

# Supplementary material for

## Enhancing Student Engagement and Learning in Database Programming Through Active Learning Strategies

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### Students' data analysis

#### 1. Qualifications

```
CualificationsData <- read.table("Qualifications.csv", header=TRUE, sep=";", na.strings="NA",  
dec=".", strip.white=TRUE)
```

```
##### Means per type of students #####
```

```
##### non Framework Students #####
```

```
nonFS <- subset(CualificationsData, Program=="NonFS")
```

```
nonFS
```

```
summary(nonFS)
```

```
mean(nonFS$MarksA, na.rm = TRUE)
```

```
##Number of students: 50
```

```
##MarksA Mean : 5.3225
```

```
mean(nonFS$MarksAb, na.rm = TRUE)
```

```
##MarksAb Mean : 0.799125
```

```
##### Framework Students #####
```

```
FS <- subset(CualificationsData, Program=="FS")
```

```
FS
```

```
summary(FS)
```

```
mean(FS$MarksA, na.rm = TRUE)
```

```
##Number of students: 92
```

```
##MarksA Mean : 6.873641
```

```
mean(FS$MarksAb, na.rm = TRUE)
```

```
##MarksAb Mean : 1.031046
```

```
#####
```

```
## null hypothesis: independent variable (learning method-variable Program) has no
```

```
##### effect on the dependent variable (score- variable MarksA), that is, there
```

```
##### are no differences between means
```

```
## alternative hypothesis: assumes that the learning method has an effect
```

```
##### on students' scores (i.e., the means are different)
```

```
##Perform the t-test for marks and program
```

```
## Marks A
```

```
t.test(MarksA ~ Program, data=CualificationsData)
```

```
Welch Two Sample t-test
```

data: MarksA by Program

t = 2.8752, df = 91.588, **p-value = 0.005021**

alternative hypothesis: true difference in means between group FS and group NonFS is not equal to 0

95 percent confidence interval:

0.4796059 2.6226767

sample estimates:

mean in group FS mean in group NonFS

6.873641 5.322500

##Remember install lsr for cohen coefficient

##install.packages("effsize")

##library(effsize)

cohen.d(MarksA ~ Program, data = CualificationsData)

Cohen's d

d estimate: **0.522105 (medium)**

95 percent confidence interval:

lower upper

0.1693829 0.8748271

**##Since p-VALUE <0.01 --> The results yielded**

**##### statistically significant differences between the marks scores**

**##### of the non-framework students and the framework students, so we can reject the**

**##### null hypothesis and accept the alternative hypothesis.**

**#####Gender #####**

**#####means by program**

**#####non-framework students**

```
nonFSMale <- subset(nonFS, Gender=="0")
```

```
nonFSMale
```

```
mean(nonFSMale$MarksA, na.rm = TRUE)
```

5.239865

```
mean(nonFSMale$MarksAb, na.rm = TRUE)
```

0.7869932

```
nonFSFemale <- subset(nonFS, Gender=="1")
```

```
nonFSFemale
```

```
mean(nonFSFemale$MarksA, na.rm = TRUE)
```

5.557692

```
mean(nonFSFemale$MarksAb, na.rm = TRUE)
```

0.8336538

**##### framework students**

```
FSMale <- subset(FS, Gender=="0")
```

```
FSMale
```

```
mean(FSMale$MarksA, na.rm = TRUE)
```

7.09507

```
mean(FSMale$MarksAb, na.rm = TRUE)
```

1.064261

```
FSFemale <- subset(FS, Gender=="1")
```

```
FSFemale
```

```
mean(FSFemale$MarksA, na.rm = TRUE)
```

6.125

```
mean(FSFemale$MarksAb, na.rm = TRUE)
```

0.91875

```
##Remember install car
##install.packages("car")
##library(car)
###ANCOVA with gender (Gender) to check whether it has any effect with the MarksA
#### Program2: FS → 1, NonFS → 0
#### Gender: Male: 0, Female: 1
#### Result: SIGNIFICATIVE DIFFERENCES
CData <- read.table("Qualifications.csv", header=TRUE, sep=";", na.strings="NA", dec="," ,
strip.white=TRUE)
```

```
model1<-aov(CData$MarksA ~ CData$Program + CData$Gender, data=CData)
Anova(model1, type = "III")
summary.lm(model1)
```

```
Call:
aov(formula = CData$MarksA ~ CData$Program + CData$Gender, data = CData)
```

```
Residuals:
    Min     1Q  Median     3Q    Max
-5.986 -2.664  1.032  2.505  4.550
```

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)    6.9856    0.3376  20.690 < 2e-16 ***
CData$ProgramNonFS -1.5356    0.5229  -2.937  0.00388 **
CData$Gender     -0.4903    0.5852  -0.838  0.40354
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 2.974 on 139 degrees of freedom
Multiple R-squared:  0.06406,    Adjusted R-squared:  0.05059
F-statistic: 4.757 on 2 and 139 DF, p-value: 0.01004
```