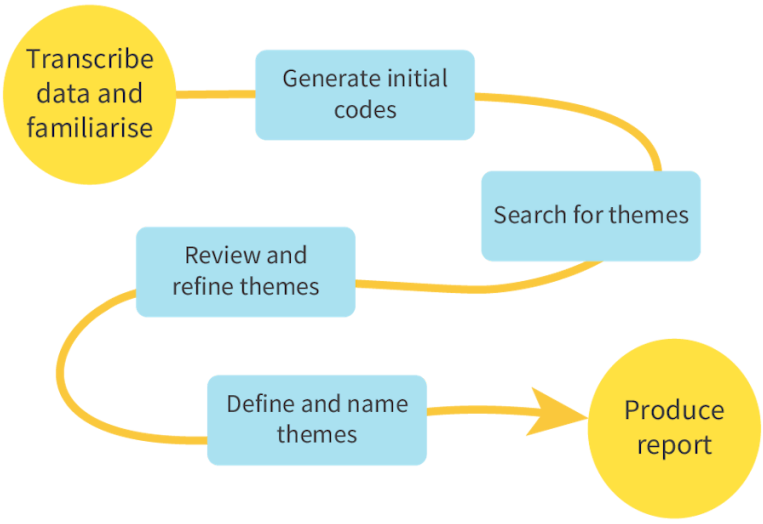

Figure 1. The process of thematic analysis of qualitative data.

Source: Adapted from Braun and Clarke (2008) (https://www.tandfonline.com/doi/abs/10.1191/1478088706qp063oa).[1]

More information for figure 1

Flowchart showing these stages: Transcribe data and familiarise; Generate initial codes; Search for themes; Review and refine themes; Define and name themes; and Produce report.

Each step in thematic analysis takes the researcher deeper into the data and into interpretation. In step-by-step form, the process (Braun and Clarke, 2008) in **Figure 1** is as follows:

1. Familiarise yourself with the data (including transcription of verbal data).
2. Generate initial codes, using notes, highlights or sticky notes on the most basic segments of the verbal data.
3. Search for themes, by sorting codes into potential themes, sub-themes and data extracts.
4. Review and refine themes in relation to data extracts, differentiating or merging them to create overarching themes (also known as higher-order themes) and defining a 'thematic map' for the data.
5. Define, name and briefly describe themes by analysing data within each theme and identifying sub-themes.
6. Produce a report, telling the complicated story of the data.

According to Braun and Clarke's model, the interpretation begins with searching for themes, and researchers refine and repeat the analysis from there. The process of thematic analysis is framed as step-by-step, but it is not necessarily linear. Researchers refine their themes repeatedly as they analyse and re-analyse the data.

Along with highlighting similarities and differences across a data set, thematic analysis summarises key features of the data and offers a 'thick description' of it (Braun and Clarke, 2008). It also allows for psychological *and* social interpretations of data, which in turn makes it useful for research in the sociocultural approach.

Braun and Clarke (2008) argue that thematic analysis should be a foundational method for qualitative researchers because it provides core transferable skills necessary for other kinds of qualitative analysis, such as coding verbal data into themes.

Concept

Bias

Bias poses challenges in qualitative research, where subjectivity is significant. Reflexivity helps researchers examine their influence, raising questions about the possibility of complete objectivity.

Reflection questions

1. How does the process of reflexivity seek to remove bias from the qualitative research process?
2. Is the removal of all bias from any research investigation possible?

Identifying themes

The abstraction of data in inductive content analysis takes the higher-order categories and gives them a characteristic name. For example, interview data from a qualitative study on the effectiveness of cognitive treatment for depression could include verbatim evidence like 'knowing my triggers' or 'recognising the warning signs' (Allen et al., 2009) (https://www.cambridge.org/core/journals/behavioural-and-cognitive-psychotherapy/article/participants-experiences-of-mindfulnessbased-cognitive-therapy-it-changed-me-in-just-about-every-way-possible/F55887EF2347B44650ECBE7F19D4491A).[2] A researcher might include those quotations in a theme named 'detecting relapses,' which in turn might be abstracted under the higher-order theme of 'control.' This is how verbatim extracts lead to meaningful categories and themes in qualitative research.

The higher-order themes synthesise the data into broader categories, analysing the main issues in play. In **Table 1**, for example, it is clear that the overarching issues in the treatment of depression appear to be related to control, acceptance, relationships and struggle. This helps to formulate general conclusions from verbal data.

