

# Mastering Data Visualization with Matplotlib & Seaborn —

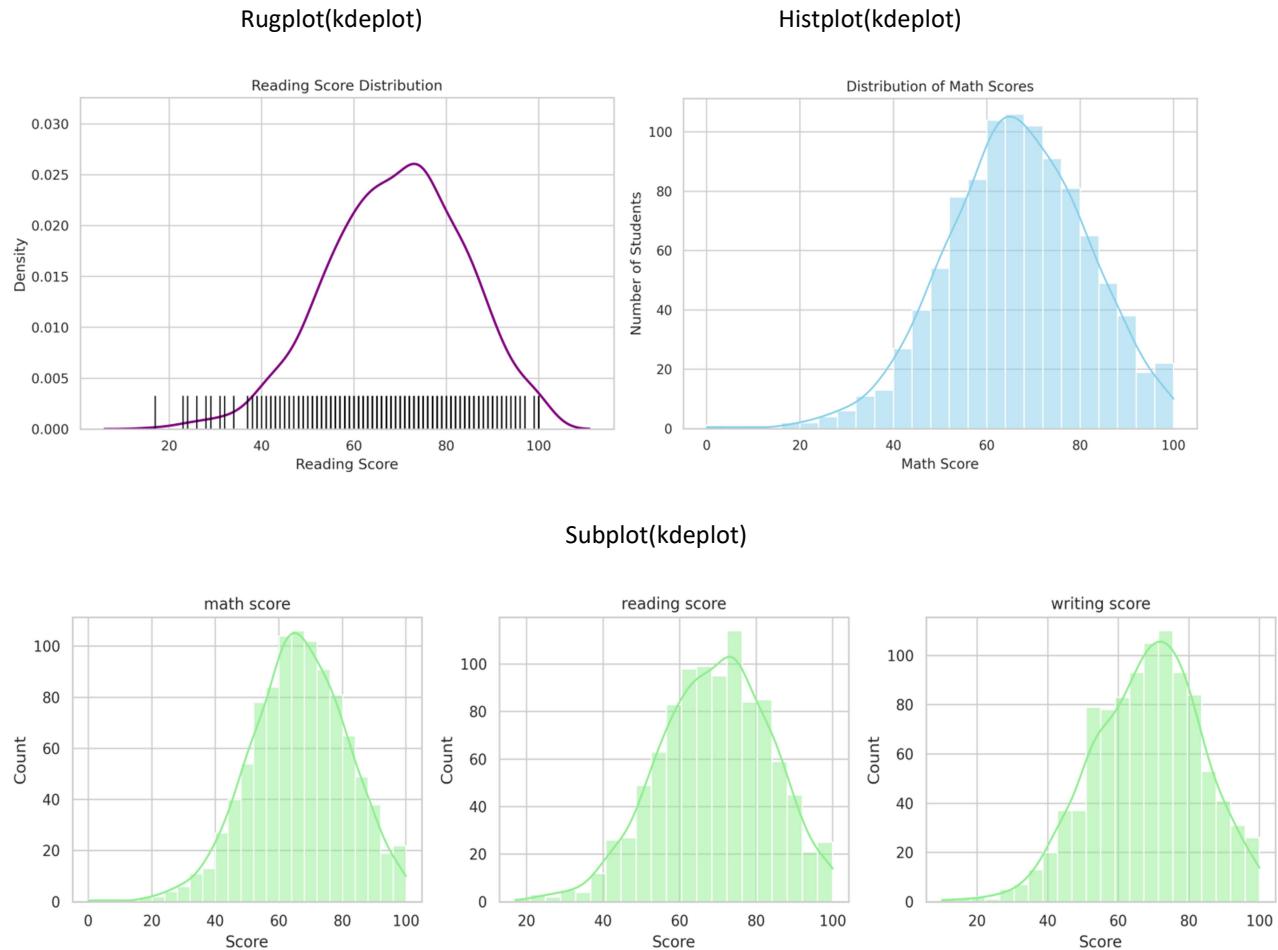
## Student Performance with Real Data Analysis

