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GCSE (9–1)
Teacher Guide

PSYCHOLOGY

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For first teaching in 2017

Quantitative skills for GCSE Psychology

Version 1

www.ocr.org.uk/psychology

GCSE (9–1)
PSYCHOLOGY

Introduction

This teacher guide provides information that can be used by teachers or adapted for learners for the research methods content relating to **quantitative skills**. The content of research methods will be embedded in the assessment across both component 1 and component 2 and a minimum of 10% of the overall marks across the two components will be targeted at the assessment of mathematics relevant to research methods in psychology. Some learners will find the content of mathematics in psychology relatively straightforward, but those who are weaker at maths in general may need additional support. The websites suggested at the end of this guide should be useful points of direction for extra maths practice or to help learners who need extra support.

This guide is intended to provide teachers with mathematical information to deliver that is simplified and straightforward. This guide could be amended by individual teachers to embed learning activities for learners and could then be used as a learner resource as well.

The guide should help teachers and learners to:

- understand the difference between qualitative and quantitative data and the associated strengths and weaknesses
- to understand why measures of central tendency are used, how to calculate the mean, median and mode and draw inferences from them
- to be able to understand and calculate several mathematical skills such as ratio, fractions, percentages, standard and decimal form, decimal figures, significant figures, making estimations from data and normal distribution curves
- to be able to identify, draw and interpret appropriate tables, charts and graphs including tally charts, bar charts, pie charts, histograms, line graphs, and scatter diagrams.

What is quantitative data?

What is quantitative data?

Quantitative data is information collected from participants in psychological research that is in numerical form. This type of data allows psychologists to easily identify trends, averages and differences between individuals or groups of participants. This type of data is relatively easy to interpret, analyse and score and can be collected through numerous ways such as: the scores of participants in an experiment, answers to closed questions in a questionnaire, notes from structured observations or correlational data.

Examples of **quantitative** data collected from the **key research studies**

Development: Piaget (1952)

The amount of children in the different age groups who correctly completed the conservation of number tasks.

Criminal Psychology: Heaven (1996)

The amount of males and females engaging in delinquency at both Time 1 and Time 2. Correlational analysis of Psychoticism at both Time 1 and Time 2 with delinquency at Time 1 and Time 2. Extroversion at Time 2 with delinquency at Time 2.

Strengths of quantitative data

- The data is numerical and so it is easy to analyse differences between participants and summarise data using descriptive statistics.
- Due to data being numerical it allows for easy replication of measurement by others which can increase external reliability and allow easy checks for inter rater reliability.

Weaknesses of quantitative data

- Numerical data cannot provide any insight into why behaviour occurred clearly which can lead to reduced construct validity.
- Numerical data oversimplifies the reality of human experience as it only provides simple answers to complex behaviour.

How is this different to qualitative data?

Qualitative data is written descriptions of behaviour collected from psychological research and so is non-numerical. This type of data is more difficult to interpret and score because it contains thoughts and feelings which cannot be easily categorised without intense analysis. The majority of qualitative data is generated by case studies, interviews, questionnaires (open questions) and unstructured observation notes. It may also include descriptions of participants' reactions. Qualitative data cannot be counted to identify trends but it can be turned into quantitative data by placing the data into categories (grouping answers together to enable comparisons) this then enables trends to be identified.

Examples of **qualitative** data collected from the **key research studies**

Social Influence: Morrell *et al*. (2011)

Data collected from interviews with young people and stakeholders in relation to who was involved in the riots and the motivators for involvement in rioting and/or looting.

Memory: Wilson *et al.* (2008)

Case study notes gathered on Clive Wearing, an individual who suffered from anterograde and retrograde amnesia following a viral infection. Neurological and psychological experiences were recorded.

Strengths of qualitative data

- Qualitative data can generate information about the reasons behind behaviour in detail, allowing psychologists to find out 'why' behaviour occurred. This can increase the construct validity.
- As thoughts and behaviours are not reduced to numbers, qualitative data provides rich details and can therefore better represent the complexities of human behaviour.

Weaknesses of qualitative data

- Qualitative data causes practical issues, as it is very time consuming and difficult to analyse and draw conclusions from.
- Qualitative data is open to subjective interpretation as different people may analyse the data differently. This could potentially lead to a lack of construct validity in analysis.

Analysing quantitative data – Descriptive statistics

Descriptive statistics are used to analyse raw data and enables the researcher to describe and summarise the data collected from psychological research to provide more meaningful results. They are the first step in any data analysis. Looking for typical or representative values (i.e. averages) to put in a summary table can be done by looking at **measures of central tendency**, such as the **mean, median** and **mode**. The specification requires that learners are able to calculate these and draw inferences from tables of results.

