Performance of students in Math and Porgugese

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These data come from the UCI Machine Learning database at
http://archive.ics.uci.edu/ml/datasets/Student+Performance#

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Abstract

This data approach student achievement in secondary education of two Portuguese schools. The data attributes include student grades, demographic, social and school related features) and it was collected by using school reports and questionnaires. Two datasets are provided regarding the performance in two distinct subjects: Mathematics (mat) and Portuguese language (por).

Keywords: apa, R, markdown

Word count: X

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What is the relationship between student performance in language and mathematics tasks? This is an important question that has been studied extensively. For example, E. K. Horwitz, Horwitz, and Cope (1986) found that students frequently feel anxiety in foreign language classes. Collier (1992) combined several studies on language achievement and found that language-minority students may need special treatment plans. Interestingly, language appears to be related to performance in mathematics (Abedi & Lord, 2001). In one study based on a survey of 1,174 8th grade students, Abedi and Lord (2001) found that students who were English language learners (ELLs) scored lower on math tests than proficient speakers of English.

The purpose of the present research was to see if previous results replicate in a new sample of language and mathematics learners. To test this, we analysed data of student performance in Mathematics and Portugese classes.

Methods

Participants

Data were collected from the UCI machine learning repository at http://archive.ics.uci.edu/ml/datasets/Student+Performance. Data from 395 students in a Mathematics class, and 649 students in a Portugese class were collected.

Procedure

The primary measures were three exam scores taken at the beginning, middle, and end of each class.

Results

All analyses were conducted using R (R Core Team, 2016) using the papaja package (Aust & Barth, 2015).

Distributions of the three exam scores for the Mathematics and Portugese classes are presented in Figure 1.