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**Seaborn Section:** 7+ plots with insights

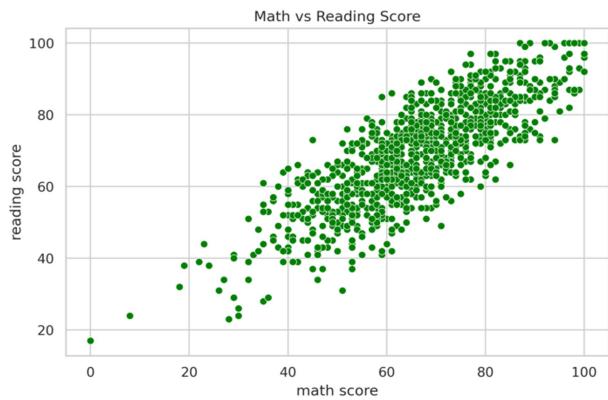
Rugplot, Kdeplot, Histplot – Distribution Plot :



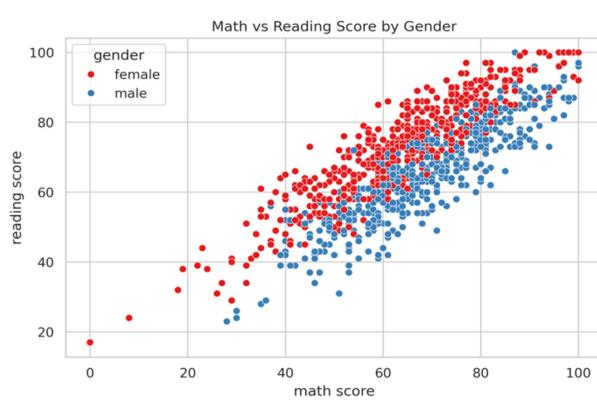
The reading scores are mostly concentrated between 60 and 90, showing a strong central tendency. The KDE line reveals a slight right skew, meaning a few students performed exceptionally well. Rugplot dots at the base highlight individual student scores. Overall, the distribution reflects moderate consistency in reading performance.

