7.11 Correlational Analysis: Co-Variables, Correlation Coefficients and Scattergrams

AQA 7182 · about 60 minutes · Write-in edition

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer the short questions in full sentences where required. The final 8-mark question must be answered in full sentences. Time guidance: 60 minutes.

1 In the context of correlational analysis in psychology, define the term 'co-variable' and give one example of a pair of co-variables that might be studied in health psychology.

(Total for Question 1 is 2 marks)

2 List and briefly explain four limitations of correlational analysis, each linked to why it weakens causal claims.

(Total for Question 2 is 4 marks)

3 Describe clearly whether each of the following pairs of co-variables is likely to show a positive correlation, a negative correlation, or zero correlation in everyday contexts: (i) number of hours spent revising and exam score, (ii) number of cigarettes smoked per day and lung capacity, (iii) number of fingers on a hand and level of stress.

(Total for Question 3 is 3 marks)

4 A researcher provides the following co-variable data for 5 participants in a study of hours of sleep and attention score. Sketch a labelled scattergram on graph paper and plot the five points. Data: Participant A (hours sleep = 6, attention score = 62), B (8, 78), C (5, 55), D (7, 73), E (4, 50). In your answer box state the coordinates you plotted and indicate the method mark criteria.

(Total for Question 4 is 4 marks)

5 A published study reports a correlation coefficient of r = 0.78 between weekly exercise time and self-reported wellbeing in adults. Describe what the value r = 0.78 tells you about the direction and strength of the relationship and give one limitation of interpreting this number on its own.

(Total for Question 5 is 3 marks)

6 State briefly why correlational analysis cannot establish cause and effect. Give one example of a plausible third variable that could produce an observed correlation between two co-variables.

(Total for Question 6 is 4 marks)

7 A scattergram is drawn showing the relationship between hours of study per week (x) and number of social activities attended per week (y) for 7 students. The plotted points are roughly clustered with higher study hours associated with fewer social activities. Describe the correlation you would report for this scattergram, state whether it is positive, negative or zero, and give one practical implication a researcher might draw.

(Total for Question 7 is 4 marks)

8 Sketch and label axes and plot these points for co-variables 'daily screen time in hours' (x) and 'sleep hours per night' (y): P1 (2, 8.0), P2 (4, 7.0), P3 (6, 6.0), P4 (8, 5.0). State the coordinates you plotted and explain briefly why these points illustrate the concept of a linear negative correlation. (Method mark: plotting correctly earns 1 mark.)

(Total for Question 8 is 3 marks)

9 A researcher finds r = -0.05 for the relationship between number of pets owned and happiness score in a large sample. Describe what r = -0.05 indicates about direction and strength, and suggest two reasons why a researcher should not conclude that pets have no effect on happiness from this coefficient alone.

(Total for Question 9 is 3 marks)

10 Explain two ways in which correlational studies can be useful to psychologists, giving a brief example for each use.

(Total for Question 10 is 2 marks)

11 A study reports r = -0.64 between daily stress score and hours of sleep per night in a working adult sample. Explain fully what this coefficient tells you about the relationship, and give three evaluation points about the practical interpretation and limitations of this finding.

(Total for Question 11 is 6 marks)

12 Discuss the use of correlations in psychological research. In your answer, describe what correlational analysis can show and how it differs from experimental methods, then evaluate strengths and limitations with reference to real examples or plausible applications. You should support your discussion with both AO1 knowledge and AO3 evaluation.

(Total for Question 12 is 8 marks)

Mark scheme · 7.11 Correlational Analysis: Co-Variables, Correlation Coefficients and Scattergrams

Question 1

defines co-variable as a measurable variable that can vary and be measured in a correlation study, not manipulated oe **B1**

gives an appropriate example, e.g. hours of exercise per week and resting heart rate, or stress level and sleep duration oe **B1**

Answer: A co-variable is a measurable variable that can vary and be measured in a correlational study rather than being manipulated. Example: hours of exercise per week and resting heart rate.

Question 2

identifies the directionality problem and explains it weakens causal claims because correlation cannot show which variable came first oe **B1**

identifies the third-variable problem and explains it weakens causal claims because an unmeasured factor may cause both correlated variables oe **B1**

identifies measurement or reliability issues and explains that poor measurement can hide or create spurious correlations, reducing confidence in causal interpretation oe **B1**

identifies that correlations cannot detect non-linear relationships if a linear coefficient is used, and explains this could lead to incorrect conclusions about absence of a relationship oe **B1**

Answer: Limitations: (1) Directionality problem: correlations cannot show which variable causes the other, so causal claims are weakened. (2) Third-variable problem: an unmeasured factor may cause both variables, so the observed association is not causal. Additional limitations include measurement reliability issues which can obscure true effects, and linear correlation measures missing non-linear relationships.

