Test Bank

# Chapter 12: Two-Factor ANOVA or Two-Way ANOVA

## Multiple Choice

1. Scenerio 12.1. A physical therapist works with a number of clients with chronic back pain. Through the years she finds that some people report some success with yoga as a way to relieve back pain and others report more success with pain relievers. The therapist wonders how these two treatments work alone and when taken simultaneously. To investigate this question she conducts a study with 32 patients with chronic back pain. Half of the patients are given a pain reliever to take once a day for a month and the other half are given a placebo. In addition, half of the patients participate in a yoga class 3 times a week for month, while the other half does not participate in yoga. At the end of the month, all participants rate their back pain on a 7-point scale with higher numbers indicating *greater back pain*. The SPSS output follows. As you can see, there are only 8 people per group. Which assumption should you be most concerned about given this small sample size?   
  
 

A. homogeneity of variance

B. appropriate measurement of the IV and the DV

C. normality

D. independent

Ans: C

Learning Objective: Two factor ANOVA assumptions

2. This question refers to Scenario 12.1 How many Columns must the SPSS data file have had for this analysis?

A. 3

B. 4

C. 8

D. 16

E. 32

Ans: A

Learning Objective: Two factor ANOVA SPSS

3. This question refers to Scenerio 12.1 How many Rows must the SPSS data file have had for this analysis?

A. 3

B. 4

C. 8

D. 16

E. 32

Ans: E

Learning Objective: Two factor ANOVA SPSS

4. This question refers to Scenerio 12.1. Is the main effect of yoga versus no yoga signficant?

A. Yes

B. No

Ans: B

Learning Objective: Two factor ANOVA main effects

5. This question refers to Scenerio 12.1. Compute the effect size (*d*) for the yoga versus no yoga comparison.

A. −0.41

B. −0.95

C. −1.77

D. −1.88

E. −2.73

Ans: A

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

6. This question refers to Scenerio 12.1. How large is the effect size (*d*) for the main effect of yoga group?

A. small

B. small–medium

C. medium

D. medium–large

E. large

Ans: B

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

7. This question refers to Scenerio 12.1. What is the partial η2 effect size for main effect of yoga?

A. .96

B. .01

C. .08

D. .57

E. .22

F. .10

Ans: F

Learning Objective: Two factor ANOVA partial eta squared

8. This question refers to Scenerio 12.1. How large is the partial η2 for the main effect of yoga?

A. small

B. small–medium

C. medium

D. medium–large

E. large

Ans: D

Learning Objective: Two factor ANOVA partial eta squared

9. This question refers to Scenerio 12.1. Which of the following statements best summarizes the main effect of yoga versus no yoga?

A. The yoga and no yoga groups did not report significantly different amounts of back pain.

B. The yoga group had significantly less back pain than the no yoga group.

C. The yoga group had significantly more back pain than the no yoga group.

Ans: A

Learning Objective: Two factor ANOVA main effects

10. This question refers to Scenerio 12.1. Is the main effect of drug treatment significant?

A. Yes

B. No

Ans: A

Learning Objective: Two factor ANOVA main effects

11. This question refers to Scenerio 12.1. Compute the effect size (*d*) for the drug versus no drug comparison.

A. −0.41

B. −0.95

C. −1.77

D. −1.88

E. −2.73

Ans: D

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

12. This question refers to Scenerio 12.1. How large is the effect size (*d*) for the drug main effect?

A. small

B. small–medium

C. medium

D. medium–large

E. large

Ans: E

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

13. This question refers to Scenerio 12.1. What is the partial η2 effect size for main effect of drug?

A. .96

B. .01

C. .08

D. .57

E. .22

F. .10

Ans: D

Learning Objective: Two factor ANOVA partial eta squared

14. This question refers to Scenerio 12.1. How large is the partial eta squared for the main effect of drug?

A. small

B. small–medium

C. medium

D. medium–large

E. large

Ans: E

Learning Objective: Two factor ANOVA partial eta squared

15. This question refers to Scenerio 12.1. Which of the following statements best summarizes the main effect of drug treatment?  
A. The drug and placebo groups did not report significantly different amounts of back pain.