### Scatterplot, Relplot, Lineplot – Relationship Plot:

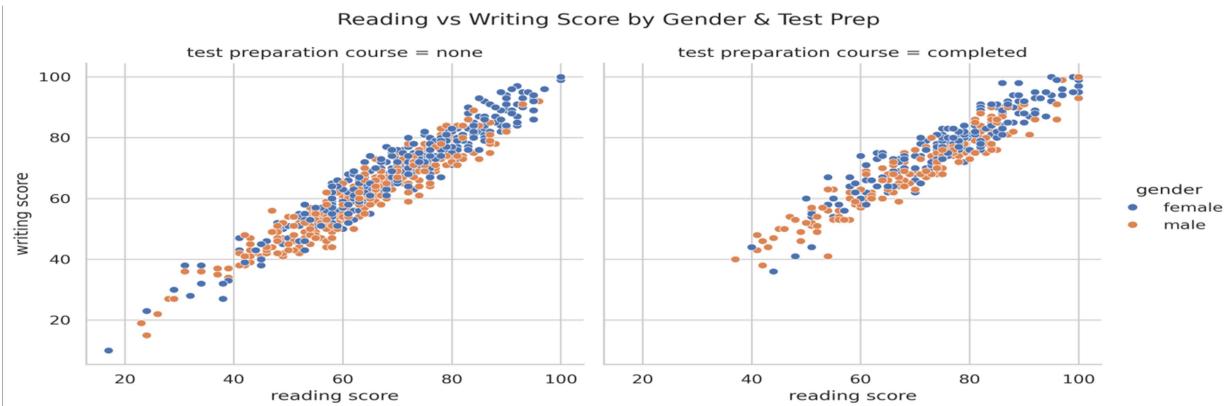
Scatterplot



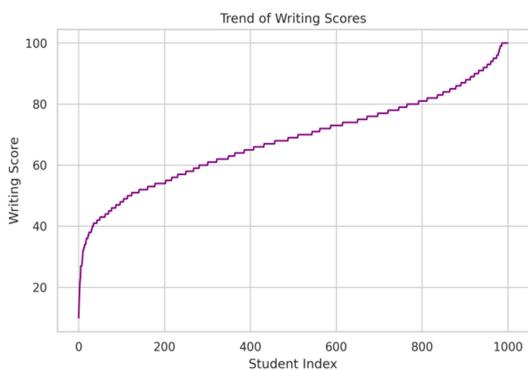
Scatterplot(hue-gender>color)



Relplot



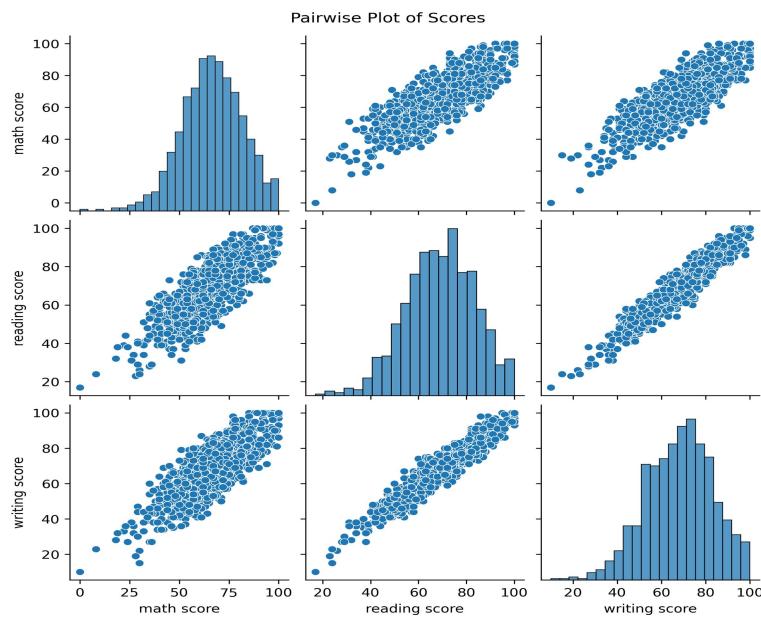
Lineplot



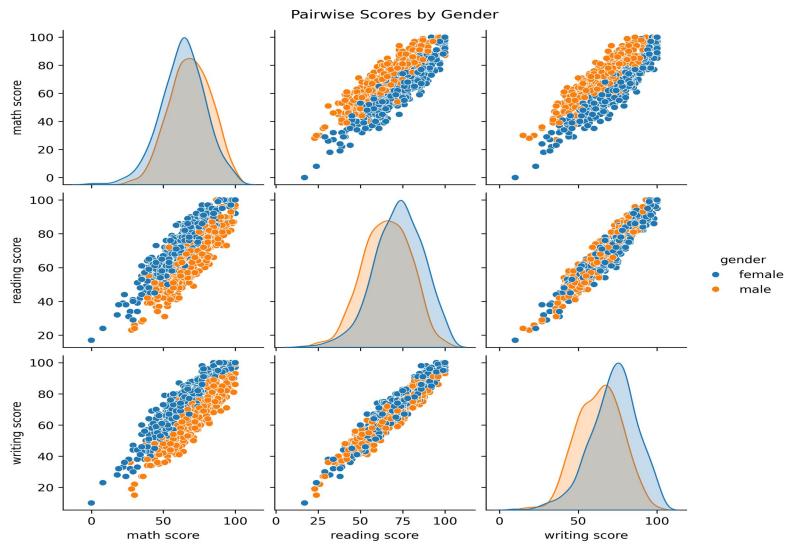
There is a strong positive correlation between reading and writing scores — as one increases, so does the other. This suggests that literacy skills in students are generally aligned. The trend line is consistent across genders and test prep statuses. The relationship plot helps visualize patterns across categories.

