

# FA9

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Data Summary: We will look at the summary statistics for political interest across gender and education levels.

```
library(tidyverse)

## — Attaching core tidyverse packages — tidyverse 2.0.0 —
## ✓ dplyr      1.1.4    ✓ readr      2.1.5
## ✓ forcats    1.0.0    ✓ stringr   1.5.1
## ✓ ggplot2    3.5.0    ✓ tibble    3.2.1
## ✓ lubridate  1.9.3    ✓ tidyr     1.3.1
## ✓ purrr      1.0.2
## — Conflicts — tidyverse_conflicts() —
## ✖ dplyr::filter() masks stats::filter()
## ✖ dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors

data <- data.frame(
  gender = c(1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
             1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
             1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
             2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
             2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
             2, 2, 2, 2, 2, 2, 2, 2, 2, 2),
  education_level = c(1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
                     2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
                     3, 3, 3, 3, 3, 3, 3, 3, 3, 3,
                     1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
                     2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
                     3, 3, 3, 3, 3, 3, 3, 3, 3, 3),
  political_interest = c(38, 39, 35, 38, 41, 40, 36, 37, 33, 41.5,
                        41.5, 44.3, 44.5, 44, 46.5, 42, 43.5, 38.5, 63, 64,
                        61, 64, 69, 69, 66, 62, 63, 60, 40, 41,
                        36, 39, 44, 44, 42, 38, 38, 34, 45, 46,
                        41, 44, 49, 49, 47, 43, 43, 39, 57, 58,
                        63, 66, 65, 61, 59, 55, 45, 51, 50, 52))

data$gender <- factor(data$gender, levels = c(1, 2), labels = c("Male", "Female"))
data$education_level <- factor(data$education_level, levels = c(1, 2, 3), labels = c("Low", "Medium", "High"))

summary(data)

##      gender  education_level political_interest
## Male   :30   Low   :20         Min.   :33.00
## Female:30   Medium:20         1st Qu.:40.00
##              High  :20         Median :44.25
##              Mean   :48.14
##              3rd Qu.:58.25
##              Max.   :69.00
```

ANOVA Analysis: We will conduct a two-way ANOVA to determine the main and interaction effects of gender and education level on political interest.

```
anova_result <- aov(political_interest ~ gender * education_level, data = data)
summary(anova_result)

##              Df Sum Sq Mean Sq F value    Pr(>F)
## gender              1      0      0.1    0.002    0.964
## education_level      2   3595   1797.6   35.426 1.49e-10 ***
## gender:education_level 2      77     38.6    0.760    0.473
## Residuals            54   2740    50.7
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Post Hoc Tests: If there are significant main or interaction effects, we may perform post hoc tests to understand where these differences lie.

```
library(emmeans)

## Welcome to emmeans.
## Caution: You lose important information if you filter this package's results.
## See '? untidy'

emmeans(anova_result, pairwise ~ gender | education_level)

## $emmeans
## education_level = Low:
##   gender emmean   SE df lower.CL upper.CL
##   Male   37.9 2.25 54    33.3    42.4
##   Female 40.6 2.25 54    36.1    45.1
##
## education_level = Medium:
##   gender emmean   SE df lower.CL upper.CL
##   Male  47.2 2.25 54    42.7    51.7
##   Female 47.0 2.25 54    42.5    51.5
##
## education_level = High:
##   gender emmean   SE df lower.CL upper.CL
##   Male  59.5 2.25 54    55.0    64.0
##   Female 56.7 2.25 54    52.2    61.2
##
## Confidence level used: 0.95
##
## $contrasts
## education_level = Low:
##   contrast      estimate    SE df t.ratio p.value
##   Male - Female   -2.75 3.19 54   -0.863  0.3918
##
## education_level = Medium:
##   contrast      estimate    SE df t.ratio p.value
##   Male - Female    0.20 3.19 54    0.063  0.9502
##
## education_level = High:
##   contrast      estimate    SE df t.ratio p.value
##   Male - Female    2.80 3.19 54    0.879  0.3833

emmeans(anova_result, pairwise ~ education_level | gender)