Table 1. Example analysis of verbal data from Allen et al. (2009) on Mindfulness-Based Co Therapy (MBCT) and depression.

Source: Adapted from Allen et al. (2009) (https://www.cambridge.org/core/journals/behaviour cognitive-psychotherapy/article/abs/participants-experiences-of-mindfulnessbased-cogn therapy-it-changed-me-in-just-about-every-way-possible/F55887EF2347B44650ECBE7F19D4491A)[2]

Higher-order themes			
Control	Acceptance	Relationships	Struggle
detecting relapses	de-stigmatisation	valuing self	striving with M

	Higher-order themes		
taking action	depression objectified	improved relationships	acceptance change
impact of mindfulness			
sense of control			

Qualitative analysis is flexible and captures the qualitative elements of experience. However, a limitation is that no single 'fixed' way of doing it exists. Therefore, researchers need skill and experience to conduct a thematic content analysis effectively.

Learning outcomes

By the end of this section, you should be able to:

- Identify the steps to ensuring credibility in research.
- Identify and discuss how data is represented and analysed in different forms based on the design of the study and the nature of the data.
- Describe the role of reflexivity and the process of checking for unconscious bias.
- Analyse and interpret different types of data tables, graphs and results.
- Discuss factors that should be considered when transferring findings of a study to another population or context.

[1] Braun, V. & Clarke, V. (2008) 'Using thematic analysis in psychology,' *Qualitative Research in Psychology*, Volume 3, Issue 2, Pages 77–101 © Taylor & Francis.

[2] Mark Allen, Andrew Bromley, Willem Kuyken & Stefanie J. Sonnenberg (2009), 'Participants' Experiences of Mindfulness-Based Cognitive Therapy: "It Changed Me in Just about Every Way Possible,"' *Behavioural and Cognitive Psychology*, Volume 37, Issue 4, Pages 413–430 © Cambridge University Press, reproduced with permission.

1.1 Research methodology

What is sampling and why does it matter?

Guiding question(s)

In this subtopic, you are thinking about the question, '**When can we say something causes something else?**' This section will help you to make an informed response by working through the following guiding question:

- Why do sampling techniques and populations matter in psychological research?

Keep the guiding question in mind as you progress through this section. The guiding question(s) build into the subtopic question(s). You will return to the subtopic question(s) at the end of each subtopic. The subtopic question(s) require you to pull together your knowledge and skills from different sections, to see the bigger picture and to build your conceptual understanding.

A hypothetical research group is curious about the relationship between social media use and buying habits. Specifically, they want to know the extent to which time spent on social media influences buying habits.

Before they begin their investigation, they have to make some choices:

- What is their population?
- Which sampling technique will they use to identify participants?
- Which research method should they use?

Population

Choosing who to enlist in a research study is an important decision. The group of people from whom researchers get their sample is called the population. Different populations come with different characteristics. These characteristics are often

defined by demographic characteristics, such as (but not limited to):

- nationality
- gender
- age
- income level
- education level
- ethnicity.

Populations can also be defined and described by more specific biological and environmental elements, such as a shared gene or addiction to a specific drug.

Researchers should consider the population from which they take their sample. For example, a driving investigation requires a sample from a population with driving experience.

Making connections

Applying research findings

Understanding the strengths and limitations of sampling techniques is important. It can inform your evaluation of your findings' applicability to other populations. For example, a student investigating the efficacy of different biomedical treatments for depression would benefit from evaluating the sampling techniques used in research to validate or support a given biomedical approach.

Different populations can also have different built-in confounding variables. Therefore, researchers need to understand the populations from which samples are taken and acknowledge the confounds within them. This can help researchers structure an investigation that minimises possible biases.

Sampling

Once researchers have chosen their population, they then need to enlist individuals from that population into their study using a sampling method. There are various sampling methods, each with its strengths and limitations. **Table 1** outlines some of the most common sampling methods and highlights their strengths and limitations.

