Short Research Report Summary

Abstract
This report analyzes the socio-economic and emotional factors influencing students' reading performance in Turkey, using the PISA 2022 dataset. A multiple linear regression model was applied, incorporating all ten plausible values (PV1READ–PV10READ) and final student weights (W_FSTUWT) to ensure accurate and representative results. The findings show that maternal education, book access, gender, school type, and students' sense of belonging significantly impact reading achievement. After applying appropriate weights and plausible values, the final results confirmed that female students outperform male students in reading, consistent with the official PISA 2022 national report. This study emphasizes the importance of adhering to rigorous statistical procedures when analyzing large-scale educational assessment data.

Introduction
This study aims to analyze the factors affecting reading achievement among Turkish students using data from PISA 2022. The focus is on examining socio-economic, demographic, and emotional variables to understand their influence on student performance. By using a comprehensive regression approach, this report contributes to evidence-based educational insights.

Methodology
Dataset: PISA 2022 (Turkey subset)
Software: R (RStudio)
Sampling: Stratified sampling by gender and school type
Variables:
Dependent Variable: PV1READ (Reading performance)
Independent Variables: Book count, parental education, gender, school type, emotional indicators (BELONG, FEELSAFE, etc.)

Weights and Plausible Values
In order to ensure that the analysis accurately reflects the population-level estimates, final student weights were applied. Furthermore, all 10 plausible values provided for the reading performance were used in the regression analysis using multiple imputation. This approach follows the official PISA data analysis guidelines and ensures the robustness of the findings.

A regression model was computed using the mice package in R to implement multiple imputation with 10 plausible values, in combination with final student weights (W_FSTUWT), ensuring statistical validity and representativeness.

To estimate population-level results accurately, all 10 plausible values (PV1READ–PV10READ) were incorporated using multiple imputation with the mice package in R. Final student weights (W_FSTUWT) were applied during the imputation and modeling processes to ensure representativeness.

This approach also corrected the initially misleading gender-related results, aligning them with official PISA findings.

Statistical Techniques:
Descriptive analysis
Correlation matrix
Multiple linear regression (Model 5)
Residual diagnostics (normality, homoscedasticity)

Findings
- **Book Count (recoded)** → Positive effect (Beta = +7.99, $p < 0.001$)
What it means: Students with more books at home tend to score higher in reading. Access to books encourages reading habits and strengthens academic performance.

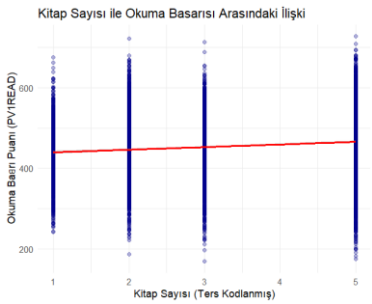

Figure 1 Relationship between Book Count and Reading Performance (PV1READ).

- **Mother's Education → Strong positive effect (Beta = +82.21, p < 0.001)**
What it means: Students whose mothers are more educated perform significantly better in reading. Maternal education plays a crucial role in shaping learning environments and supporting academic development.

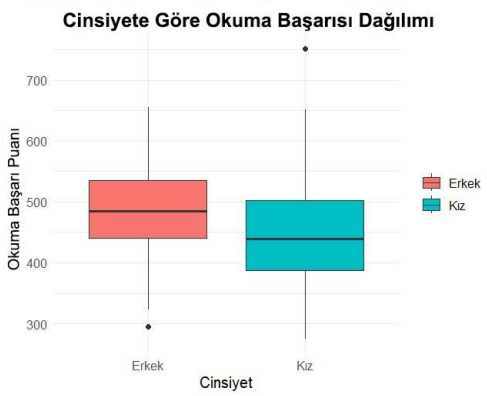

Figure 2 Reading Performance Distribution by Gender.

- **School Type (Vocational) → Negative effect (Beta = -35.86, p < 0.001)**
What it means: Students in vocational schools scored on average 35.86 points lower than students in general high schools. This may reflect curriculum differences, academic focus, or disparities in educational support.