## $emmeans
## gender = Male:
##   education_level emmean   SE df lower.CL upper.CL
##   Low             37.9 2.25 54    33.3    42.4
##   Medium           47.2 2.25 54    42.7    51.7
##   High            59.5 2.25 54    55.0    64.0
##
## gender = Female:
##   education_level emmean   SE df lower.CL upper.CL
##   Low             40.6 2.25 54    36.1    45.1
##   Medium           47.0 2.25 54    42.5    51.5
##   High            56.7 2.25 54    52.2    61.2
##
## Confidence level used: 0.95
##
## $contrasts
## gender = Male:
##   contrast      estimate    SE df t.ratio p.value
##   Low - Medium   -9.35 3.19 54   -2.935  0.0133
##   Low - High     -21.65 3.19 54   -6.796 <.0001
##   Medium - High  -12.30 3.19 54   -3.861  0.0009
##
## gender = Female:
##   contrast      estimate    SE df t.ratio p.value
##   Low - Medium   -6.40 3.19 54   -2.009  0.1198
##   Low - High     -16.10 3.19 54   -5.054 <.0001
##   Medium - High   -9.70 3.19 54   -3.045  0.0099
##
## P value adjustment: tukey method for comparing a family of 3 estimates
```

Check Assumptions For ANOVA, the assumptions of normality and homogeneity of variance should be met.

```
shapiro.test(residuals(anova_result))

##
## Shapiro-Wilk normality test
##
## data:  residuals(anova_result)
## W = 0.97208, p-value = 0.1843

library(car)

## Loading required package: carData

##
## Attaching package: 'car'

##
## The following object is masked from 'package:dplyr':
##
##   recode

## The following object is masked from 'package:purrr':
##
##   some

leveneTest(political_interest ~ gender * education_level, data = data)

## Levene's Test for Homogeneity of Variance (center = median)
##      Df F value Pr(>F)
## group 5  1.1119 0.365
##      54
```

## Introduction

The purpose of this analysis was to investigate the effect of gender (male, female) and education level (low, medium, high) on political interest. A two-way ANOVA was conducted to examine both the main effects and the interaction effect between gender and education level on political interest.

## Method

A two-way ANOVA was conducted with gender and education level as independent variables and political interest as the dependent variable. Post hoc comparisons were performed to further investigate any significant main effects.

## Results

The two-way ANOVA revealed a significant main effect of education level on political interest,  $F(2,54)=35.43$ ,  $p<.001$ , indicating that political interest levels differed across education levels. There was no significant main effect of gender on political interest,  $F(1,54)=0.002$ ,  $p=.964$ , suggesting that political interest does not vary significantly between males and females. Furthermore, the interaction effect between gender and education level was not significant,  $F(2,54)=0.76$ ,  $p=.473$ , indicating that the effect of education level on political interest was similar for both genders.

## Post Hoc Tests

Post hoc tests using the Tukey method revealed the following:

For males, political interest was significantly higher in the "medium" education level group than in the "low" education level group,  $t=-2.94$ ,  $p=.0133$ . Political interest was significantly higher in the "high" education level group compared to both the "low" education level group,  $t=-6.80$ ,  $p<.001$ , and the "medium" education level group,  $t=-3.86$ ,  $p=.0009$ . For females, political interest was also significantly higher in the "high" education level group compared to both the "low" education level group,  $t=-5.05$ ,  $p<.001$ , and the "medium" education level group,  $t=-3.05$ ,  $p=.0099$ . These results indicate that higher education levels are associated with increased political interest in both genders.

## Assumptions

The Shapiro-Wilk test indicated that the residuals were approximately normally distributed,  $W=0.972$ ,  $p=.1843$ . Levene's test for homogeneity of variance was also not significant,  $F(5,54)=1.112$ ,  $p=.365$ , suggesting that the assumption of equal variances was met.

## Discussion

The analysis demonstrated that education level significantly impacts political interest, with higher levels of education associated with greater political interest. This effect was consistent across both genders, as indicated by the non-significant interaction between gender and education level. Gender alone did not significantly affect political interest, suggesting that the influence of education on political interest is independent of gender.

These findings contribute to the understanding of the factors that influence political interest and suggest that educational attainment plays a critical role in shaping political engagement.