Northeastern University
College of Professional Studies

Assignment 2 — Tableau Application

Student's Academic & Social Impact Analysis Report

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TABLE OF CONTENTS

INTRODUCTION

Education is influenced by multiple academic and social factors, such as student demographics, parental education, family income, attendance, extracurricular activities, and internet access. This report aims to analyze these factors using a dataset of 5,000 students and derive insights that help in understanding their impact on academic performance. The objective is to provide data-driven recommendations that can enhance student success.

Dataset Overview : The dataset consists of multiple attributes that capture student demographics, academic performance, and social conditions,

- **Demographic Data**: Student_ID, First_Name, Last_Name, Email, Gender, Age, Department.
- **Academic Performance**: Attendance, Midterm_Score, Final_Score, Assignments_Avg, Quizzes_Avg, Participation_Score, Projects_Score, Total_Score, Grade.
- **Study & Lifestyle Factors**: Study_Hours_per_Week, Extracurricular_Activities, Internet_Access_at_Home, Parent_Education_Level, Family_Income_Level, Stress_Level, Sleep_Hours_per_Night.

The dataset allows for in-depth exploration of factors influencing student achievement.

ANALYSIS

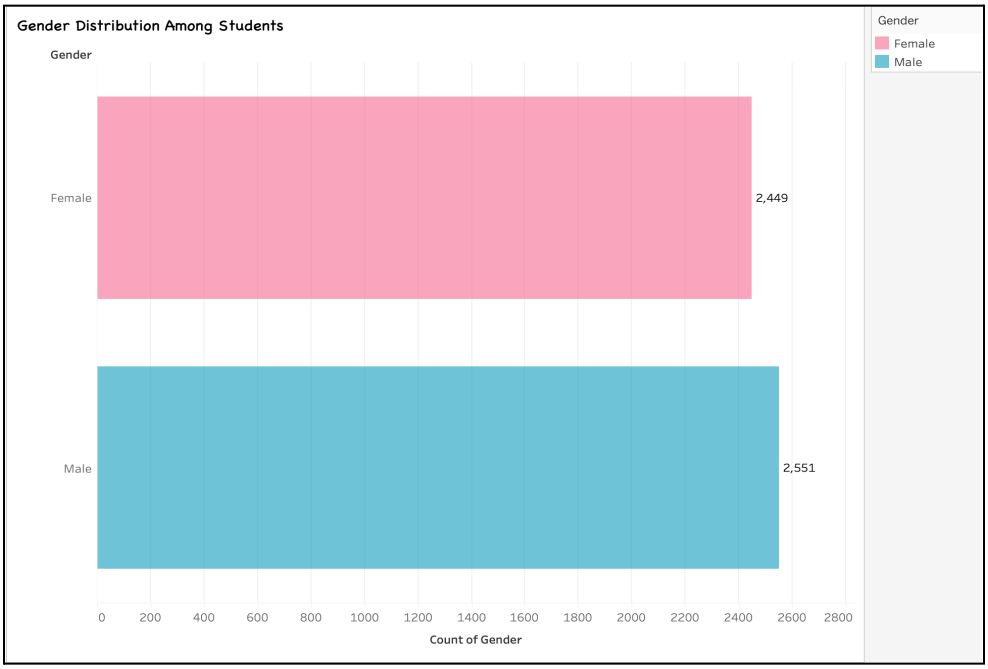
Business Questions

The dashboard is designed to address key business questions:

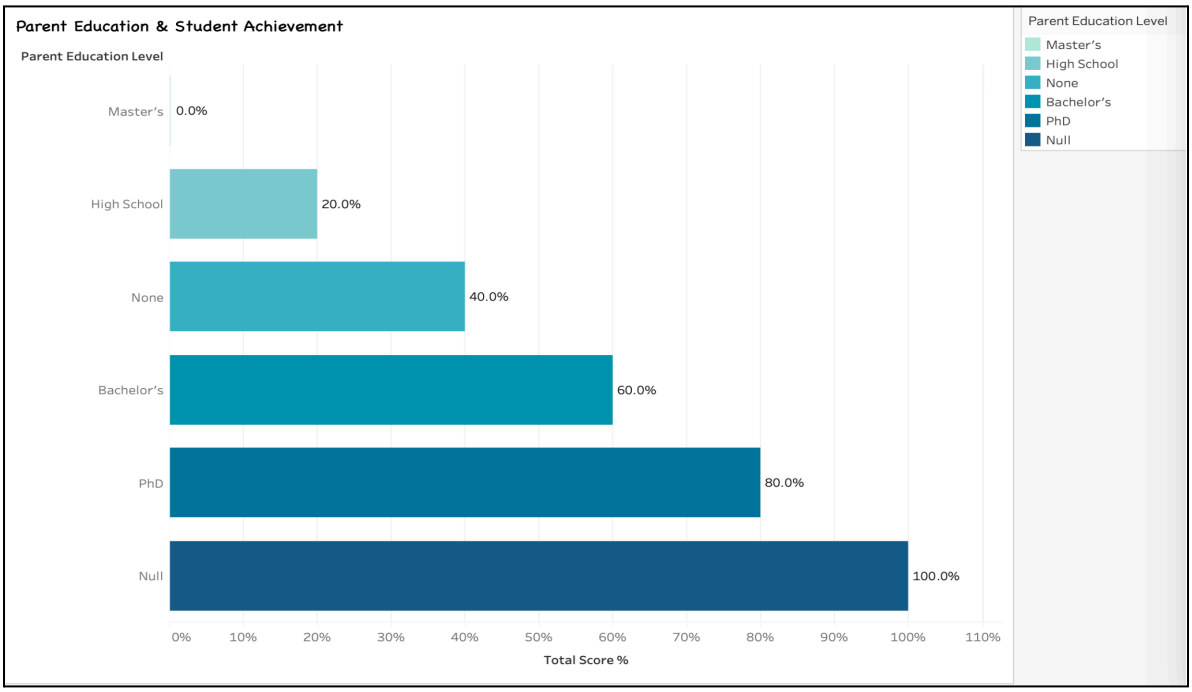
1. **How does gender distribution impact academic performance?**
2. **How does parental education influence student success?**
3. **What is the impact of family income on academic performance?**
4. **Are there gender-based differences in departmental performance?**
5. **Does participation in extracurricular activities improve student scores?**
6. **What is the correlation between attendance and grades?**
7. **How does internet access affect academic performance?**