Question 3

(i) positive correlation, more revision associated with higher exam score, oe **B1**

(ii) negative correlation, more cigarettes associated with lower lung capacity, oe **B1**

(iii) zero correlation, number of fingers normally does not vary with stress level, or no systematic relationship oe **B1**

Answer: (i) Positive correlation. (ii) Negative correlation. (iii) Zero correlation.

Question 4

plots all five points in their correct positions on a labelled axes system (hours sleep on x axis, attention score on y axis) awarding the method mark **M1**

states plotted coordinates correctly: A (6,62), B (8,78), C (5,55), D (7,73), E (4,50) oe **B1**

labels axes with units or scales for hours and attention score oe **B1**

provides a brief comment on overall pattern, e.g. points show a positive association, attention tends to increase with hours sleep oe **B1**

Answer: Plotted coordinates: A (6,62), B (8,78), C (5,55), D (7,73), E (4,50). Method mark awarded for plotting all five points correctly on labelled axes with a consistent scale; the plotted pattern shows a positive association where attention tends to increase with more hours of sleep.

Question 5

states direction: r = 0.78 is a positive correlation, as r is greater than zero oe **B1**

states strength: 0.78 indicates a strong relationship, fairly close to +1 oe **B1**

gives limitation: correlation does not imply causation, or there may be a third variable affecting both exercise and wellbeing, oe **B1**

Answer: r = 0.78 indicates a strong positive relationship, so higher weekly exercise is associated with higher wellbeing. A limitation is that the coefficient alone does not show causation and could reflect a third variable or directionality problems.

Question 6

states that correlations measure association, not manipulation of an IV, so no variable has been experimentally manipulated to establish causation oe **B1**

states directionality problem: cannot tell which variable, if either, causes the other oe **B1**

states third-variable problem: a separate factor could be causing both correlated variables oe **B1**

gives a plausible example of a third variable, e.g. socio-economic status affecting both exercise levels and wellbeing, or personality influencing both stress and sleep duration oe **B1**

Answer: Correlations show associations but do not manipulate an independent variable, so they cannot prove cause and effect. There is a directionality problem, and a third-variable could cause both measured variables. Example third variable: socio-economic status could influence both exercise levels and self-reported wellbeing.

Question 7

describes pattern: as hours of study increase, number of social activities tends to decrease oe — **B1**

identifies correlation as negative oe — **B1**

comments on strength: gives plausible qualifier, e.g. weak/moderate/strong negative association based on how tightly points cluster oe — **B1**

gives a practical implication, e.g. universities may consider that encouraging more study time could reduce social engagement, or they should design support so students can balance study and social life oe — **B1**

Answer: The scattergram shows a negative correlation: as study hours increase, social activities tend to decrease. Depending on clustering, this could be described as a moderate negative association. A practical implication is that support for student wellbeing should consider how increased study requirements may reduce social engagement, so timetabling could help students balance both.

Question 8

plots all four points in their correct positions on labelled axes, awarding the method mark — **M1**

states plotted coordinates correctly: P1 (2,8.0), P2 (4,7.0), P3 (6,6.0), P4 (8,5.0) oe — **B1**

explains that the points lie roughly on a straight line sloping downwards, showing that as x increases y decreases, which is a linear negative correlation oe — **B1**

Answer: Plotted coordinates: P1 (2,8.0), P2 (4,7.0), P3 (6,6.0), P4 (8,5.0). Method mark for plotting all four correctly with labelled axes. These points lie close to a straight line sloping downwards, so higher daily screen time is associated with fewer hours of sleep, illustrating a linear negative correlation.

Question 9

states direction: r = -0.05 is a very small negative correlation, slightly below zero oe — **B1**

states strength: -0.05 indicates a negligible or almost zero relationship, very close to 0 oe — **B1**

gives two reasons not to conclude no effect: e.g. measurement error or low reliability of the happiness measure, or a third variable masking an effect, or a non-linear relationship that Pearson r would not capture oe — **B1**

Answer: r = -0.05 indicates a very small negative relationship, essentially negligible. However, this does not prove pets have no effect: measurement error or poor reliability could hide a real effect, a third variable could be masking a relationship, or the true relationship might be non-linear and so not well summarised by Pearson r.