### Pairplot – Pairwise Relationship:

Pairplot-Numeric Columns



Pairplot with Hue-(Gender Wise)

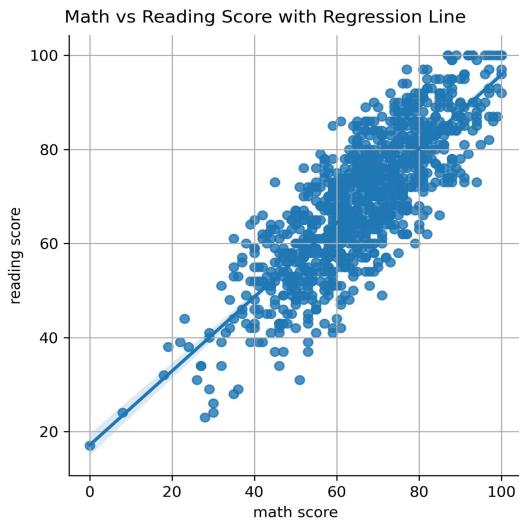


All three scores — math, reading, and writing — show a high degree of positive correlation. Students scoring well in math tend to also perform well in language-based subjects.

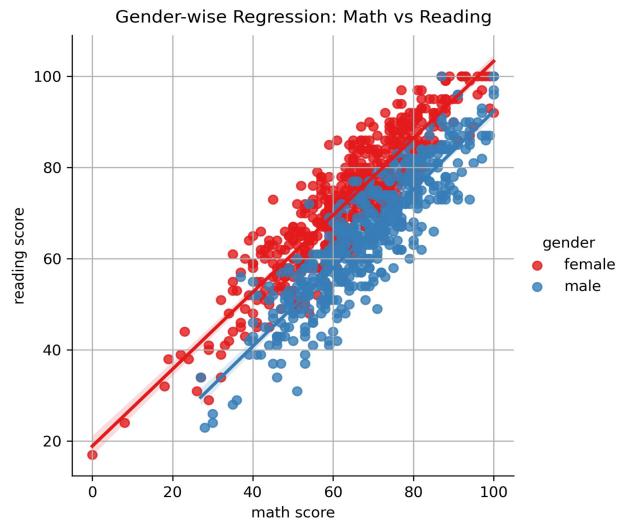
Pairplot serves as a quick diagnostic for multivariate analysis.

### Lmplot – Regression Plot:

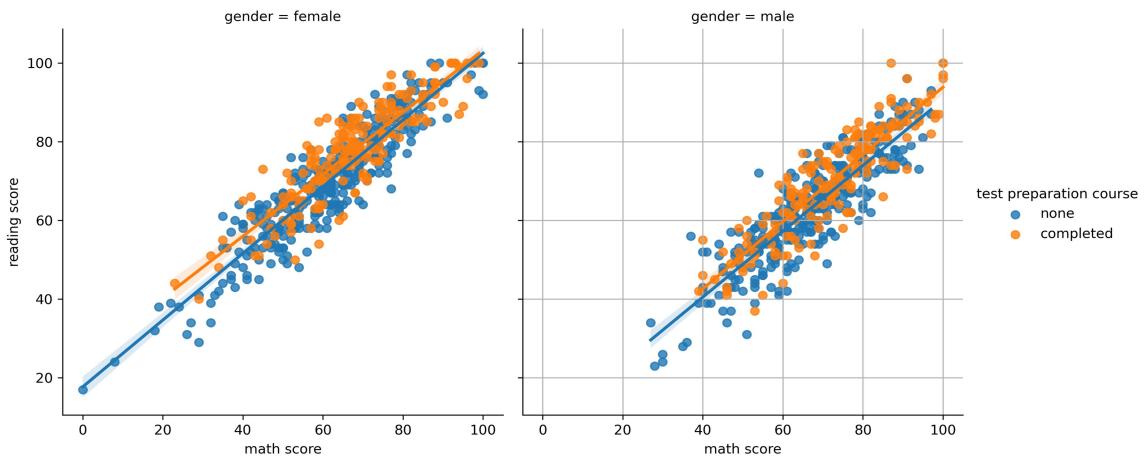
Lmplot-Regression with Relationship



Lmplot-Gender Wise Regression(hue)