Table 1. Sampling methods and their strengths and limi

Sampling method	Strengths	
Random Participants are selected randomly from a population. Each member of the population has an equal chance of being selected.	Random sampling is considered the 'gold standard' of sampling methods because random sampling: • reduces sampling bias. • increases representativeness by removing any systematic or biased selection of participants. • increases generalisability due to the representativeness of the sample.	• In ha popu samp chall • Rand alway logis restra • Beca self-s issue data the re • Rand suffe This that r resea popu Whit Indus Dem exam Harv rand year' samp parti beca likely of th whol not b globa

Sampling method	Strengths	
Opportunity/convenience Participants are selected from a population based on their accessibility, proximity and ease of recruitment.	• It is easy to do (less planning). • It eliminates the need for travel, marketing or outreach of other kinds, so costs less than other methods. • Because participants are chosen based on availability, this method takes less time.	• There in eff repre result stron exam oppo your purp and study bias scho drivi • The a limits • Repr chall inves achie chara
Stratified Divides the population into different strata (groups) based on a defining set of characteristics, then samples a specific number of participants from each stratum.	• The main goal of stratified sampling is improved representativeness. Dividing the population into strata ensures this. • Increased representativeness also increases generalisability.	• Strati diffic • It inc requi • It req popu succ • Poor redu the s • It is n inten meth

Sampling method	Strengths	
Snowball Existing participants recruit subsequent participants and those participants recruit others, like a snowball growing as it rolls down a hill and picks up snow.	• It facilitates access to hard-to-reach populations. • Researchers can spend less on marketing and recruiting. • It is very efficient.	• Samp repre selec resea heroi snow Howe lack beca study heroi • The a limits • The c depe parti • There with priva parti acqu
Self-selected Self-selected sampling uses participants who choose to take part. This usually occurs when participants respond to an advertisement of some kind.	• It is easy to recruit participants. Researchers create an advertisement or marketing campaign. • Researchers can target motivated participants. Because participants volunteer, they are usually motivated and engaged throughout the study.	• Samp repre selec • The a limits • Can overr grou • Parti motiv selec their durin

Sampling limitations that can affect the outcome of an investigation are broadly referred to as sampling bias. Researchers strive to reduce sampling biases and confounds when choosing a sampling method. However, some types of investigations require certain methods, while others may not be an option. Therefore, it is important that researchers understand and acknowledge the limitations and biases inherent in their chosen sampling method.

Concept

Bias

Bias in sampling is a critical consideration in psychological research. Reflecting on sampling methods helps us understand their role in shaping research outcomes.

Reflection questions

1. How can bias confound (confuse) the results of an investigation as a result of sampling?
2. Why does random sampling reduce bias in research findings?

To what extent can researchers apply their results to broader populations or contexts?

The goal of psychology is to increase human well-being and thriving. Therefore, researchers seek to apply their research findings beyond their participants to humans in the 'real world.' This is why understanding populations and sampling techniques is so important. In general, investigation results should only be applied to the population sampled. However, even that may not be valid if sampling bias is too prevalent.

Researchers must be cautious not to overgeneralise. As you will learn throughout this course, there are myriad factors that contribute to human behaviour and cognition, including culture, biology and mindset. By understanding and acknowledging this fact, researchers can see the risk of overgeneralising a finding from a sample group to a broader population.

Of course, both data and research triangulation can make findings more valid and therefore increase the level of transferability. When determining the extent to which findings can be transferred to a population outside of the research population, it is crucial for researchers to consider both the internal and external

validity of their findings, and to determine the extent to which their sample would accurately represent the context or population to which they intend to transfer their findings.

For example, an experiment conducted on a non-stratified sample of 50 male students at a university in London may not have the same level of transferability as that same experiment conducted on a stratified sample of London citizens. In this way, different sampling methods can help to increase the transferability of an investigation's finding.

That is why psychological research must be contextualised and viewed as a massive collaborative effort among scientists, who continually strive to refine and validate existing psychological theories and claims.

Activity

IB learner profile attribute: Knowledgeable

Approaches to learning: Thinking skills

Time required to complete activity: 20—30 minutes

Activity type: Individual/Pair

Populations and sampling

Concept application: Measurement

This section began with a hypothetical research group curious about the relationship between social media use and buying habits. Using this real-life scenario, answer the reflection questions.

Reflection questions

1. a. Identify and define a population from which you think the fictional researchers should take their sample.

   b. Identify possible confounding variables within the population that could affect the results of the investigation.

2. a. What sampling technique should the research group use?

   b. Why did you suggest this technique? What are its strengths and limitations?

