

# [Problem set 2 × 3 between s factorial](https://assignbuster.com/problem-set-2-3-between-s-factorial/)

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PSY 870: Module 4 Problem Set 2 × 3 Between s Factorial ANOVA: Study Environments by Gender This study investigates whether study environment affects academic performance. In addition, this study investigates whether sex of student " moderates" the effect of study environment on academic performance (that is, do males and females differ in how much benefit they get from studying in certain environments).   
During the first half of the spring semester, 120 male students and 120 female students in grade 10 at a public high school in a large metropolitan area in the southwestern region of the United States were randomly assigned to one of three study environment: study in front of the TV, at the library, or in the food court. The students could ONLY study in the environment to which they were assigned during the research period. At the end of the 7-week research period, mid-term GPA was computed for each student. A change score was computed for each student: each students spring midterm GPA was subtracted from his or her GPA for the preceding fall semester. The difference was each students GPA Improvement score. The GPA improvement score was used to measure academic performance.   
Directions:   
Using the SPSS 2 × 3 ANOVA data file for Module 4 (located in Topic Materials), answer the following questions. NOTE: Helpful hints are provided here for you to use while answering these questions. There is no separate answer sheet/guide to use while doing this assignment.   
1. What are the two independent variables in this study? What is the dependent variable?   
Independent variable:   
Study environment   
Sex   
Dependent variable:   
Academic performance   
2. Why is a two-way between-subjects factorial ANOVA the correct statistic to use for this research design?   
Then two‐way between subjects ANOVA is used to analyze the results of a between subjects factorial design with two independent variables (factors). The two‐way ANOVA tests three hypotheses: the main effects for each of the two factors and the interaction effect   
3. Did you find any errors that the researcher made when setting up the SPSS data file (Remember to check the variable view)? If so, what did you find? How did you correct it?   
No errors are observed in setting up of the data file; the data is coded and appropriately entered   
4. Run Descriptive Statistics on the dependent variable data. What do the skewness and kurtosis values tell you about whether the data satisfy the assumption of normality?   
Descriptive Statistics   
N   
Minimum   
Maximum   
Mean   
Std. Deviation   
Skewness   
Kurtosis   
Statistic   
Statistic   
Statistic   
Statistic   
Statistic   
Statistic   
Std. Error   
Statistic   
Std. Error   
GPA Improvement   
240   
-. 10   
1. 00   
. 2867   
. 24781   
. 652   
. 157   
-. 063   
. 313   
Valid N (listwise)   
240   
The data is positively skewed while the kurtosis value is -0. 063 and is platykurtic. The assumption is not satisfied.   
5. Perform a between-subjects factorial ANOVA on the data.   
Multivariate Testsb   
Effect   
Value   
F   
Hypothesis df   
Error df   
Sig.   
Environment   
Pillais Trace   
. 785   
867. 008a   
1. 000   
238. 000   
. 000   
Wilks Lambda   
. 215   
867. 008a   
1. 000   
238. 000   
. 000   
Hotellings Trace   
3. 643   
867. 008a   
1. 000   
238. 000   
. 000   
Roys Largest Root   
3. 643   
867. 008a   
1. 000   
238. 000   
. 000   
Environment \* sex   
Pillais Trace   
. 000   
. 099a   
1. 000   
238. 000   
. 753   
Wilks Lambda   
1. 000   
. 099a   
1. 000   
238. 000   
. 753   
Hotellings Trace   
. 000   
. 099a   
1. 000   
238. 000   
. 753   
Roys Largest Root   
. 000   
. 099a   
1. 000   
238. 000   
. 753   
a. Exact statistic   
b. Design: Intercept + sex   
Within Subjects Design: Environment   
6.   
a. What do the results of the Levenes Test tell you about your data? What does this mean in terms of interpreting the outcomes of the ANOVA?   
Multiple Comparisons   
GPA Improvement   
LSD   
(I) Environment   
(J) Environment   
Mean Difference (I-J)   
Std. Error   
Sig.   
95% Confidence Interval   
Lower Bound   
Upper Bound   
Front of TV   
Library   
-. 2200\*   
. 02758   
. 000   
-. 2743   
-. 1657   
Food Court   
. 1175\*   
. 02758   
. 000   
. 0632   
. 1718   
Library   
Front of TV   
. 2200\*   
. 02758   
. 000   
. 1657   
. 2743   
Food Court   
. 3375\*   
. 02758   
. 000   
. 2832   
. 3918   
Food Court   
Front of TV   
-. 1175\*   
. 02758   
. 000   
-. 1718   
-. 0632   
Library   
-. 3375\*   
. 02758   
. 000   
-. 3918   
-. 2832   
Based on observed means.   