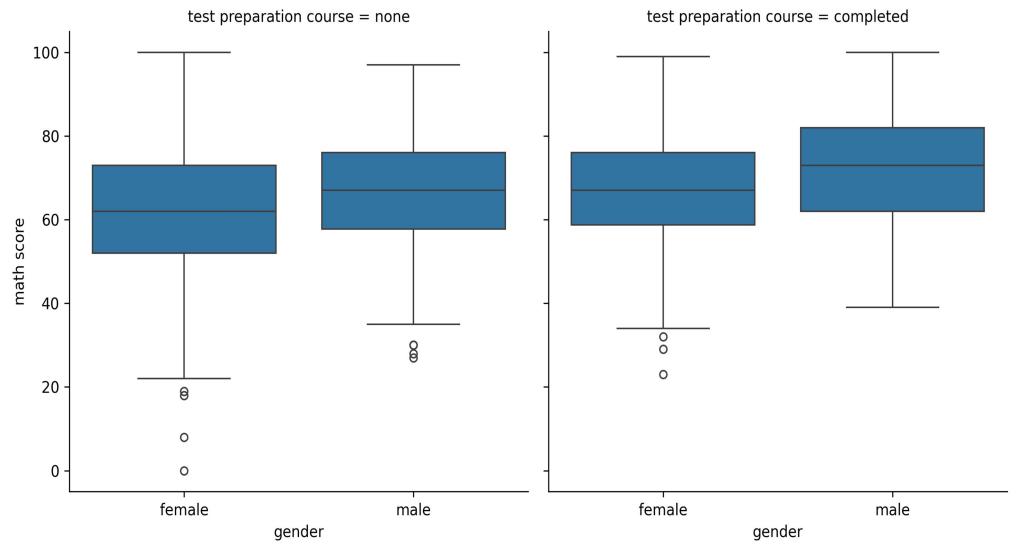


Test Prep vs Gender-wise Regression

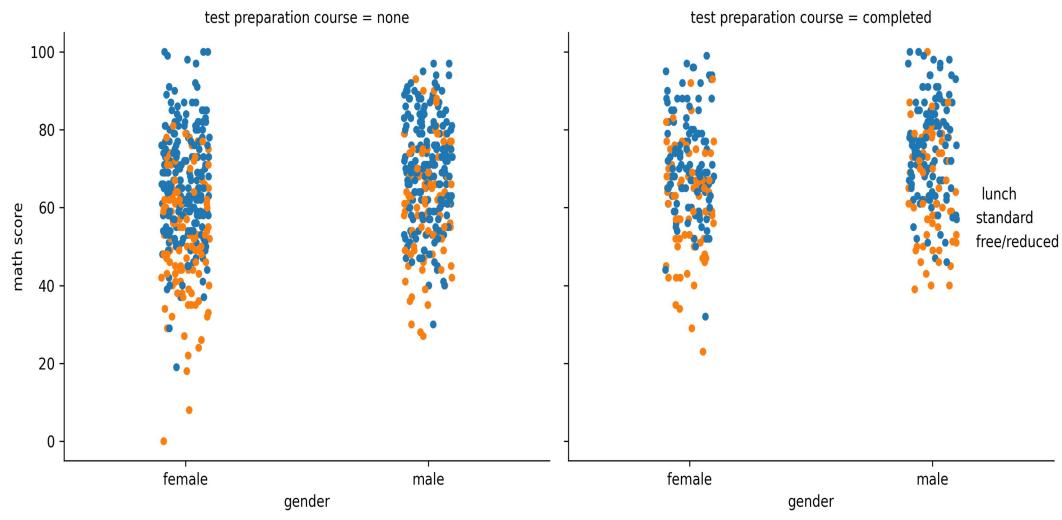


Students who score higher in math generally have higher reading scores too. The regression line confirms a linear trend, especially among those who completed the test preparation course. This indicates a possible transfer of analytical skills across subjects.