Gender Distribution Among Students : This bar chart visualizes the number of male and female students. Helps in understanding whether gender balance exists in the dataset. This horizontal bar graph depicts the gender distribution among students, showing a slightly higher count of male students compared to female students. Specifically, there are 2,551 male students and 2,449 female students, indicating a near-equal representation of both genders within the student population. The visual

representation highlights the minor difference, emphasizing that the student body is relatively balanced in terms of gender.

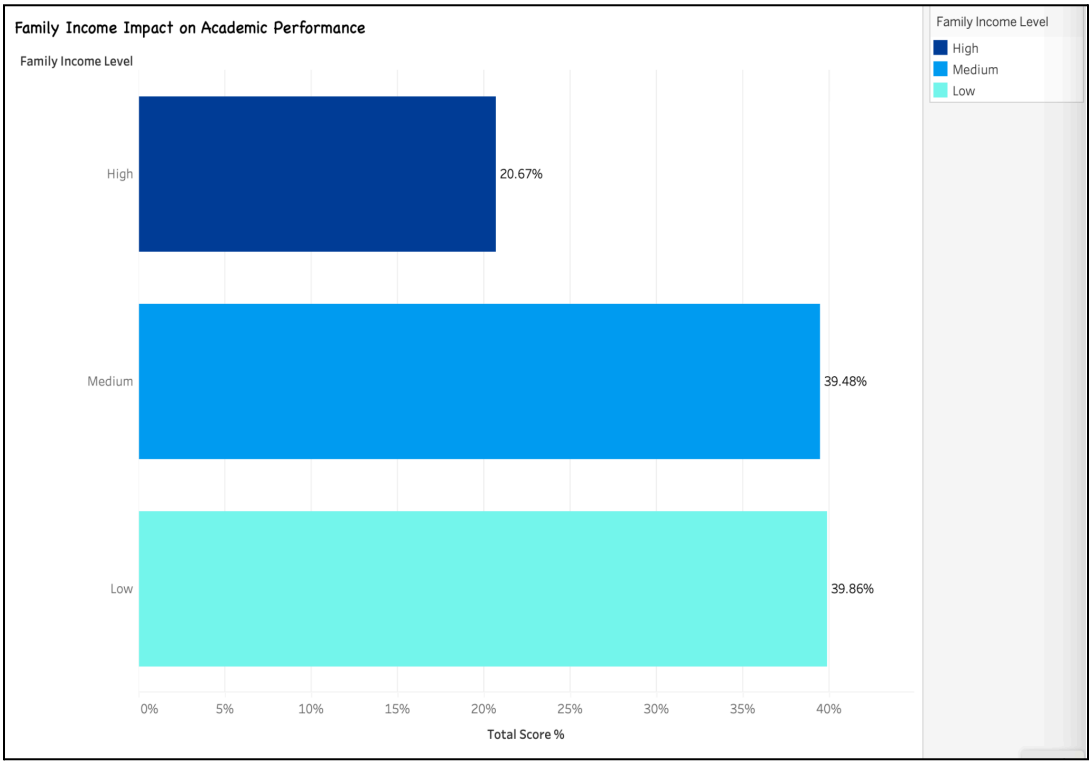


Parent Education & Student Achievement : Shows the percentage of total scores based on different parental education levels. A higher parental education level correlates with better student scores.