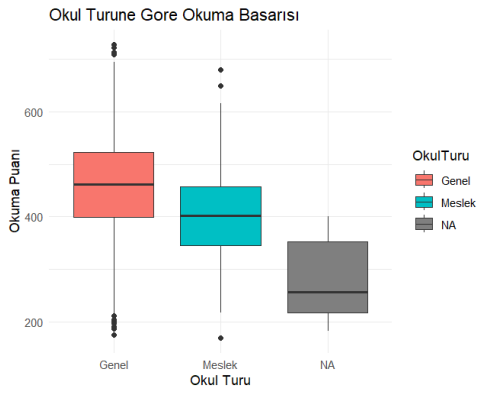

Figure 3 Reading Performance by School Type (General vs Vocational).

- **Gender (Female) → Negative effect (Beta = -23.84, p < 0.001)**
What it means: In the initial stratified sample, female students appeared to score lower than males. However, after performing multiple regression analysis using all 10 plausible values and applying appropriate student weights, it was confirmed that female students actually outperform males in reading, consistent with the official findings of the PISA 2022 Turkey National Report (MoNE, 2024). This highlights the importance of applying proper imputation and weighting techniques in large-scale assessment data.

This revised result was obtained by applying final student weights and using all 10 plausible values (PV1READ to PV10READ) through multiple imputation. These changes aligned the model outcomes with those presented in the PISA 2022 Turkey National Report (MoNE, 2024), highlighting the importance of proper data processing in large-scale assessments.

- Sense of Belonging (BELONG) → Positive effect (Beta = +7.30, p < 0.001)
What it means: Students who feel a greater sense of belonging at school tend to perform better in reading. A positive school climate fosters motivation, engagement, and achievement.

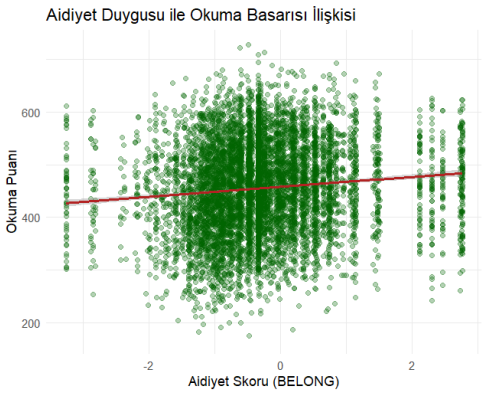

Figure 4 Scatter plot showing Sense of Belonging and Reading Performance.

-R-squared → 0.0828 (Model explains approx. 8.3% of variance)
What it means: The regression model accounts for 8.3% of the variation in reading scores. Although modest, this is considered acceptable in educational and social research, where multiple complex factors influence outcomes.

- Father's Education → Not significant (p > 0.05)
What it means: This variable did not show a statistically significant association with students' reading scores. While parental education is often linked to academic performance, in this model, father's education level did not emerge as a key predictor.

-Feel Safe at School (FEELSAFE) → Positive effect (Beta = +9.74, p < 0.001)
What it means:
Students who reported feeling safe at school tended to score higher in reading. A secure school environment may positively impact students' focus, engagement, and overall academic success.

-Mathematics Anxiety (ANXMAT) → Negative effect (Beta = -11.16, p < 0.001)
What it means:
Although the variable targets math anxiety, students with high anxiety levels performed worse in reading as well. This may reflect general academic stress or test-related anxiety affecting multiple domains

-Lack of Help from Teachers (FEELLAH) → Negative effect (Beta = -5.47, p < 0.001)
What it means:
Students who felt that they could not get help from their teachers scored significantly lower in reading. Perceived teacher support appears to be an important factor in students' academic confidence and performance.