### Catplot – Category-wise Plot:



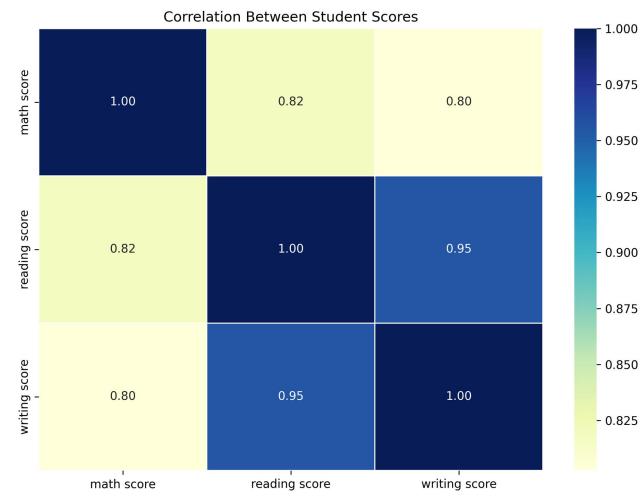
Math Score by Gender, Lunch & Test Prep



Female students with standard lunch and test prep tend to perform better in writing. The catplot reveals visible gaps between lunch types and test prep groups.

Breaking down by category reveals hidden disparities that a global average may miss.

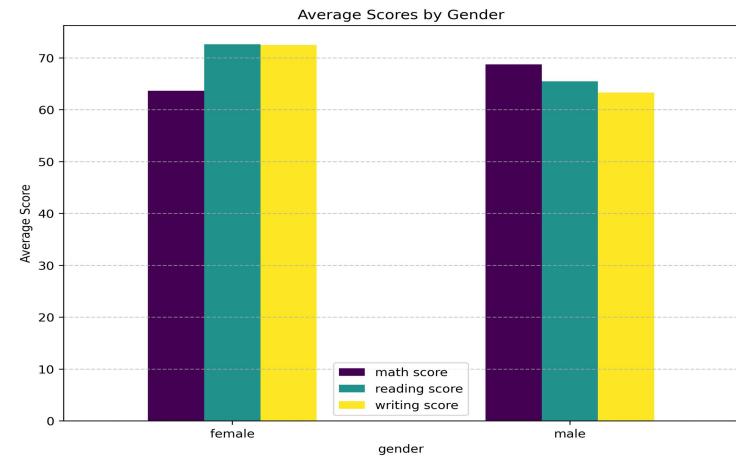
### Heatmap:



This heatmap highlights the correlation between Math, Reading, and Writing scores. We observe a strong positive relationship between reading and writing — suggesting that improvement in one often reflects improvement in the other."

