Student Performance Analysis Report

1. Introduction & Objective

The purpose of this report is to analyze student academic performance using demographic and educational factors. The analysis focuses on understanding how **gender, race, parental level of education, lunch type, and test preparation** influence students' scores in **Math, Reading, and Writing**.

The findings aim to provide meaningful insights that can help educators and institutions design better academic support strategies.

2. Dataset Overview

The dataset contains student performance data with the following key features:

- **Academic Scores:** Math Score, Reading Score, Writing Score
- **Demographic Information:** Gender, Race/Ethnicity
- **Socioeconomic Indicators:** Lunch Type, Parental Level of Education
- **Academic Support Indicator:** Test Preparation Course

Each record represents one student along with their academic scores and background information.

3. Data Cleaning and Preparation

Before analysis, the dataset was cleaned and standardized to ensure accuracy and consistency:

- Column names were renamed for better readability.
- Text-based categorical variables were standardized using proper case formatting.
- Parental education categories were consolidated to remove redundancy.
- Missing values in the *Test Preparation* column were treated as **"Not Completed"**, as missing values indicated students who did not complete the preparation course.

- Data types were verified to ensure numerical and categorical fields were correctly formatted.
- The cleaned dataset was saved for further analysis and dashboard creation.

This step ensured that the analysis was based on reliable and interpretable data.

4. Exploratory Data Analysis (EDA)

4.1 Gender Distribution and Performance

- The dataset contains a slightly higher number of female students compared to male students.
- When comparing average scores:
    - Female students perform better in **Reading and Writing**.
    - Math scores show relatively smaller differences between genders.

This suggests that gender-based performance differences are more pronounced in language-related subjects.

4.2 Test Preparation Impact

Test preparation shows a **strong and consistent impact** on student performance:

- Students who **completed** the test preparation course achieved a significantly higher **overall average score**.
- On average, students who completed preparation scored approximately **8 points higher** across subjects than those who did not.

This indicates that structured academic preparation plays a crucial role in improving student outcomes.

4.3 Lunch Type and Student Performance

Lunch type was analyzed as a proxy for socioeconomic background:

- Students receiving **Standard lunch** consistently scored higher across Math, Reading, and Writing.

- Students with **Free/Reduced lunch** showed comparatively lower average scores.

This highlights the influence of socioeconomic factors on academic performance.

4.4 Parental Level of Education

Parental education shows a moderate relationship with student performance:

- Students whose parents have **higher educational qualifications** tend to perform better, especially in Reading and Writing.
- Differences are gradual rather than extreme, indicating that parental education supports learning but does not solely determine outcomes.

4.5 Score Distribution and Correlation

- Math, Reading, and Writing scores are **strongly correlated**, suggesting that students who perform well in one subject often perform well in others.
- Distribution plots and boxplots indicate a relatively balanced spread of scores with some high-performing outliers.

5. Power BI Dashboard Summary

An interactive Power BI dashboard was developed to visualize the key findings:

- KPI cards display average Math, Reading, and Writing scores.
- A dedicated visual highlights the **impact of test preparation on overall average scores**.
- Comparative visuals show performance differences by gender and lunch type.
- Filters for **Parental Level of Education** and **Race** allow dynamic exploration of student performance.

The dashboard enables quick, data-driven insights for both technical and non-technical users.

6. Key Insights

- Test preparation has the **strongest positive impact** on student performance.
- Female students outperform male students in Reading and Writing.
- Socioeconomic factors, represented by lunch type, influence academic outcomes.
- Parental education contributes positively but does not guarantee high performance.
- Academic subjects are strongly correlated, indicating consistent learning patterns.

7. Conclusion

This analysis demonstrates that **academic support mechanisms and socioeconomic factors** play a vital role in student performance. Test preparation emerges as the most impactful factor, suggesting that targeted preparation programs can significantly improve outcomes. While demographic and background factors influence performance, structured academic support can help bridge performance gaps.

The insights from this report can support data-driven decision-making in educational planning and student support initiatives.