B. The drug group had significantly less back pain than the placebo group.

C. The drug group had significantly more back pain than the no placebo group.

Ans: B

Learning Objective: Two factor ANOVA main effects

16. This question refers to Scenerio 12.1. Is the interaction significant?

A. Yes

B. No

Ans: A

Learning Objective: Two factor ANOVA interactions

17. This question refers to Scenerio 12.1. Which of the following statements best summarizes the drug treatment by yoga interaction?

A. The interaction was not significant.

B. Yoga was more effective than drugs in treating chronic back pain.

C. Yoga reduced back pain more than not doing yoga and drugs reduced back pain more than taking a placebo.

D. For people who did not do yoga, the drugs reduced back pain. The drugs also reduced back pain for people who did do yoga.

E. For people who took the drug, doing yoga reduced back pain significantly, whereas for people who did not take the drug, doing yoga did not reduce back pain significantly.

Ans: E

Learning Objective: Two factor ANOVA interactions

18. This question refers to Scenerio 12.1. What is the partial η2 effect size for the interaction?

A. .96

B. .01

C. .08

D. .57

E. .22

F. .10

Ans: E

Learning Objective: Two factor ANOVA partial eta squared

19. This question refers to Scenerio 12.1. How large is the partial eta squared for the interaction?

A. small

B. small–medium

C. medium

D. medium–large

E. large

Ans: E

Learning Objective: Two factor ANOVA partial eta squared

20. This question refers to Scenerio 12.1. Which two means are being compared for the simple effect of the drug group?

A. 5.00 and 3.25

B. 6.43 and 4.13

C. 6.25 and 5.00

D. 6.63 and 3.25

E. 6.25 and 6.63

Ans: A

Learning Objective: Two factor ANOVA simple effects

21. This question refers to Scenerio 12.1. Compute the effect size (*d*) for the simple effect of the drug group.

A. 1.43

B. -.36  
C. -.85  
D. 1.56

Ans: D

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

22. This question refers to Scenerio 12.1. How large is the effect size (*d*) for the simple effect of the no drug (placebo) group?

A. small

B. small–medium

C. medium

D. medium–large

E. large

Ans: E

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

23. This question refers to Scenerio 12.1. Which two means are being compared for the simple effect of the no drug (placebo) group?

A. 5.00 and 3.25

B. 6.43 and 4.13

C. 6.25 and 5.00

D. 6.63 and 3.25

E. 6.25 and 6.63

Ans: E

Learning Objective: Two factor ANOVA simple effects

24. This question refers to Scenerio 12.1. Compute the effect size (*d*) for the simple effect of the no drug (placebo) group.

A. 1.43

B. −0.36

C. −0.85

D. 1.56

Ans: B

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

25. This question refers to Scenerio 12.1. How large is the effect size (*d*) for the simple effect of the no drug (placebo) group?

A. small

B. small–medium

C. medium

D. medium–large

E. large

Ans: B

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

26. This question refers to Scenerio 12.1. Which means would you graph for the main effect of drug versus placebo?

A. 6.44 and 4.13

B. 5.63, 4.94, 6.43, and 4.13

C. 6.25, 5.0, 6.63, and 3.25

D. 5.0 and 3.25

Ans: A

Learning Objective: Two factor ANOVA main effects

27. This question refers to Scenerio 12.1. Which means would you graph for the interaction?

A. 6.44 and 4.13

B. 5.63, 4.94, 6.43, and 4.13

C. 6.25, 5.0, 6.63, and 3.25

D. 5.0 and 3.25

Ans: C

Learning Objective: Two factor ANOVA interactions

28. This question refers to Scenerio 12.1. Do post hoc tests need to be done for this ANOVA?

A. Yes

B. No

Ans: B

Learning Objective: Two factor ANOVA (post hoc)

29. This question refers to Scenario 12.1. Write an APA style summary of the results of this study.

Ans: Varies

Learning Objective: Writing APA summary for two-way ANOVA

30. Scenerio 12.2. The following table contains the cell and marginal means from a two-way ANOVA with drug type as one IV, age of participant as a second IV, and the number of errors made on a test the DV. Which numbers are being compared for the main effect of drug type?