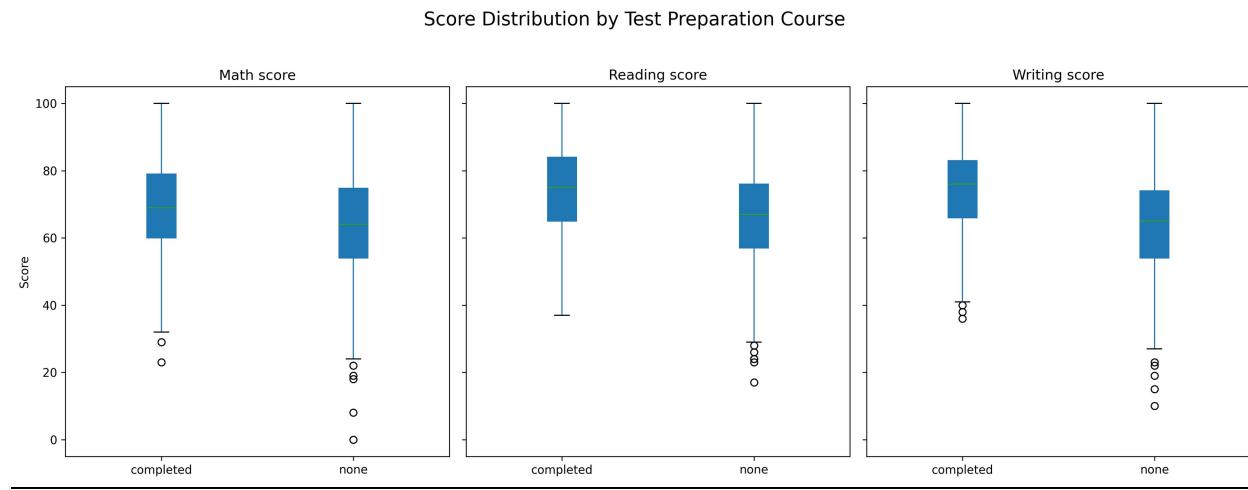
### **Matplotlib Section:** 7 plots with insights

#### Bar Plot:



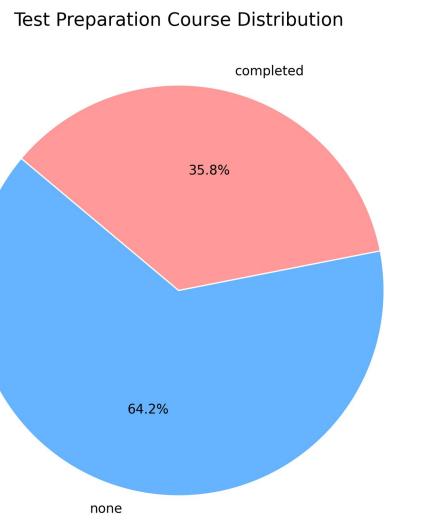
The bar plot illustrates the average scores of male and female students across math, reading, and writing. It clearly shows that female students performed better on average in reading and writing, while male students slightly outperformed in math. This visualization highlights gender-based performance trends and may help inform more balanced educational strategies.

Box Plot:



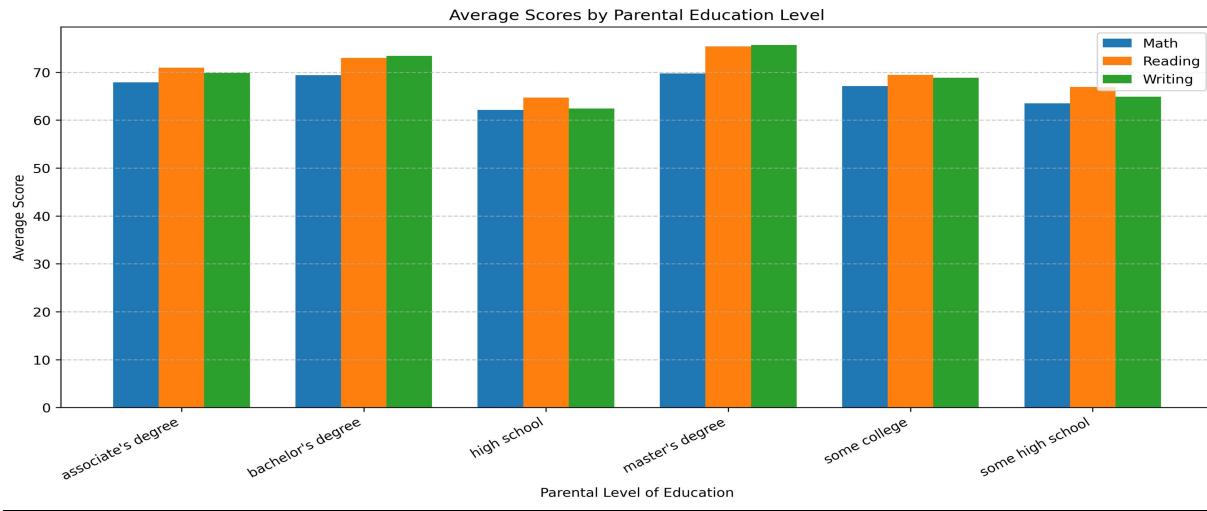
The box plots compare the distribution of math, reading, and writing scores between students who completed a test preparation course and those who did not. In all three subjects, students who took the preparation course consistently achieved higher median scores and had fewer low outliers. This indicates a positive impact of test preparation on academic performance, especially in improving overall consistency and score elevation.