The error term is Mean Square (Error) = . 030.   
\*. The mean difference is significant at the 0. 05 level.   
The results are statistically significant   
b. What do the results of the Tests of Between-Subjects Effects tell you? Was there a significant main effect of Environment on GPA improvement? Was there a significant main effect of Sex on GPA improvement? Was there a significant interaction effect of Environment X Sex on GPA improvement? Report the results for each of these questions providing the actual F-value and p value using the following format: F(df1, df2) = 0. 785\_\_\_\_, p = . \_\_000\_ or if the p is shown as . 000, write it as p < . 001; an example of this formatting is F(1, 400) = 15. 4, p = . 02).   
Tests of Between-Subjects Effects   
Dependent Variable: GPA Improvement   
Source   
Type III Sum of Squares   
df   
Mean Square   
F   
Sig.   
Corrected Model   
7. 557a   
5   
1. 511   
49. 675   
. 000   
Intercept   
19. 723   
1   
19. 723   
648. 189   
. 000   
envir   
4. 696   
2   
2. 348   
77. 173   
. 000   
sex   
. 081   
1   
. 081   
2. 651   
. 105   
envir \* sex   
2. 780   
2   
1. 390   
45. 688   
. 000   
Error   
7. 120   
234   
. 030   
Total   
34. 400   
240   
Corrected Total   
14. 677   
239   
a. R Squared = . 515 (Adjusted R Squared = . 505)   
For environment,   
F (2, 239) = 77. 173, p < 0. 05), significantly related to academic performance   
For sex (2, 239) = 2. 651, p = 0. 105, not significant related to academic performance   
c. Use eta squared to provide effect size/proportion of variance accounted associated with each F-value. If the F-value for a main effect and/or for an interaction effect is statistically significant, what is the eta squared (2) value associated with that outcome?   
HINT:   
Report eta squared, 2; ignore partial eta squared that SPSS can provide. You have to calculate eta squared yourself. It is not given to you by SPSS, but you can use what SPSS provides to calculate it. Eta squared is calculated by using the values in the column headed " Type III Sum of Squares" from the table with the results for Tests of Between-Subjects Effects." To compute eta squared, which would be notated as 2, take that sources Type III Sum of Squares and divide it by the value for Corrected Total in the same column. For example, if the Type III Sum of Squares for Environment had been 4. 5 rather than 4. 696, you would divide 4. 5 by 14. 677 to get the effect size for Environment. If the Type III Sum of Squares for Sex had been 2. 0, you also would divide that by 14. 677, etc. Interpret these eta squared results for effect size using the following guidelines from Cohen (1988):   
. 01 ~ small   
. 06 ~ medium   
. 14 ~ large   
For environment, 4. 696/14. 677 which gives 0. 319956394 and hence considered large   
For sex, its 0. 081/14. 677 = 0. 005518839 and hence considered small   
d. If the result for the main effect of Environment was statistically significant, what did you find out when you performed post hoc tests (Tukey HSD) to look at possible statistically significant differences in the pairs of means for Environment groups?   
GPA Improvement   
Environment   
N   
Subset   
1   
2   
3   
Tukey Ba,, b   
Food Court   
80   
. 1350   
Front of TV   
80   
. 2525   
Library   
80   
. 4725   
Means for groups in homogeneous subsets are displayed.   
Based on observed means.   
The error term is Mean Square(Error) = . 030.   
a. Uses Harmonic Mean Sample Size = 80. 000.   
b. Alpha = 0. 05.   
The results are confirmed as being statistically significant. It is more better to study in the library than in front of TV or food court.   
e. When you have a factorial ANOVA and the interaction effect is significant, does the researcher give much attention to any significant main effects when interpreting the results of the study?   
Yes, these are important in further explaining the findings of the research.   
7. Citing the results of your statistical analyses, what is the conclusion you can draw (and support) regarding research question that was posed in this research (see problem statement)? Write a results section for this study that expresses and supports this conclusion.   
HINT:   
Use the sample write-up of the results for the Two-Way Between-Subjects ANOVA example that is in the textbook to see what you should report and how to say it. Just substitute the correct language and values for the analyses you have done for this problem.   
There is a relationship between academic environment and academic performance but not sex