The **mode** is the value or event that occurs most frequently in a data set. This measurement is a basic measure of central tendency. To calculate the mode the value that occurs most frequently simply needs to be counted. When there is more than one number that appears most frequently, this is called bimodal. For example: **5**, 6, **5**, 8, 10, 11, **5**, 3, 4 = Here the mode would be 5.

Strength of using the mode

It is useful when the data is in categories for example the number of people who have a different type of pet dog as you can simply count most common occurring category.

Weakness of using the mode

It is not useful if there are several modes as you cannot draw conclusions about what occurs the most frequently.

The **median** is the middle value when the raw data is placed in order (from smallest to largest). If there is an odd number, the median is the middle number. If there is no direct midpoint in the data you have to add the two middle values together and divide by two to get the median. For example: 3, 5, 7, 10, **12**, 13, 14, 15, 17 = Here the median would be 12.

Strength of using the median

It is not affected by extreme scores as they are marginalised.

Weakness of using the median

It is not as sensitive as the mean because all of the values are not reflected in the data set.

The **mean** score is the score commonly known as an **average**, and the one that will most likely be used by psychologists when analysing data. To calculate, you add all the numbers in the data set together and divide by the total amount of results. For example: 6 + 9 + 9 + 13 + 15 + 21 + 24 + 24 + 28 + 32 = 181 = 181/10 (as there are 10 scores) = 18.1.

Strength of using the mean

It makes use of all the values in the data set and is therefore the most sensitive measure of central tendency, as no results are left out.

Weakness of using the mean

It can be misrepresentative of the numbers if there are any extreme values (very high or very low known as **anomalies**) – This inflates or deflates the score.

The **range** is a **measure of dispersion** and measures how spread out a set of data is. The range of scores in a collection of data is the difference between the largest and smallest scores. To calculate the range, take away the smallest number from the largest number and add 1. For example: **3**, 5, 7, 10, 12, 13, 14, 15, **17** = Here the range would be 17-3 + 1 =15.

Strength of using the range

It is easy to calculate.

Weakness of using the range

It can be affected by extreme values - either high or low scores.

Several **mathematical skills** are also required to be learnt in the specification by learners, for example, methods used to express numbers that are part of a whole number. The mathematical skills required include the following:

Ratios

A ratio is how much of one thing there is compared to something else. For example, if a group of two learners share a pizza with 10 slices but one learner has 4 slices and the other has 6 slices then the ratio would be 4:6. Ratios can be simplified by dividing each score by 2. So here the ratio of 4:6 can be simplified as 2:3.

Percentages

Percentages represent the data out of 100. To calculate percentages, you need to divide by 100. So to find the percentage of a raw test score of 17 out of 30 the following calculation would be used: 17/30 x 100 = 56.6%.

To calculate a certain percentage of a whole number the following calculation would be used: To find 16% of 40 you would calculate 16/100 x 40. A percentage can also be expressed as a decimal or fraction. For example, 25% can also be expressed as: 0.25 (decimal) or ¼ (fraction).

Fractions

Represent a proportion of something whole. There are two parts to a fraction. The top number of the fraction is called the numerator, the bottom number is called the denominator. To find the fraction of a whole number e.g. 2/5 divide the whole number by the denominator, then multiply the answer you get by the numerator, for example, to find 2/ 5 of £15, divide 15 by 5 (the denominator): 15 ÷ 5 = 3 then multiply the answer 3 by 2 (the numerator): 3 x 2 = £6.

To convert fractions to a **percentage**, divide the top fraction by the bottom fraction and multiply by 100.

Expressions in decimal and standard form

Decimal form allows portions of whole numbers to be represented. Each digit after the decimal point is 1/10 the size of the one before. For example: 0.9 = 9/10, 0.09 = 9/100.

Sometimes psychologists have to work with very large numbers so it is often necessary to simplify these using shorthand, this is known as **standard form**. This makes the numbers easier to understand. For example, 85,000 would be 8.5×10^4 – this means 8.5 x (10 x 10 x 10 x 10).