3. To whom would the results of the researchers' findings be generalisable? Explain your answer.

Learning outcomes

By the end of this section, you should be able to:

- Discuss the advantages and disadvantages of different sampling techniques.
- Identify the steps to ensuring credibility in research.
- Discuss factors that should be considered when generalising findings to another population or context.
- Discuss how sampling bias can impact a result.
- Discuss how sampling techniques can be used to reduce bias.
- Discuss factors that should be considered when transferring findings of a study to another population or context.

1.1 Research methodology

How do ethical frameworks guide human research in psychology?

Guiding question(s)

In this subtopic, you are thinking about the question, '**How do ethical frameworks guide research in psychology?**' This section will help you make an informed response by working through the following guiding question:

- What ethical guidelines are in place regarding human research?

Keep the guiding question in mind as you progress through this section. The guiding question(s) build into the subtopic question(s). You will return to the subtopic question(s) at the end of each subtopic. The subtopic question(s) require you to pull together your knowledge and skills from different sections, to see the bigger picture and to build your conceptual understanding.

Figure 1. Child psychiatrist Peter Neubauer of NYU conducted a quasi-experiment in the 1960s that involved forcibly separating twins for adoption into different families.

Credit: George Marks, Getty Images

It is 1961, and a prestigious psychiatrist, Dr. Peter Neubauer, at Bellevue Hospital, New York University (NYU), wants to understand the extent to which environmental factors shape a child's development relative to biological factors. He realises that identical twins would be the best participants for such an investigation (because their biology is the same (**Figure 1**). The problem, however, is getting the twins to be raised in two different environments.

The professor devises a solution: find twins in need of adoption at various orphanages around New York City and separate them. Ensure that each twin goes to a different family.

Is such an experiment (https://yaledailynews.com/blog/2018/10/01/records-from-controversial-twin-study-sealed-at-yale-until-2065/) ethically permissible?

Concept

Responsibility

Ethical considerations are central to psychological research, shaping how studies are designed, conducted and evaluated. Reflecting on the roles of various stakeholders and the complexities of differing ethical standards raises important questions about responsibility and the validity of knowledge.

Reflection questions

1. Who should take responsibility for ensuring that only ethically responsible research is conducted: universities, governments, individual research teams?
2. What happens when the ethical systems between different cultures, countries and stakeholders differ?
3. Is knowledge acquired unethically still valid?

Today, the answer to that question is a resounding 'no.' However, in 1960's New York, this investigation was approved by NYU and adoption agencies around the city. Five sets of twins and one set of triplets were separated, and each adopted

into different homes. The triplets became the subject of a TV documentary (**Video 1**).

Video 1. A set of triplets was intentionally separated and adopted into different homes for the purpose of research. Their story became the subject of a TV documentary.

Unfortunately, the history of psychological research is littered with studies and investigations that would no longer be considered ethical. As psychologists around the world have learned more about the impact of research-based actions on participants, they have developed guidelines designed to protect participants from undue physical and psychological harm.

Creativity, activity, service

Strand

Service

Learning outcome

- Demonstrate engagement with issues of global significance.

An often overlooked element of ethics in psychology is access. Is it an ethical responsibility for societies to ensure access to psychological care (such as psychologists, psychiatrists, counsellors and treatment) by ensuring everyone in society can afford or access care?

Many communities do have programmes designed to provide access to individuals, but the awareness of the existence of these programmes may vary.

Are there any gaps in access in your community that you think you could fill by increasing awareness of government services?

Ethical considerations during research

Ethical considerations are published by psychological associations worldwide (such as the American Psychological Association (https://www.apa.org/ethics/code)). While there are variations in emphasis, the guidelines below provide a foundation for ethical evaluation throughout the course.

Informed consent

A participant needs to be informed of the aims and objectives of the research and what it involves, and they need to give their consent to participate. An informed consent statement typically includes details related to:

- the study itself
- the researchers and supervisors
- the right to withdraw from the study
- confidentiality and anonymity
- means of accessing results.

Informed consent applies to research that might involve involuntary participation (such as covert observation) and to any video or audio recordings made during the research.

The biggest challenge presented by informed consent is that participants formally know they are being studied, which has various impacts on validity. Participants do not always act 'naturally' in the research setting.

The importance of informed consent is even greater when research participants are children or vulnerable adults. The question then becomes, 'who gives consent?'