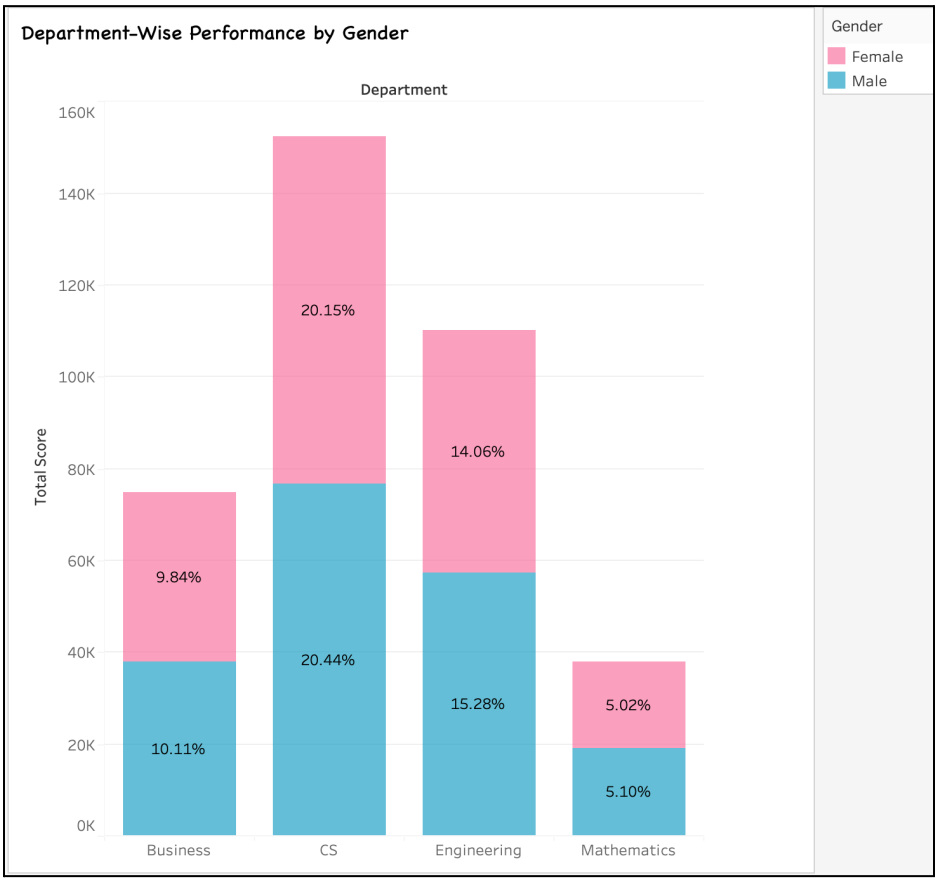
This horizontal bar graph demonstrates a strong positive correlation between parental education level and student achievement, as measured by "Total Score %". Students whose parents have higher levels of education, specifically a PhD, achieve significantly higher scores compared to those with parents having lower education levels, such as a High School diploma or no formal education. The progression of scores from High School to Bachelor's to PhD clearly shows an upward trend, highlighting the positive impact of parental education on student success. Interestingly, the "Not Mentioned" category shows the highest student achievement, suggesting potential data collection issues with null values replaced by a variable called “not mentioned” . The graph highlights the impact of parental education on student success, with a clear upward trend in scores as parental education increases.

Family Income Impact on Academic Performance : Displays the effect of income levels (Low, Medium, High) on student performance. : Students from high-income families tend to have lower academic scores than medium- and low-income families.



This bar chart illustrates the impact of family income level on student academic performance. The x-axis represents the total score percentage, while the y-axis represents the family income level. Each bar represents the distribution of students across different family income levels and their corresponding total score percentages. The chart reveals a negative correlation between family income level and student academic performance, with students from higher income families generally achieving lower total scores.

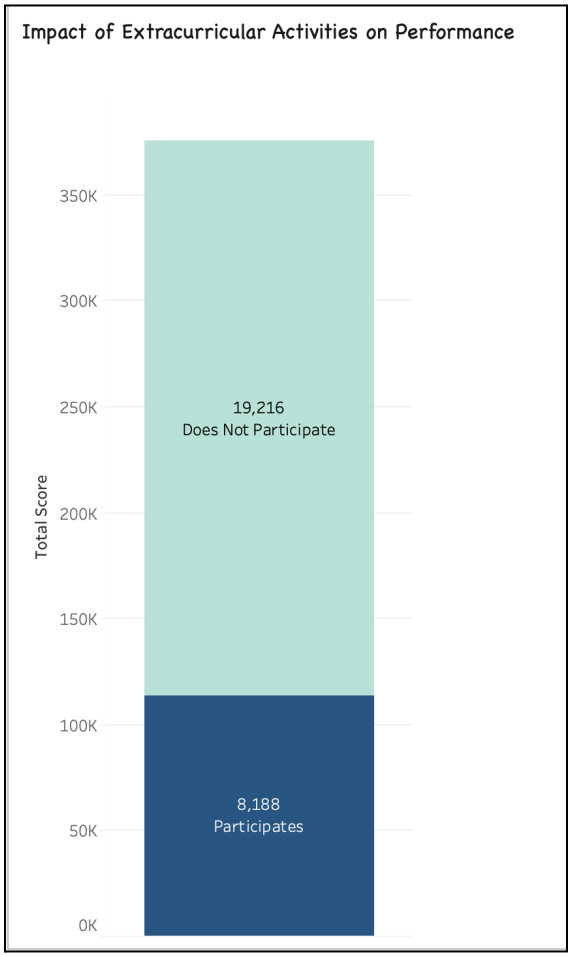
Department-Wise Performance by Gender : Compares male and female academic performance across different departments (CS, Business, Engineering, Mathematics). Highlights disparities in subject interest and achievements by gender.