Analysing quantitative data – Descriptive statistics

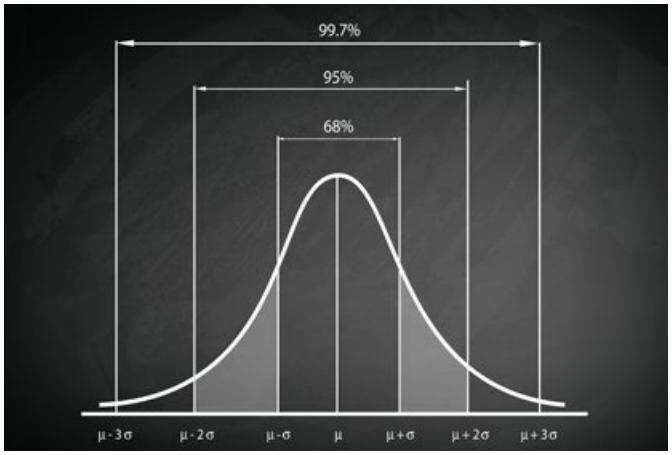
Decimal places and significant figures

Decimal places allow whole and part of numbers to be expressed. The digits to the left of the decimal place are whole numbers and the digits to the right are part numbers. For example, 1.5 mean one and a half.

Significant figures allow easy analysis of numerical data by removing some of the digits. In order to reduce the number of significant figures, rounding is required. If the next digit is 5 or above round up. If it is 4 or below round down. For example, 43,600 rounded up to 2 significant figures is 44,000.

Normal distributions

Normal distribution curves occur when certain variables are measured and the variables are distributed so that most of the scores are clustered around the mean, median and mode. All of the measures of central tendency are at the midpoint. The curve has a symmetrical bell shape so it represents 50% of scores to the left and 50% of the scores to the right of the mean. An IQ test would be a good example of where a normal distribution curve would be used because the average score is 100 and it is assumed that IQ scores are normally distributed.



Estimations from data collected

Sometimes psychologists might be interested in a quick approximation of data collected and so they may make estimations from data collected. This is done by working out an approximate value by rounding values up or down, for example to make a quick estimation of 457 x 5178 – 457 can be rounded up to 500 and 5178 can be rounded down to 5000 so the psychologists would calculate 500 x 5000.

Tables, charts, and graphs

Tables, charts, and graphs are all used to visually represent and describe data once it has been summarised and they make it easier for the data to be understood. The specification requires learners to be able to draw, interpret and analyse tables, charts, and graphs. Note: that an accurately drawn graph will need two fully labelled axis, an appropriate title and correctly labelled scales.

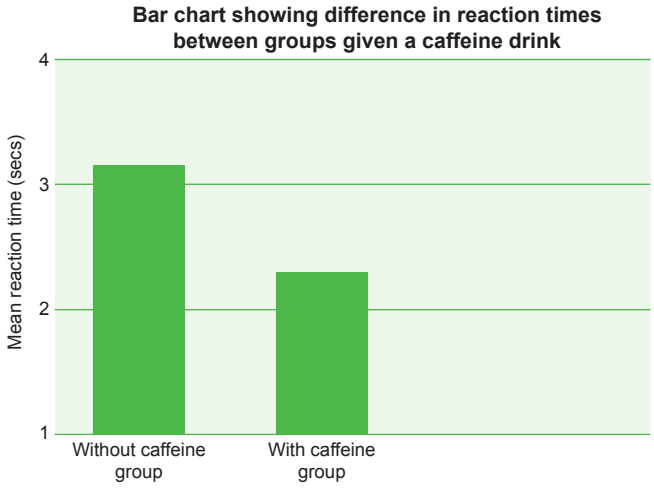
Frequency tables (tally chart)

Sometimes a table might be used when collecting and recording certain data. For example, in an observation study a tally chart might be used to count up instances of behaviour and collect quantitative data. Tally charts record the number of times something is seen. Here is an example of a tally chart for an observational study to investigate study behaviours shown by University students in study zones.

Category of behaviour	Tally	Total
Reading	𝍸 |	6
Talking	||||	4
Writing	𝍸 𝍸 |	11
Using phone	||	2

Bar charts

These can be used to represent the data from frequency tables, mean scores, or the totals of behaviour. *The mean or frequency is displayed on the y-axis and the categories of behaviour are displayed on the x – axis.* In a bar chart the columns do not touch and they have equal width and spacing.