Physical or psychological harm, discomfort or stress

Research that causes undue or excess anxiety, stress, distress, pain, discomfort, self-esteem issues or even any long-lasting change in the participant is generally not permitted.

This guideline is sometimes known as protection of participants. These same guidelines apply to animal research.

Right to withdraw

No matter the reason, participants always have the right to withdraw from a study, and researchers cannot prevent them. No pressure, in any form, should be placed on participants to continue the research if they want to withdraw. This ensures respect for individuals.

Typically, the right to withdraw is included with informed consent. Some researchers place certain terms on withdrawal because it can have major repercussions for the researcher. Depending upon what was agreed to in the informed consent, participants may only be paid a portion of the remuneration if they withdraw before the completion of a study.

Confidentiality and anonymity

Participants have a right to confidentiality and anonymity, and no participant should be identifiable by name or any other distinguishing detail.

There is an important difference between confidentiality and anonymity.

- Confidentiality means the information is **private**, but it is technically possible for a researcher to figure out a participant's identity.
- Anonymity means that it is impossible for anyone, even the researcher, to connect a participant with their data.

While a researcher can often link a participant with their results, these results are always published in aggregate form, with no individual data. This helps to ensure anonymity

Deception

Deception refers to misleading participants or misrepresenting their participation in some untrue way. Up until the refinement of professional guidelines for research, deception was employed quite regularly in psychological research, partly because it allowed for more valid measurement of naturally occurring behaviour.

This presents a major challenge to individual respect, however, and unjustified deception is generally not permitted anymore. It remains possible for researchers to use deception in certain limited cases, approved by ethics review boards, who evaluate the need (or lack thereof) for deception in the study, and its potential benefit.

Debriefing

When the research is over, every effort must be made to return participants to their original state, so that they are not changed in any lasting way by participating in the research.

Usually, this simply involves an explanation of the research and what role the participant played in it, but, in more severe cases, debriefing might go as far as psychological counselling (if that is what is necessary to return participants to their original state). Debriefing is especially necessary when deception is used during the study.

Researchers need human participants in order to understand human behaviour, but the safety and well-being of the participants must take priority over knowledge acquisition. As demonstrated by the tragic example of Neubauer's research, this was not always the case.

Ethical guidelines are also important because participants who are emotionally or physically distressed may not provide valid data and therefore ethical guidelines also contribute to credibility.

The activity below is designed around a famous but ethically questionable study. Stanley Milgram of Yale University (https://www.britannica.com/science/Milgram-experiment), in the early 1960s, investigated the extent to which an individual would inflict violence on a stranger simply because an authority figure asked them to. The results of Milgram's many replications and partial replications were surprising both to him and the global community after he published his results.

HL Extension

Motivation

Motivation is an important factor for every researcher, and being aware of one's motivation for conducting research is a major component of reflexivity.

Every research study presents an opportunity cost. Milgram was motivated to conduct research into blind obedience to authority, and this motivation caused him to conduct the research he did as opposed to some other investigation.

Consider how motivation plays a role in your daily choices.

Activity

IB learner profile attribute: Thinker/Principled

Approaches to learning: Thinking

Time required to complete activity: 15—20 minutes

Activity type: Pairs

Ethics and research

Read the synopsis of the famous 'Obedience to Authority: An Experimental View (https://nature.berkeley.edu/ucce50/ag-labor/7article/article35.htm),' conducted by Stanley Milgram of Yale University.

Now, consider the following elements of the ethical framework (https://www.apa.org/ethics/code) put forward by the American Psychological Association (APA):

- protection from harm
- informed consent
- confidentiality
- right to withdraw
- minimal use of deception and only when necessary to achieve the aim.

Using the APA's ethical framework and the information in 'Ethical considerations during research' above, answer the following questions in a short presentation or written response.

1. Evaluate the extent to which you find the Milgram experiment ethically justified or unjustified. If unjustified, what specific elements of an ethical framework did the study violate?
2. **(Concept application: responsibility)** Discuss the concept of responsibility relative to psychological investigations. In what ways can a researcher's responsibility to participants get in the way of their responsibility to seek psychological knowledge?

Learning outcomes

By the end of this section, you should be able to:

- Describe the potential effects of ethical considerations in psychological research.
- Identify the steps to ensuring credibility in research.
- Discuss the role that responsibility plays in psychological research.