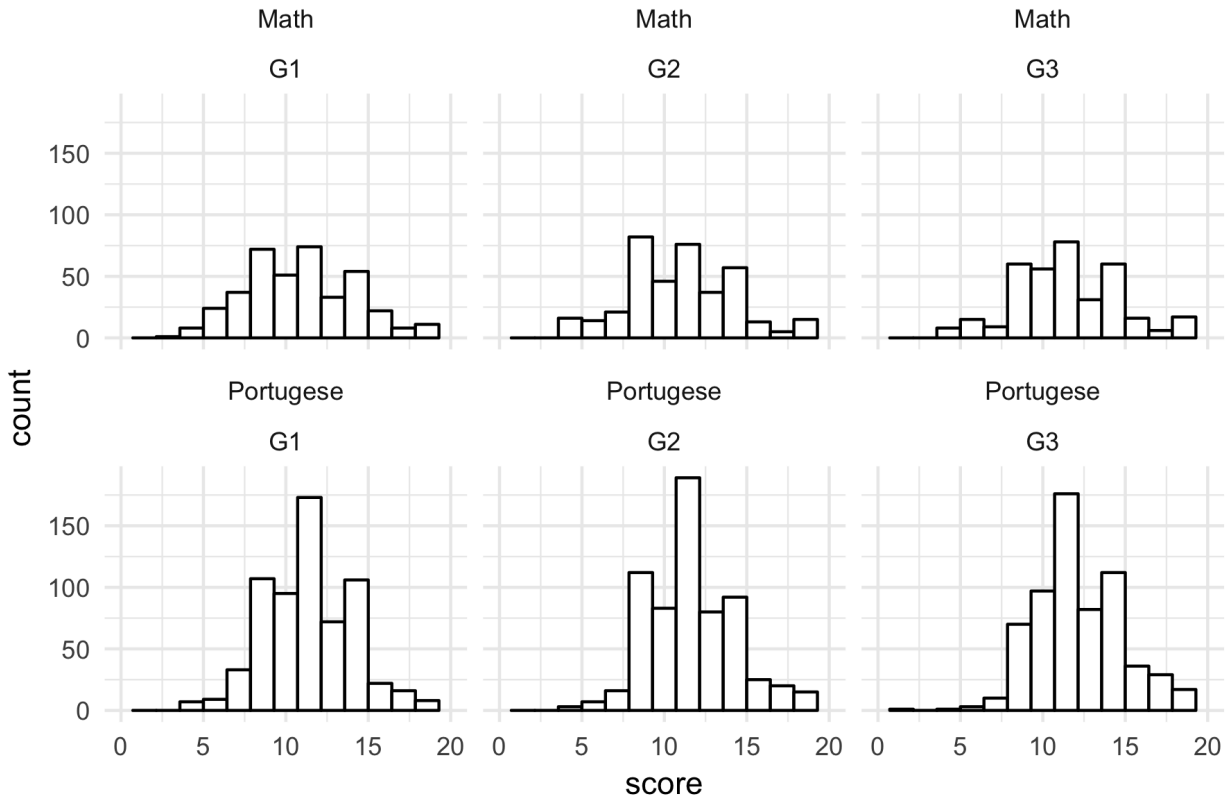

Figure 1. Distributions of class scores.

Correlations between numeric predictors in the Math data are shown in Figure 2:

Descriptive statistics of grades separated by sex and school are presented in Tables 1 and 2. Grades tended to increase over the course of the semester. For example, the mean grade in the first Portugese exam was 11.40 which increased to 11.91 by the last exam.

Did men and women perform differently on the first exams in each class? To tese this, we conducted two separate two-sample t-tests on first exam scores as a function of sex. The t-test on Portugese exam 1 was significant ($t(589.90) = 2.69$, $p = 0.01$), showing that women performed better than men on the first Portugese exam.

The t-test on Math exam 1 was non-significant ($t(589.90) = -1.82$, $p = 0.07$), showing no evidence for a difference between men and women on Math exam 1.

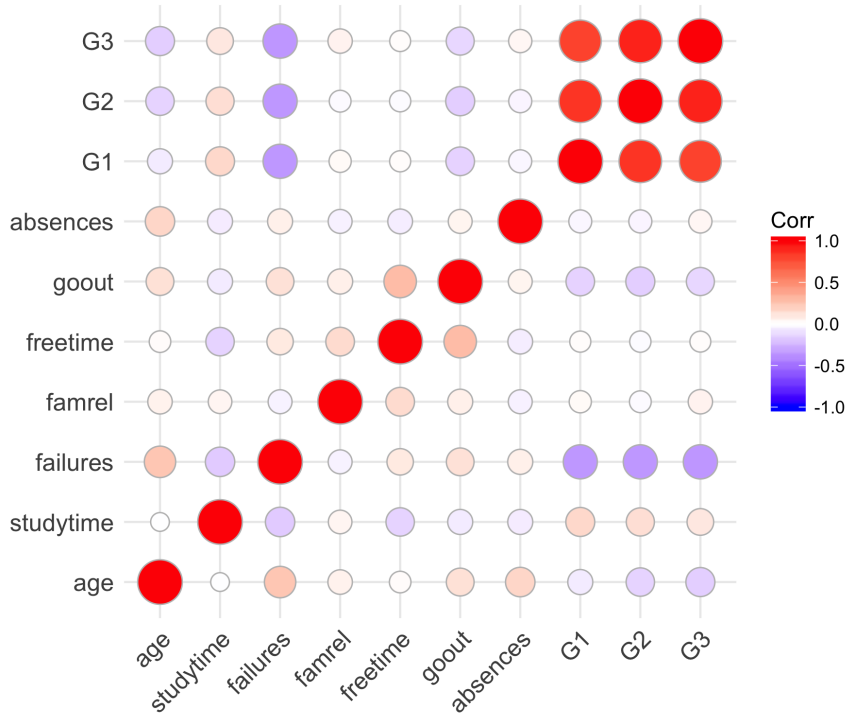

Figure 2. Correlations of numeric variables in the math data.

```
## $estimate

## $estimate$block

## [1] "$\\eta^2_G = .649$"

##

## $estimate$N

## [1] "$\\eta^2_G = .505$"

##

## $estimate$P

## [1] "$\\eta^2_G = .043$"

##

## $estimate$K
```

Table 1

Mean Portugese exam scores

sex	school	Exam 1	Exam 2	Exam 3
F	GP	12.29	12.50	13.00
F	MS	10.58	10.72	11.03
M	GP	11.60	11.69	12.03
M	MS	9.79	10.09	9.95

```
## [1] "$\\eta^2_G = .339$"
##
## $estimate$N_P
## [1] "$\\eta^2_G = .103$"
##
## $estimate$N_K
## [1] "$\\eta^2_G = .152$"
##
## $estimate$P_K
## [1] "$\\eta^2_G = .003$"
##
##
## $statistic
## $statistic$block
## [1] "$F(5, 12) = 4.45$, $\\mathrm{MSE} = 15.44$, $p = .016$"
##
## $statistic$N
## [1] "$F(1, 12) = 12.26$, $\\mathrm{MSE} = 15.44$, $p = .004$"
```