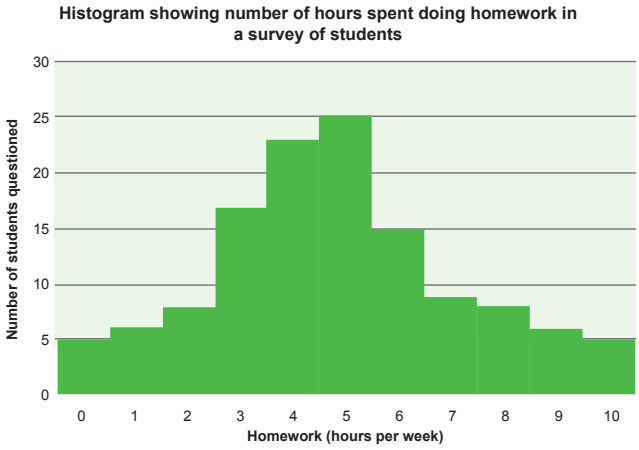


Pie charts

Are circular graphs that show the relative contribution that different categories contribute to an overall total, the bigger the slice on the pie chart the more data that has been collected. Pie charts are good for displaying data for around six categories or fewer, where the categories show some variation. To draw a pie chart, each part of the data needs to be represented as a proportion of 360, because there are 360 degrees in a circle. For example, if 55 out of 270 participants said that twitter was their favourite social media website, this would be calculated in the following way. 55/270 x 360 = 73 degrees.

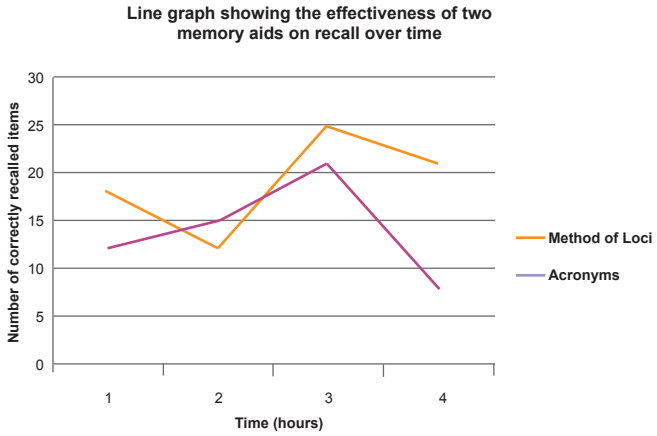
Histograms

Histograms are used to represent data on a 'continuous' scale. They look similar to a bar chart but the columns touch because each one forms a single score (interval) on a related scale, e.g. time - number of hours of homework learners do each week. Scores (intervals) are placed on the *x-axis*. The height of the column shows the frequency of values, e.g. number of learners in each interval – this goes on the *y-axis*.



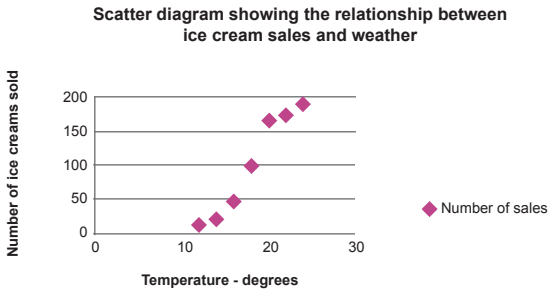
Line graphs

These can be used as an alternative to a histogram. The lines show where mid-points of each column on a histogram would reach. The data is continuous and they are particularly useful for comparing two or more conditions simultaneously.



Scatter diagrams

These are used in correlational analysis and measure the relationship between two co-variables. Data from one variable is presented on the *x-axis*, while the other is presented on the *y-axis*. An 'x' should be plotted on the graph where the two variables meet. The pattern of plotted points reveals different types of correlation, e.g. positive, negative or no relationship.



Additional information

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There are a lot of helpful and informative websites that can aid both teachers and learners with the mathematical requirements of the specification. Many of these have tasks and activities that learners can practice their maths skills on outside of the classroom. Below is a selection of such websites:

- https://www.mymaths.co.uk/ – Good for interactive lessons and assessments where teachers can track learners' progress. Ideal for independent study or homework tasks to consolidate and check learning.
- BBC GCSE bitesize (maths section) is ideal for less able learners to refresh their memory of the skills and rules surrounding the calculations of descriptive statistics and also has good visual representations of the different types of graphs.
- http://www.bbc.co.uk/education/topics/z2c4jxs/resources/1 - A good section on the BBC bitesize website for help and information regarding graphs.
- www.purplemath.com/modules/meanmode.htm - Offers a step by step guide to calculating the averages.
- www.mathworksheets4kids.com – A website where a selection of maths worksheets can be downloaded.
- There are also some useful YouTube clips online that have short video clips on how to carry out the different calculations, this would be a good place to direct visual learners.
- It might be beneficial for the weaker learners to be provided with an on going maths practice booklet for them to keep practicing their maths skills.

The small print

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