Question 10

useful for studying variables that cannot be ethically or practically manipulated, e.g. correlation between smoking and lung disease where experimental manipulation would be unethical oe — **B1**

useful for establishing relationships to generate hypotheses for later experimental testing, e.g. finding a correlation between social media use and anxiety could lead to experimental studies or longitudinal research oe — **B1**

Answer: Correlational studies are useful for examining relationships where manipulation is unethical or impossible, for example smoking and lung disease. They are also useful for identifying associations that suggest hypotheses for later experimental or longitudinal study, for example an observed link between social media use and anxiety.

Question 11

states direction: r = -0.64 is a negative correlation oe — **M1**

states strength: -0.64 indicates a moderately strong to strong negative relationship, fairly far from 0 toward -1 oe — **A1**

explains meaning in context: higher stress scores are associated with fewer hours of sleep per night, on average oe — **A1**

evaluation point: practical significance, e.g. the strength suggests a meaningful association that might warrant workplace interventions to reduce stress to improve sleep oe — **B1**

evaluation point: limitation due to causality, e.g. directionality problem means it could be that poor sleep increases stress rather than stress reducing sleep oe — **B1**

evaluation point: third-variable or sampling issues, e.g. a health condition or shift-working status might cause both high stress and reduced sleep, or the sample may not generalise to all workers oe — **B1**

Answer: r = -0.64 indicates a moderately strong negative relationship: as stress increases, hours of sleep tend to decrease. Practically, this suggests a meaningful association that might justify interventions to reduce workplace stress to improve sleep. Limitations are that causality is not established, since sleep problems might cause stress (directionality), and a third variable such as shift work or health problems could underlie the association; the sample may also limit generalisability.

Question 12

Level 4 Knowledge of correlational analysis is accurate and well detailed. The discussion is thorough and balanced, showing clear understanding of how correlations differ from experiments and giving a range of relevant strengths and limitations, developed with reasons and examples. Realistic applications or study examples are used to support points. The answer is coherent, well organised and uses appropriate specialist terms.	**7-8**
Level 3 Knowledge of correlational analysis is clear with some good detail. The discussion includes both strengths and limitations with some development and examples, though one area may be less fully developed. Differences from experimental methods are explained. The answer is mostly organised and uses specialist terms appropriately.	**5-6**
Level 2 Knowledge is present but limited. The answer includes basic points about correlational analysis and at least one strength or limitation, but explanations lack depth or development. Comparisons with experiments may be superficial. Organisation may be uneven and specialist terms used inconsistently.	**3-4**
Level 1 Knowledge is very limited. The answer may be a list of brief, undeveloped points. There is little or no effective evaluation and little comparison with experimental methods.	**1-2**
Level 0 No creditable content.	**0**

Indicative content:

- AO1: Correlational analysis measures the association between two co-variables, producing a coefficient (for example Pearson r) between -1 and +1 that indicates direction and strength of a linear relationship.
- AO1: Scattergrams are used to display paired data and to visualise positive, negative or zero correlations and the degree of scatter around a relationship.
- AO1: Correlations differ from experiments because no independent variable is manipulated and no random allocation to conditions occurs, so correlational designs do not establish cause and effect.
- AO3: Strength - ethical and practical usefulness: correlations allow study of variables that cannot be manipulated for ethical or practical reasons, for example the relationship between smoking and lung cancer, or trauma exposure and later mental health.
- AO3: Strength - useful for prediction and hypothesis generation: a reliable correlation, for example between exam attendance and grades, can be used for predictive purposes and to generate causal hypotheses to test experimentally or longitudinally.
- AO3: Limitation - directionality problem: a correlation between A and B does not show whether A causes B or B causes A, for example between stress and poor sleep.
- AO3: Limitation - third-variable problem: an unmeasured variable may cause the association, for example socio-economic status affecting both nutrition and cognitive test performance.
- AO3: Limitation - correlations do not capture non-linear relationships well when summarised by a single linear coefficient, and measurement error can obscure real relationships.
- AO3: Application and evaluation: consider real studies or plausible examples, weighing practical value against limitations and suggesting ways to strengthen evidence (triangulation, longitudinal designs, statistical control for third variables, or follow-up experiments).