Table 2

Mean Math exam scores

sex	school	Exam 1	Exam 2	Exam 3
F	GP	12.29	12.50	13.00
F	MS	10.58	10.72	11.03
M	GP	11.60	11.69	12.03
M	MS	9.79	10.09	9.95

```
##
## $statistic$P
## [1] "$F(1, 12) = 0.54$, $\\mathrm{MSE} = 15.44$, $p = .475$"
##
## $statistic$K
## [1] "$F(1, 12) = 6.17$, $\\mathrm{MSE} = 15.44$, $p = .029$"
##
## $statistic$N_P
## [1] "$F(1, 12) = 1.38$, $\\mathrm{MSE} = 15.44$, $p = .263$"
##
## $statistic$N_K
## [1] "$F(1, 12) = 2.15$, $\\mathrm{MSE} = 15.44$, $p = .169$"
##
## $statistic$P_K
## [1] "$F(1, 12) = 0.03$, $\\mathrm{MSE} = 15.44$, $p = .863$"
##
##
## $full_result
```

```
## $full_result$block
## [1] "$F(5, 12) = 4.45$, $\\mathrm{MSE} = 15.44$, $p = .016$, $\\eta^2_G = .649$"
##
## $full_result$N
## [1] "$F(1, 12) = 12.26$, $\\mathrm{MSE} = 15.44$, $p = .004$, $\\eta^2_G = .505$"
##
## $full_result$P
## [1] "$F(1, 12) = 0.54$, $\\mathrm{MSE} = 15.44$, $p = .475$, $\\eta^2_G = .043$"
##
## $full_result$K
## [1] "$F(1, 12) = 6.17$, $\\mathrm{MSE} = 15.44$, $p = .029$, $\\eta^2_G = .339$"
##
## $full_result$N_P
## [1] "$F(1, 12) = 1.38$, $\\mathrm{MSE} = 15.44$, $p = .263$, $\\eta^2_G = .103$"
##
## $full_result$N_K
## [1] "$F(1, 12) = 2.15$, $\\mathrm{MSE} = 15.44$, $p = .169$, $\\eta^2_G = .152$"
##
## $full_result$P_K
## [1] "$F(1, 12) = 0.03$, $\\mathrm{MSE} = 15.44$, $p = .863$, $\\eta^2_G = .003$"
##
##
## $table
##          Effect   $F$ $\\mathit{df}_1$ $\\mathit{df}_2$ $\\mathrm{MSE}$
## 1         Block  4.45                5                12           15.44
## 2             N 12.26                1                12           15.44
## 3             P  0.54                1                12           15.44
```

```
## 4             K  6.17              1              12           15.44
## 5 N $\\times$ P  1.38              1              12           15.44
## 6 N $\\times$ K  2.15              1              12           15.44
## 7 P $\\times$ K  0.03              1              12           15.44
##    $p$ $\\eta^2_G$
## 1 .016        .649
## 2 .004        .505
## 3 .475        .043
## 4 .029        .339
## 5 .263        .103
## 6 .169        .152
## 7 .863        .003
```

Discussion

Understanding the relationship between language and math performance is important for understanding learning. Our results are generally in line with Abedi and Lord (2001) who found a relationship between language and mathematics performance.

References

Abedi, J., & Lord, C. (2001). The language factor in mathematics tests. *Applied Measurement in Education*, *14*(3), 219–234.

Aust, F., & Barth, M. (2015). *Papaja: Create apa manuscripts with rmarkdown*. Retrieved from https://github.com/crsh/papaja

Collier, V. P. (1992). A synthesis of studies examining long-term language minority student data on academic achievement. *Bilingual Research Journal*, *16*(1-2), 187–212.

Horwitz, E. K., Horwitz, M. B., & Cope, J. (1986). Foreign language classroom anxiety. *The*

Modern Language Journal, *70*(2), 125–132.

R Core Team. (2016). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from https://www.R-project.org/