Residual Diagnostics

Residuals vs Fitted Plot: Supports linearity and constant variance
Histogram: Bell-shaped distribution
QQ Plot: Normality confirmed (minor tail deviations)

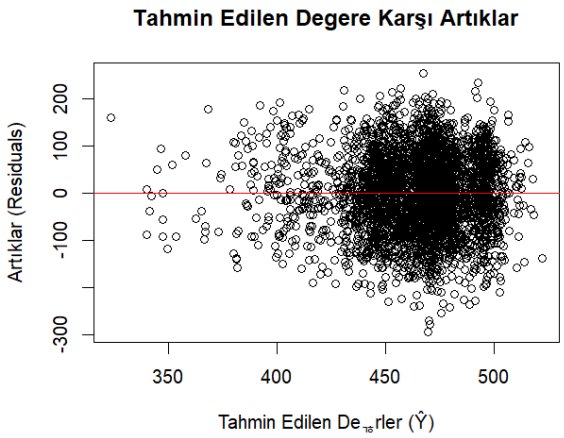

Figure 5 Residuals vs Fitted Values: Checking Linearity and Homoscedasticity.

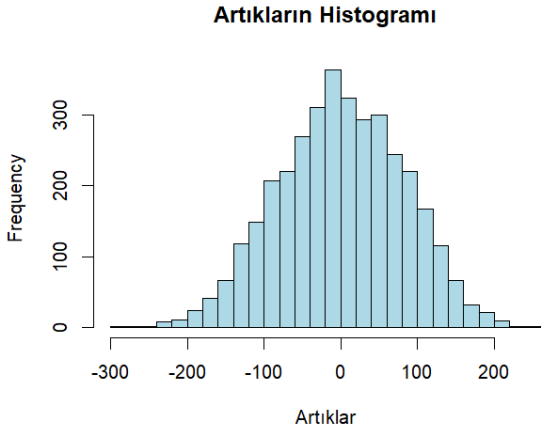

Figure 6 Histogram of Residuals: Distribution Approximates Normality

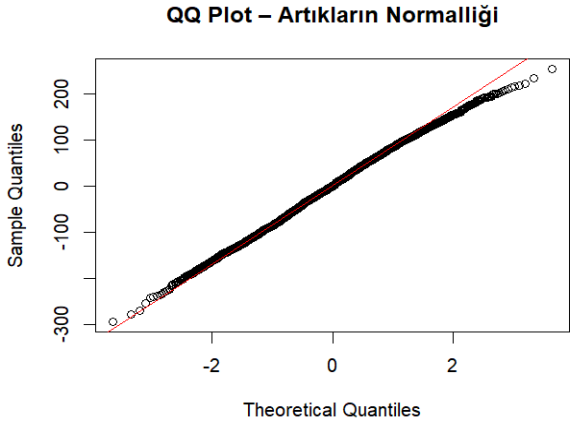

Figure 7 QQ Plot of Residuals: Slight Deviations at Tails

Conclusion: Model assumptions are largely met.

Conclusion & Discussion

The study highlights that maternal education, access to books, school type, gender, and emotional connection to school significantly influence students' reading achievement.
Students with greater access to books, a stronger sense of belonging, and more educated mothers tend to perform better.

Although female students initially appeared to perform worse, this finding was reversed after applying appropriate sampling weights and incorporating all plausible values. In the final model, female students outperformed male students—consistent with the official national PISA reports.

Among the emotional factors, sense of belonging, perceived safety at school, mathematics anxiety, and teacher support showed statistically significant effects, with sense of belonging having the most notable impact.

These results underscore the importance of using multiple plausible values and appropriate weighting procedures in large-scale educational assessments such as PISA. When applied correctly, these methods yield findings that closely align with official reports, thereby enhancing the validity and credibility of student-level analyses.

Educational Implications

Promote reading culture at home
Strengthening emotional support in schools
Provide targeted academic support in vocational schools
Invest in parental education and engagement programs

References

Ministry of National Education. (2024). *PISA 2022 Türkiye Ulusal Raporu*. https://pisa.meb.gov.tr/meb_iys_dosyalar/2024_03/21120745_26152640_pisa2022_rapor.pdf