STUDENT PERFORMANCE REPORT

Mathematics and Portuguese Subjects

Introduction

- This study analyzes students' academic performance in Mathematics and Portuguese. The objective is to identify demographic, family, lifestyle, and academic behavior factors that influence students' final grades (G3).
- Understanding these factors can help educators and policymakers design effective strategies to improve student outcomes.

Problem Statement

- Students' academic performance is influenced by multiple personal, family, and lifestyle factors. However, it is not always clear which factors significantly affect final academic achievement.
- The main research question addressed in this study is:
- Which background, family, lifestyle, and academic behavior factors significantly influence students' final grades (G3)?

Demographic Characteristics

- 56.6% of students were female, and 43.4% were male.
- 37.8% of observations were from Mathematics and 62.2% from Portuguese.
- 91.5% of students expressed interest in pursuing higher education.
- 79.2% reported having internet access at home.

Academic Averages

- Average grade (G1, G2, G3): 11.26
- Average number of absences: 4.43
- Average study time: 1.97 hours

Subject Comparison

A statistical comparison between subjects showed:

- Students performed significantly better in Portuguese than in Mathematics ($p < 0.05$).
- Students studied slightly more for Mathematics (average 2 hours) compared to Portuguese (average 1.9 hours).
- This suggests that despite spending more time studying Mathematics, performance was higher in Portuguese.

Statistical Terms Used in the Report

Symbol	Full Form	Where It Is Used	Meaning
p	Probability Value (p-value)	All statistical tests	Shows whether a result is statistically significant. If $p < 0.05$, the result is considered significant.
F	F-statistic	ANOVA, Regression	Tests whether group means differ significantly. Higher F indicates stronger group differences.
η^2	Eta Squared	ANOVA	Measures effect size. Shows how much variance in the dependent variable is explained by a factor.
β	Standardized Beta Coefficient	Linear Regression	Shows the strength and direction of a predictor. Higher absolute β means stronger influence.
OR	Odds Ratio	Linear Regression	Indicates how much the odds of an outcome increase (>1) or decrease (<1).

R^2	R-squared (Coefficient of Determination)	Linear Regression	Shows how much variance in the dependent variable is explained by the model. Higher R^2 indicates better model fit.

Correlation Analysis

- G2 (second-period grade) showed a very strong positive correlation with G3.
- G1 (first-period grade) was also positively correlated with G3.
- Absences showed a weak negative relationship with final grades.
- Workday alcohol consumption had a small negative correlation with G2 and G3.
- This indicates that previous academic performance is strongly associated with final academic outcomes.

Lifestyle and Family Effects

Study Time and Final Grades

- A one-way ANOVA was conducted to examine whether study time affects final grades (G3).
- $F(3, 1040) = 10.37$
- $p < .001$
- Effect size: $\eta^2 = .029$
- The result was statistically significant. However, the effect size was small, indicating that study time explains only 2.9% of the variance in final grades.

Alcohol Consumption and Final Grades

Workday Alcohol

- $F(4, 1039) = 6.24$
- $p < .001$
- $\eta^2 = .023$

- Workday alcohol consumption had a statistically significant but small effect, explaining 2.3% of the variance in final grades.

Weekend Alcohol

- $F(4, 1039) = 3.78$
- $p < .005$
- $\eta^2 = .014$
- Weekend alcohol consumption also showed a statistically significant but very small effect, explaining 1.4% of the variance in final grades.
- Overall, alcohol consumption had a statistically significant but practically small impact on academic performance.

Internet Access

- Although 79.4% of students reported that internet access impacts their academic performance, descriptive analysis alone does not confirm a statistically significant relationship with final grades.

Multiple Linear Regression (Predicting Final Grade – G3)

- A multiple linear regression analysis was conducted to identify predictors of final academic performance (G3).
- $F(11, 1032) = 500.53$
- $p < .001$
- $R^2 = .842$
- The model explains 84.2% of the variance in final grades, indicating a very strong predictive model.

Significant Predictors

- G2 ($\beta = .797$, $p < .001$) – strongest predictor
- G1 ($\beta = .108$, $p < .001$)
- Absences ($\beta = .054$, $p < .001$) – small effect

- Previous academic failures ($\beta = -.042$, $p = .002$)
- Course subject ($\beta = .082$, $p < .001$)

Non-Significant Predictors

- Study time
- Alcohol consumption (weekday and weekend)
- Parental education
- Social activity variables
- After controlling prior academic performance, lifestyle factors were no longer significant predictors.

Logistic Regression (Predicting Pass/Fail)

- A binary logistic regression was conducted to predict the likelihood of passing the course.
- $\chi^2 = 163.45$
- $p < .001$
- Nagelkerke $R^2 = .222$
- Overall classification accuracy: 80.7%

Significant Predictors

- Study time (OR = 1.256, $p = .034$)
- Increased study time increases the likelihood of passing.
- Previous academic failures (OR = 0.343, $p < .001$)
- Prior failures significantly reduce the probability of passing.
- Course subject (OR = 2.662, $p < .001$)
- Pass probability differs between Mathematics and Portuguese.

Non-Significant Predictors

- Absences

- Alcohol consumption
- The model predicts passing well but has limited ability to detect failing students.

Conclusion

- The most important determinant of final academic performance is previous academic achievement (G1 and G2).

Key findings:

- Prior grades strongly predict final grades.
- Previous academic failures significantly reduce the likelihood of passing.
- Study time increases pass probability but explains only a small portion of grade variation.
- Alcohol consumption shows statistical significance in isolation but loses importance after controlling academic history.
- Subject type influences performance and pass rates.
- Overall, academic history is far more influential than lifestyle factors in determining student success.