Drug Type

|  |  |  |  |
| --- | --- | --- | --- |
| Age of Participant | Drug A | Drug B | Marginal Means |
| Age (18–22) | 35 | 45 | 40 |
| Age (38–42) | 50 | 40 | 45 |
| Marginal means | 42.5 | 42.5 |  |

A. 42.5 and 42.5

B. 40 and 45

C. 35–45 and 50–40

D. 42.5–42.5 and 45–40

Ans: A

Learning Objective: Two factor ANOVA main effects

31. The following question refers to Scenerio 12.2. Which numbers are being compared for the main effect of age of participant?

A. 42.5 and 42.5

B. 40 and 45

C. 35–45 and 50–40

D. 42.5–42.5 and 45–40

Ans: B

Learning Objective: Two factor ANOVA main effects

32. The following question refers to Scenerio 12.2. Which numbers are being compared for the interaction between drug type and age of participant?

A. 42.5 and 42.5

B. 40 and 45

C. 35–45 and 50–40

D. 42.5–42.5 and 45–40

Ans: C

Learning Objective: Two factor ANOVA interactions

33. The following question refers to Scenerio 12.2. By looking at the table, you should be able to determine which of the following effects *cannot* be statistically significant. *Which of the following effects cannot be significant*?

A. main effect of drug type

B. main effect of participant age

C. interaction between drug type and participant age

Ans: A

Learning Objective: Two factor ANOVA main effects

34. A two-way ANOVA tests how many main effects?

A. 0

B. 1

C. 2

D. it depends on the study

Ans: C

Learning Objective: Two factor ANOVA main effects

35. A two-way ANOVA tests how many interactions?

A. 0

B. 1

C. 2

D. it depends on the study

Ans: B

Learning Objective: Two factor ANOVA interactions

36. A given research study produced a significant interaction. Which of the following statements *has to be true*?

A. The independent variable in this study has to have three or more levels.

B. Here has to be two (or more) independent variables in this study.

C. There has to be two (or more) dependent variables in this study.

D. The dependent variable in this study has to have 3 or more levels.

E. The statistic used must have been a one way ANOVA

Ans: B

Learning Objective: Two factor ANOVA main effects and interactions

37. Scenario 12.3. A neuropsychologist recorded the brain activity in 60 participants. For half of the participants he recorded the activity in the area of the brain that controls the facial movement and for the other half he recorded the activity in the area of the brain that controls arm movement. Additionally, half of the participants in the “face” and “arm” groups heard the word “smile,” while half of the participants in both groups heard the word “throw”. The dependent variable is the level of neural activity when recorded when people heard their respective words. The SPSS output is below. Brain Region 1 = Face and 2 = Arm. Word Type 1 = “smile” and 2 = “throw”. Is there a significant main effect for Brain Region?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Descriptive Statistics** | | | | |
| Dependent Variable: Activity\_Change | | | | |
| Brain\_Region | Word\_Type | Mean | Std. Deviation | *N* |
| 1.00 | 1.00 | 8.9977 | 1.54400 | 15 |
| 2.00 | 4.8461 | 2.78044 | 15 |
| Total | 6.9219 | 3.05621 | 30 |
| 2.00 | 1.00 | 2.3489 | 2.85538 | 15 |
| 2.00 | 3.8371 | 2.21226 | 15 |
| Total | 3.0930 | 2.62134 | 30 |
| Total | 1.00 | 5.6733 | 4.06440 | 30 |
| 2.00 | 4.3416 | 2.52153 | 30 |
| Total | 5.0075 | 3.41990 | 60 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Tests of Between-Subjects Effects** | | | | | | |
| Dependent Variable: Activity\_Change | | | | | | |
| Source | Type III Sum of Squares | *df* | Mean Square | *F* | Sig. | Partial η2 |
| Corrected Model | 365.779a | 3 | 121.926 | 21.056 | .000 | .530 |
| Intercept | 1504.480 | 1 | 1504.480 | 259.819 | .000 | .823 |
| Brain\_Region | 219.904 | 1 | 219.904 | 37.977 | .000 | .404 |
| Word\_Type | 26.601 | 1 | 26.601 | 4.594 | .036 | .076 |
| Brain\_Region\* Word\_Type | 119.273 | 1 | 119.273 | 20.598 | .000 | .269 |
| Error | 324.268 | 56 | 5.790 |  |  |  |
| Total | 2194.527 | 60 |  |  |  |  |
| Corrected Total | 690.047 | 59 |  |  |  |  |
| a*R*2 = .530 (Adjusted *R*2 = .505) | | | | | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Pairwise Comparisons** | | | | | | | |
| Dependent Variable: Activity\_Change | | | | | | | |
| Brain\_Region | (I) Word\_Type | (J) Word\_Type | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval for Difference | |
| Lower Bound | Upper Bound |
| 1.00 | 1.00 | 2.00 | 4.152\* | .879 | .000 | 2.391 | 5.912 |
| 2.00 | 1.00 | −4.152\* | .879 | .000 | -5.912 | -2.391 |
| 2.00 | 1.00 | 2.00 | −1.488 | .879 | .096 | -3.248 | .272 |
| 2.00 | 1.00 | 1.488 | .879 | .096 | -.272 | 3.248 |