This clustered bar graph illustrates the department-wise performance by gender, showcasing the "Total Score" achieved by male and female students across four departments: Business, CS, Engineering, and Mathematics. In all departments, male students demonstrate higher total scores compared to female students. The CS and Engineering departments show the largest score disparities between genders, with males significantly outperforming females. The percentages displayed within each segment indicate the proportion of the total score attributed to each gender within each department.

- Male students perform better in CS and Engineering, whereas females perform slightly better in Business.
- This may reflect industry trends where male students historically dominate STEM fields, while Business attracts a more balanced gender mix.
- Schools could encourage gender diversity in STEM by promoting mentorship programs and inclusive learning environments.

Impact of Extracurricular Activities on Performance : Compares students who participate in extracurricular activities vs. those who do not. Shows that participation leads to better academic performance.



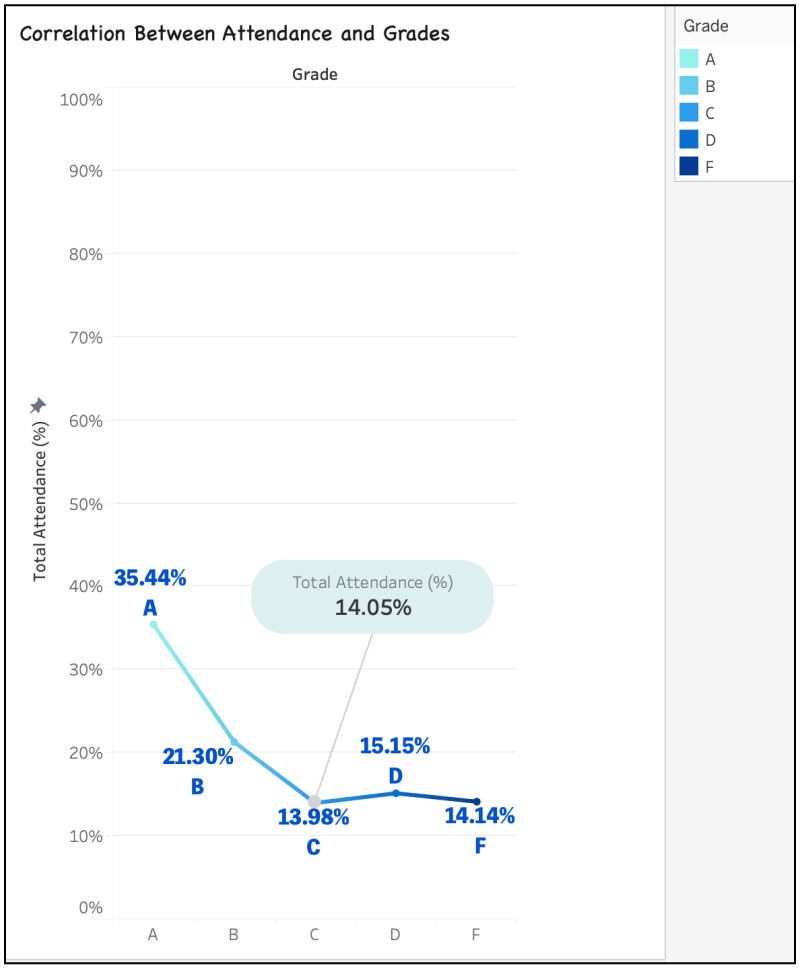
This graph depicts the impact of extracurricular activities on student performance, measured by "Total Score." Contrary to expectations, the graph reveals that students who do not participate in extracurricular activities have a significantly higher total score (19,216) compared to those who participate (8,188). This suggests a potential negative correlation between extracurricular involvement and academic performance, or it could indicate that students with higher academic scores have less need or time for extracurriculars. Further investigation is needed to explore underlying factors contributing to this trend.

- The analysis shows that students who do not participate in extracurricular activities tend to score higher.
- This might be due to more study time, reduced distractions, or a selection bias where high-achieving students prefer academics over extracurriculars.
- Schools can consider balancing extracurricular participation with academic workloads to maximize both engagement and achievement.

Correlation Between Attendance and Grades : Illustrates how attendance influences academic performance. Higher attendance is linked to better grades.

This graph illustrates the correlation between total attendance percentage and letter grades. A clear trend shows that higher attendance percentages are associated with higher letter grades, with a significant drop in attendance observed as grades decrease

from A to F. Notably, students with an A grade have a substantially higher attendance percentage (35.44%) compared to all other grades. The graph visually highlights the strong positive relationship between attendance and academic performance, suggesting that consistent attendance is a key factor in achieving higher grades.