Pie chart:



The pie chart illustrates the distribution of students based on their participation in the test preparation course. A larger proportion of students did not take the course, while a smaller group completed it. This imbalance suggests that most students are entering assessments without formal preparation, which may influence overall academic performance trends.

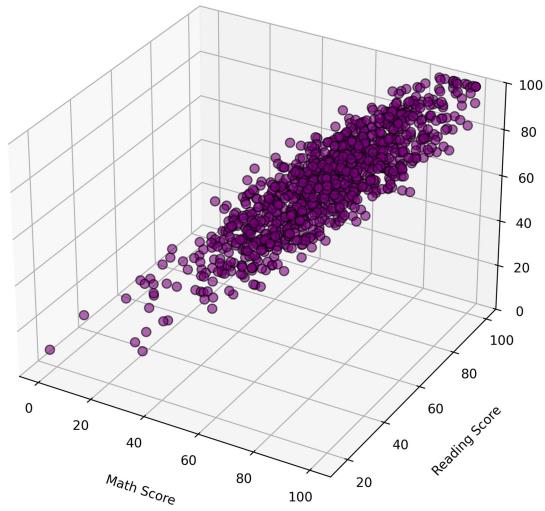
### Grouped Bar Plot:



The grouped bar plot presents the average scores in math, reading, and writing based on parental education levels. Students whose parents have higher education levels—such as bachelor's or master's degrees—tend to perform better across all subjects. This trend suggests a strong positive correlation between parental education and student academic achievement.

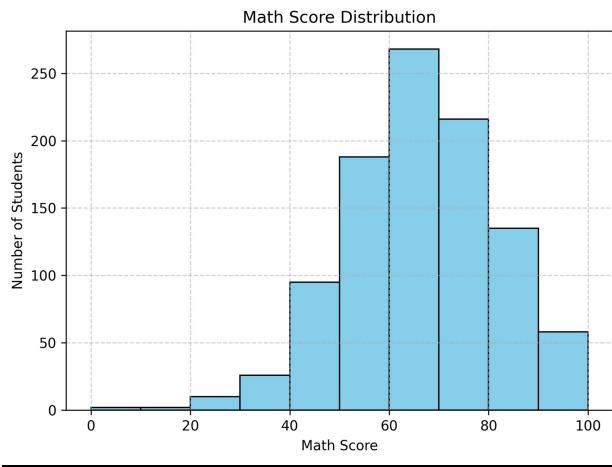
### 3D Scatter Plot:

3D Scatter Plot: Math vs Reading vs Writing



This 3D scatter plot visualizes students' performance across math, reading, and writing scores simultaneously. Each point represents a student, helping us observe overall trends and identify strong or weak areas. The plot provides a clear, multi-dimensional view of academic balance. It is a valuable tool for analyzing patterns in student achievement.

Histogram:



The distribution of students' math scores, grouped into intervals (bins). It helps us identify how scores are spread — whether they are concentrated around the average or skewed towards high or low values. The plot reveals overall performance trends in math, making it easier to detect patterns like peaks or gaps in scoring.