

Friday Quiz 2

School Data

This synthetic dataset simulates data collected from a high school’s academic enrichment program, designed to explore how various student habits relate to academic success. In particular, we imagine researchers created three survey-based variables: **x1**, representing weekly hours spent in *peer-led study groups*; **x2**, weekly hours dedicated to *quiet individual study time*; and **x3**, weekly hours spent in *school-sponsored extracurricular clubs*. The outcome variable, **y**, represents the student’s final *academic performance index* for the term, scaled from 0 to 100.

The data was generated in such a way that the three predictors are close to statistically independent (i.e., there’s no strong correlation between them), allowing for a clean interpretation of each variable’s unique contribution to academic performance. For example, a student could study independently without necessarily being involved in peer groups or clubs, making these behaviors distinct. In this synthetic model, we assume that **individual study (x2)** has the strongest positive association with performance, **peer groups (x1)** have a moderate positive effect, and **extracurricular clubs (x3)** show a slight negative association—perhaps reflecting a trade-off in time. The goal of this simulation is to help students and teachers analyze how various independent efforts and activities can affect outcomes when not confounded by overlapping behaviors.

Review of Model Metrics

type	RSS	RSE	R2	Adj_R2	AIC	BIC
Model 1: Performance ~ Study Group	600.84	2.48	0.16	0.15	469.10	476.92
Model 2: Performance ~ Study Group + Self Study	196.11	1.42	0.73	0.72	359.14	369.56
Model 3: Performance ~ Study Group + Self Study + Clubs	106.16	1.05	0.85	0.85	299.76	312.79

Model Comparisons

Model Comparison 1

```
anova(school_model_1, school_model_2)
```

Analysis of Variance Table

Model 1: performance ~ study_group

Model 2: performance ~ study_group + self_study

	Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
1	98	600.84				
2	97	196.11	1	404.72	200.18	< 2.2e-16 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Model Comparison 2

```
anova(school_model_2, school_model_3)
```

Analysis of Variance Table

Model 1: performance ~ study_group + self_study

Model 2: performance ~ study_group + self_study + clubs

	Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
1	97	196.11				
2	96	106.16	1	89.955	81.347	1.903e-14 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Review of Selected of Final Model

```
summary(school_model_3)
```

Call:

```
lm(formula = performance ~ study_group + self_study + clubs,  
    data = school_df)
```

Residuals:

Min	1Q	Median	3Q	Max
-2.50590	-0.65280	0.05288	0.68192	2.52490

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	63.0830	1.0670	59.121	< 2e-16 ***
study_group	0.9453	0.1122	8.424	3.56e-13 ***
self_study	2.0468	0.1095	18.695	< 2e-16 ***
clubs	-1.0532	0.1168	-9.019	1.90e-14 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.052 on 96 degrees of freedom

Multiple R-squared: 0.8519, Adjusted R-squared: 0.8472

F-statistic: 184 on 3 and 96 DF, p-value: < 2.2e-16