Sample means (x¯x¯) for the groups: = 48.2, 35.4, 69.8

**Intermediate steps in calculating the group variances:**

[[1]]

value mean deviations sq deviations

1 51 48.2 2.8 7.84

2 45 48.2 -3.2 10.24

3 33 48.2 -15.2 231.04

4 45 48.2 -3.2 10.24

5 67 48.2 18.8 353.44

[[2]]

value mean deviations sq deviations

1 23 35.4 -12.4 153.76

2 43 35.4 7.6 57.76

3 23 35.4 -12.4 153.76

4 43 35.4 7.6 57.76

5 45 35.4 9.6 92.16

[[3]]

value mean deviations sq deviations

1 56 69.8 -13.8 190.44

2 76 69.8 6.2 38.44

3 74 69.8 4.2 17.64

4 87 69.8 17.2 295.84

5 56 69.8 -13.8 190.44

Sum of squared deviations from the mean (SS) for the groups:

[1] 612.8 515.2 732.8

Var1=612.85−1=153.2Var1=612.85−1=153.2

Var2=515.25−1=128.8Var2=515.25−1=128.8

Var3=732.85−1=183.2Var3=732.85−1=183.2

MSerror=153.2+128.8+183.23=155.07MSerror=153.2+128.8+183.23=155.07 *Note: this is just the average within-group variance; it is not sensitive to group mean differences!*

Calculating the remaining *error* (or *within*) terms for the ANOVA table:

dferror=15−3=12dferror=15−3=12

SSerror=(155.07)(15−3)=1860.8SSerror=(155.07)(15−3)=1860.8

**Intermediate steps in calculating the variance of the sample means:**

Grand mean (x¯grandx¯grand) = 48.2+35.4+69.83=51.1348.2+35.4+69.83=51.13

group mean grand mean deviations sq deviations

48.2 51.13 -2.93 8.58

35.4 51.13 -15.73 247.43

69.8 51.13 18.67 348.57

Sum of squares (SSmeans)=604.58(SSmeans)=604.58

Varmeans=604.583−1=302.29Varmeans=604.583−1=302.29

MSbetween=(302.29)(5)=1511.45MSbetween=(302.29)(5)=1511.45 *Note: This method of estimating the variance IS sensitive to group mean differences!*

Calculating the remaining *between* (or *group*) terms of the ANOVA table:

dfgroups=3−1=2dfgroups=3−1=2

SSgroup=(1511.45)(3−1)=3022.9SSgroup=(1511.45)(3−1)=3022.9

**Test statistic and critical value**

F=1511.45155.07=9.75F=1511.45155.07=9.75

Fcritical(2,12)=3.89Fcritical(2,12)=3.89

 Decision: reject H0  Decision: reject H0

**ANOVA table**

| **source** | **SS** | **df** | **MS** | **F** |
| --- | --- | --- | --- | --- |
| group | 3022.9 | 2 | 1511.45 | 9.75 |
| error | 1860.8 | 12 | 155.07 |  |
| total | 4883.7 |  |  |  |

**Effect size**

η2=3022.94883.7=0.62η2=3022.94883.7=0.62

**APA writeup**

*F*(2, 12)=9.75, *p* <0.05, η2η2=0.62.