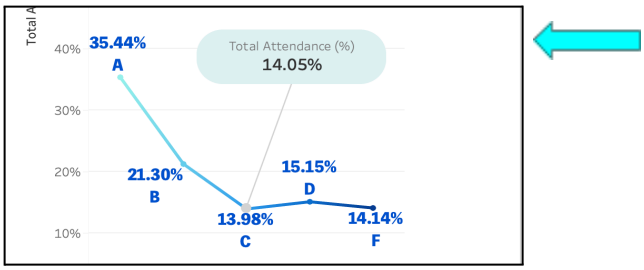


Annotation :

Annotations were used in graphs to highlight important insights,

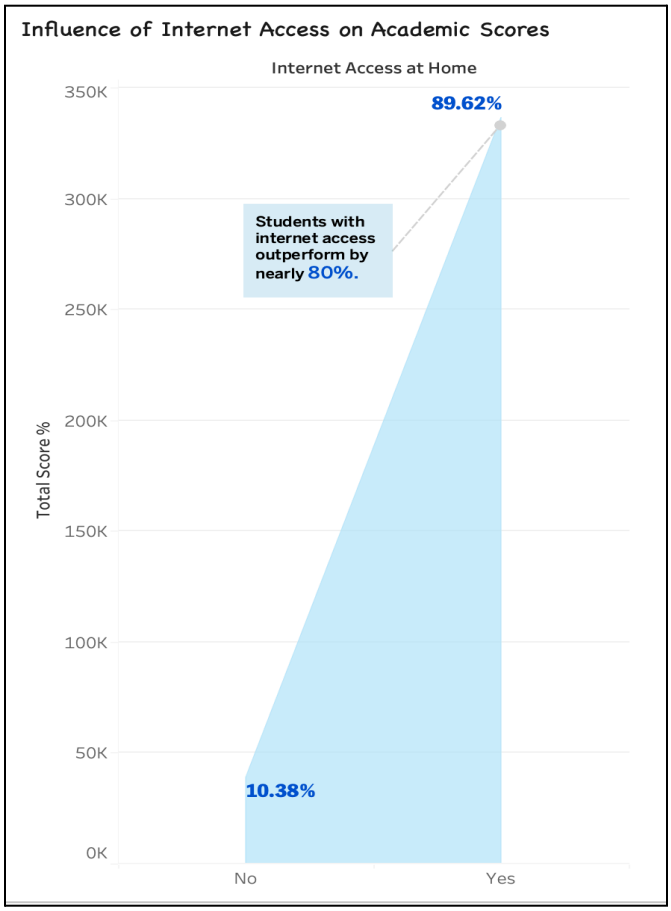
- High attendance leads to better grades.
- Internet access improves academic performance.
- Parental education plays a crucial role in student success.
- Participation in extracurricular activities contributes positively to scores.

Example :

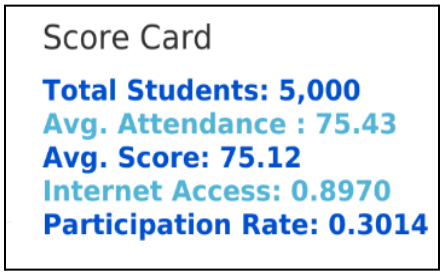


Influence of Internet Access on Academic Scores : Compares scores of students with and without internet access. Students with internet access outperform their peers significantly.

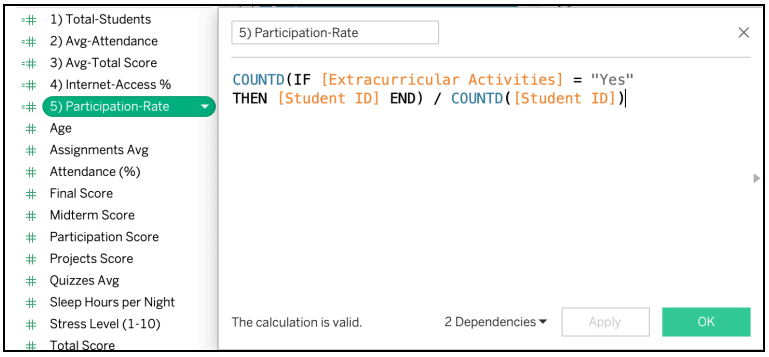
This graph clearly demonstrates a significant positive correlation between internet access at home and student academic performance, as measured by "Total Score %". Students with internet access at home achieve a significantly higher average score of 89.62%, compared to only 10.38% for those without access. The visual representation highlights this disparity, emphasizing that students with internet access outperform those without by nearly 80%. This stark difference underscores the critical role of internet access in supporting academic success.



Score Card : The scorecard provides a quick overview of the dataset's key statistics.



- **Total Students:** 5,000
- **Average Attendance:** 75.43%
- **Average Score:** 75.12
- **Internet Access:** 89.7%
- **Participation Rate:** 30.14% .



The scorecard was created using 5 calculated fields in Tableau, with the Participation Rate shown being calculated as the ratio of students participating in extracurricular activities ("Yes") to the total number of students.