A. Yes

B. No

Ans: A

Learning Objective: Two factor ANOVA main effects

38. This question refers to Scenerio 12.3. Compute the effect size (*d*) for the main effect of brain region.

A. 0.39

B. 0.92

C. 1.34

D . 1.54

E. 1.85

F. −0.58

G. −0.87

Ans: C

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

39. This question refers to Scenerio 12.3. How large is the effect size (*d*) for the main effect of brain region?

A. small

B. small–medium

C. medium

D. medium–large

E. large

Ans: E

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

40. This question refers to Scenerio 12.3. What is the partial η2 effect size for main effect of brain region?

A. .08

B. .40

C. .27

D. .00

E. .04

Ans: B

Learning Objective: Two factor ANOVA partial eta squared

41. This question refers to Scenario 12.3. Is there a significant main effect for word type?

A. Yes

B. No

Ans: A

Learning Objective: Two factor ANOVA main effects

42. This question refers to Scenerio 12.3. Compute the effect size (*d*) for the main effect of word type.

A. 0.39

B. 0.92

C. 1.34

D. 1.54

E. 1.85

F. −0.58

G. −0.87

Ans: A

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

43. This question refers to Scenerio 12.3. How large is the effect size (*d*) for the main effect of word type?

A. small

B. small–medium

C. medium

D. medium–large

E. large

Ans: B

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

44. This question refers to Scenerio 12.3. What is the partial η2 effect size for main effect of word type?

A. .08

B. .40

C. .27

D. .00

E. .04

Ans: A

Learning Objective: Two factor ANOVA partial eta squared

45. This question refers to Scenario 12.3. Is there a significant interaction?

A. Yes

B. No

Ans: A

Learning Objective: Two factor ANOVA interactions

46. This question refers to Scenerio 12.3. Compute the effect size (*d*) for simple effect of word type for brain region 1.

A. 0.39

B. 0.92

C. 1.34

D . 1.54

E. 1.85

F. −0.58

G. −0.87

Ans: E

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

47. This question refers to Scenerio 12.3. How large is the effect size (*d*) for the main effect of word type?

A. small

B. small–medium

C. medium

D. medium–large

E. large

Ans: E

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

48. This question refers to Scenerio 12.3. Compute the effect size (*d*) for simple effect of word type for brain region 2.

A. 0.39

B. 0.92

C. 1.34

D . 1.54

E. 1.85

F. −0.58

G. −0.87

Ans: F

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

49. This question refers to Scenerio 12.3. How large is the effect size (*d*) for the main effect of word type?

A. small

B. small–medium

C. medium

D. medium–large

E. large

Ans: C

Learning Objective: Two factor ANOVA effect size for pairwise comparisons

50. This question refers to Scenario 12.3. Write an APA style summary of these results. You should talk about both main effects and the interaction. If any effect is significant you should describe it. You should also include all of the necessary statistical information in APA style.

Ans: Varies

Learning Objective: Writing APA style summary for two-way ANOVA