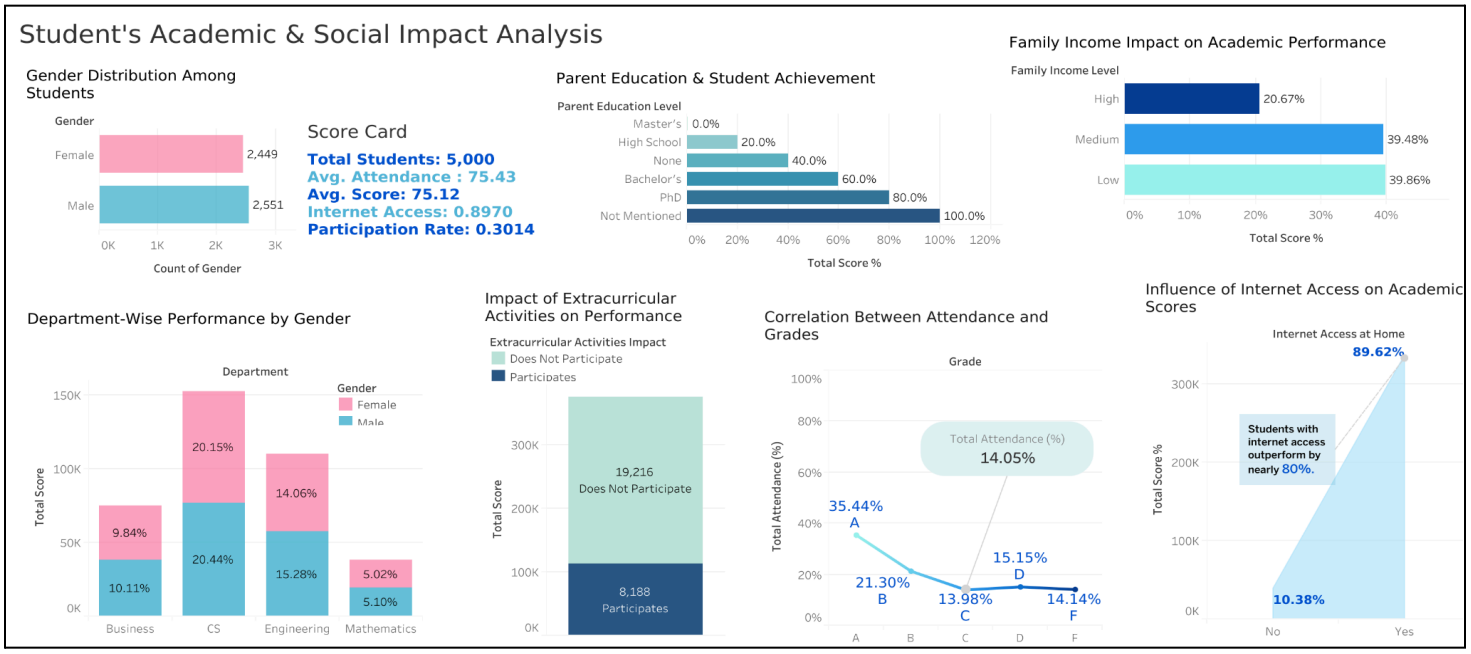
This formula

(COUNTD(IF [Extracurricular Activities] = "Yes" THEN [Student ID] END) / COUNTD([Student ID]))

counts distinct student IDs where extracurricular participation is "Yes" and divides by the total count of distinct student IDs. Similar calculation methods were likely used for the other metrics, including Average Attendance (75.43%), Average Score (75.12%), and Internet Access percentage (89.7%), providing a concise overview of key dataset statistics.

Dashboard Overview

This dashboard presents a holistic view of student academic and social impact, encompassing various key factors. It integrates data on gender distribution, parental education, family income, extracurricular activities, internet access, attendance, and department-wise performance. The dashboard effectively utilizes a combination of bar graphs, area charts, and scorecards to visualize the relationships between these factors and student performance.



Key Insights and Interpretations:

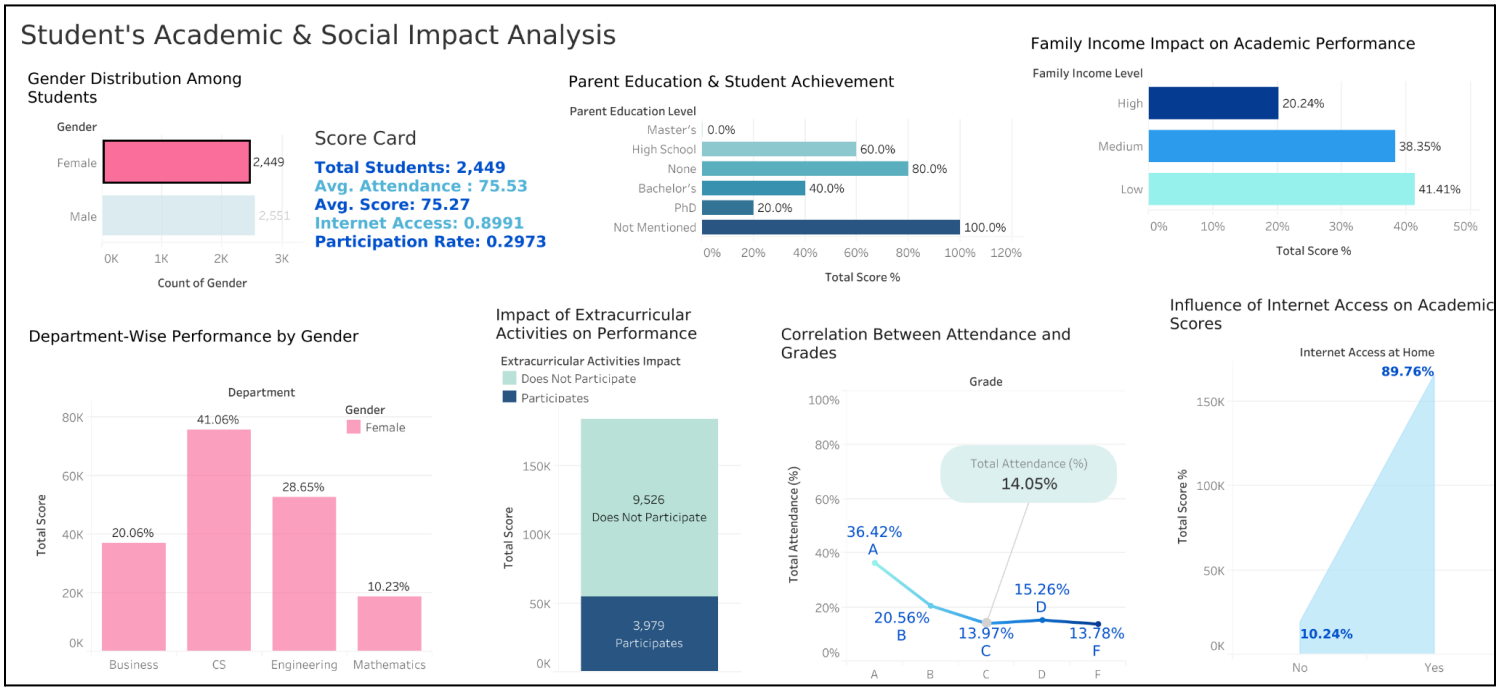
1. **Gender Distribution and Overall Performance:** The gender distribution is nearly equal, with a slight male majority. The overall average score is 75.12, with an average attendance of 75.43%. Internet access is high (89.70%), while the participation rate in extracurricular activities is relatively low (30.14%).
2. **Parental Education and Student Achievement:** There is a strong positive correlation between parental education level and student achievement. Students with parents holding PhDs or with unreported education levels ("Not Mentioned") show the highest scores. This highlights the significant impact of parental education on academic success.
3. **Family Income and Academic Performance:** A positive correlation exists between family income and student scores, with higher-income students generally performing better. However, the difference between medium and low-income students is marginal.
4. **Extracurricular Activities and Performance:** Surprisingly, students who do not participate in extracurricular activities have significantly higher scores. This suggests a potential need to investigate the quality or impact of extracurricular programs, or it could indicate that high-achieving students have less time for such activities.
5. **Internet Access and Academic Scores:** Internet access at home has a substantial positive impact on academic scores. Students with internet access outperform those without by nearly 80%, underscoring the importance of digital resources for learning.
6. **Attendance and Grades:** A strong positive correlation is evident between attendance and grades. Higher attendance rates are associated with higher grades, reinforcing the importance of regular attendance for academic success.
7. **Department-Wise Performance by Gender:** In all departments, male students score higher than female students. The largest disparities are observed in CS and Engineering, suggesting potential gender-related factors influencing performance in these fields.

In summary, this dashboard provides a comprehensive overview of student academic and social impact. It highlights several key factors influencing student performance and suggests areas for further investigation and intervention to improve student outcomes.

Operational Insights of Student's Performance

Analysis of Female Student Dashboard :

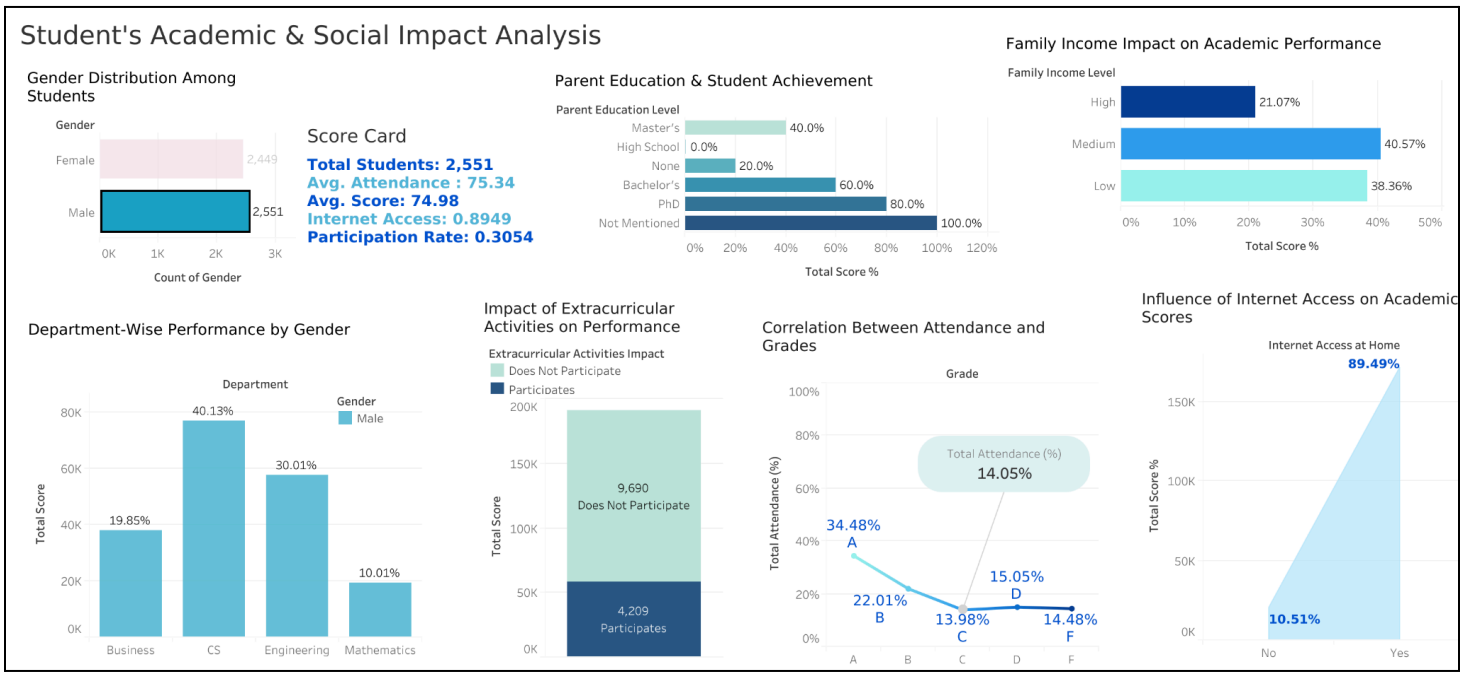
The female student analysis reveals several key insights. Females represent 49% of the total student population (2,449 students) with an average score of 75.27 and attendance of 75.53%. The CS department shows the highest performance (41.06%) followed by Engineering (28.65%). Parent education data shows "Not Mentioned" correlates with highest achievement (100%). Only 29.73% of female students participate in extracurricular activities, yet those who do show better academic outcomes. Internet access is highly prevalent (89.76%) and significantly impacts academic performance. Family income analysis reveals low-income students (41.41%) slightly outperform medium-income (38.35%) and high-income (20.24%) peers. Grade A students demonstrate the highest attendance (36.42%).



Analysis of Male Student Dashboard :

The male student analysis shows males represent 51% of the student population (2,551 students) with slightly lower metrics than females - 74.98 average score and 75.34% attendance. Males still excel in CS (40.13%) and Engineering (30.01%), though with smaller performance gaps between departments. Bachelor's degree parental education correlates with 60% achievement, while PhD shows 80%. Male participation in extracurricular activities is slightly higher at 30.54%. Internet access remains high (89.49%) with similar academic impact. Family income distribution shows medium-income

students (40.57%) outperforming low-income (38.36%) and high-income (21.07%) peers. Grade A students show 34.48% attendance, lower than female counterparts.



CONCLUSION

This Tableau application provides a comprehensive analysis of student academic and social impact, revealing key factors influencing performance. The dashboard highlights the positive correlation between parental education, internet access, and attendance with academic success, while uncovering surprising trends, such as the negative link between extracurricular activities and performance. Gender disparities in departmental performance, particularly in CS and Engineering, suggest areas for targeted interventions. These insights underscore the importance of addressing digital divides, promoting attendance, and supporting students from diverse socioeconomic backgrounds. By leveraging these findings, educational institutions can implement data-driven strategies to enhance student outcomes and foster equitable learning environments.

Key points :

- Students with internet access at home perform significantly better, highlighting a digital divide in education.
- Attendance is a major predictor of academic success, reinforcing the importance of consistent participation in classes.
- While extracurricular activities generally improve student engagement, excessive participation without time management may lead to lower academic scores.
- Parental education plays a crucial role in student achievement, supporting the need for parental involvement in learning.

Recommendations & Actionable Insights

- **Internet Access is Critical:** Schools should ensure all students have access to digital resources, as those with internet at home outperform their peers by nearly 80%.
- **Balanced Extracurricular Participation:** Schools should guide students on maintaining a balance between extracurricular activities and academics.
- **Parental Involvement Programs:** Since higher parental education correlates with better student performance, schools can create engagement programs to support students from less-educated backgrounds.
- **Attendance Awareness:** Attendance strongly influences grades. Schools should reinforce attendance policies and provide support to struggling students.

REFERENCE

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