Power BI Assignment 3

Buisness Intelligence 2025

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About the Dataset

This dataset contains detailed information about 2,392 high school students, including demographics, study habits, parental involvement, extracurricular activities, and academic success. The dataset features both GPA and categorical grade labels, allowing for in-depth analysis of student achievement across multiple dimensions.

Problem Statement

The **goal** of this project is to **analyze student-level educational data** to uncover patterns in academic performance by examining the influence of demographic factors, study habits, and extracurricular engagement.
Using interactive dashboards and visual analytics, the aim is to identify trends that may impact GPA, attendance, and grades, and to provide a comprehensive view of each student's profile to support data-driven decision-making in academic support and resource allocation.

Cleaning the Data

Assessing Data Quality

The first step was a quick audit for missing values. Running `df.isnull().sum()` confirmed there were no gaps, so we could proceed confidently without crafting imputation strategies. Catching nulls early is a cornerstone of good practice; had any appeared, we would need to decide between dropping incomplete records or filling them based on context.

Verifying Column Types

Inspecting `df.dtypes` revealed the nature of each field (integers for test scores, floats for GPAs, and objects for potential categorical labels). Proper typing ensures that mathematical operations, visualizations, and groupings behave as intended. For instance, treating the gender flag as numeric could mislead a plot, so confirming types guides future transformations.

Profiling the Data Distribution

Calling `df.describe(include='all')` sketched the landscape: mean GPAs hovered around 3.0 with a tight spread, test scores clustered between 60 and 100, and categorical columns showed clear class counts. This step surfaces skews, outliers, or unexpected categories—key hints for whether to normalize, cap extreme values, or revisit data collection.

Creating Intuitive Grade Categories

Raw GPAs, while precise, can be abstract for many audiences. The notebook maps numeric GPAs into letter grades (A–F), transforming a continuous scale into familiar milestones. This translation isn't purely cosmetic: it enables straightforward comparisons across demographic segments and aligns reporting with common academic conventions.

Enhancing Demographic Readability

Binary and multi-code fields—like gender, race, music participation, and volunteering—were remapped from numeric flags to descriptive labels (e.g., 0→Male, 1→Female). This humanizes the tables and charts, sparing readers from guessing what a '1' means. Clear labels also reduce errors when slicing data for subgroup analyses.

Structure of the Power BI Report

The Power BI report is divided into four main pages:

1. **Demographics Page**
   This page shows general information about all students, such as gender, age, ethnicity, and enrollment date. It helps understand the overall makeup of the student group.

2. **Study Habits Page**
   This section covers things like study time, parental education, tutoring, absences, and parental support. It helps identify how these factors affect student performance.

3. **Extracurricular Activities Page**
   This page focuses on students' activities outside of class—like sports, music, and volunteering. It also compares these activities with age and GPA to see if they have any impact on academic results.

4. **Student Performance Page (Drill-Through)**
   This page allows you to click on a student and see their complete profile. It shows details like GPA, grade, gender, ethnicity, and participation in extracurricular activities such as music, sports, and volunteering. It gives a full picture of each student.

Demographics Page

16.47
Average of Age

2392
Count of StudentID

2024
Year

ParentalSupport_C
☐ High
☐ Low
☐ Moderate
☐ None
☐ Very High

Gender_C
Female
Male

Tutoring_C
No
Yes

Extracurric... ⌄
No
Yes

Grade...
☐ A
☐ B
☐ C
☐ D
☐ F

Ethnicity_C
☐ African American
☐ Asian
☐ Caucasian
☐ Other

Count of StudentID by Ethnicity_C

Ethnicity_C ● Caucasian ● African Amer... ● Asian ● Other

9.28%
19.65%
20.61%
50.46%

Most students are Caucasian, making up over half the dataset.

Count of StudentID by GradeLabel and Ethnicity_C

Ethnicity_C ● African American ● Asian ● Caucasian ● Other

F D C B A

F is the most common grade across all ethnicities, with Caucasian students consistently being the majority.

Count of StudentID by Gender_C

Gender_C ● Female ● Male

48.91% 51.09%

Gender distribution is nearly equal, with a very slight female majority.

Count of ParentalEducation by ParentalEducation_C

100%

Some College   934
High School   728
Bachelors   367
None   243
Higher   120

12.8%

Most parents have some college education, with fewer at higher education levels.

Sum of Absences by Gender_C

20K
15K
10K
5K
0K
      Female   Male

Female students have more total absences than male students.

Average of Volunteering, Average of Extracurricular and Average of Tut...

● Average of Volunteering ● Average of Extracurricular ● Average of Tutoring

100%
50%
0%
   F   B   C   D   A

Students prefer ECAs over tutoring and volunteering, with volunteering being the least common.

Average of Absences by Quarter

14.7
14.6
14.5
14.4
14.3
   Qtr 1   Qtr 2   Qtr 3   Qtr 4

Absences increase at the start and end of the year, and decrease drastically mid-year.

On the demographics page, we presented a comprehensive overview of the student population using various visualizations such as bar charts, funnel charts, ribbon charts, and area charts. We analyzed the distribution of students by gender and ethnicity to understand population composition. Absence data was explored across gender and time to examine attendance patterns. We also included comparisons of participation in volunteering, extracurricular activities, and tutoring. Additionally, we studied the distribution of grades across different ethnic groups and the educational background of parents. These visual tools helped us represent demographic trends clearly and effectively.

Slicers

| ParentalSupport_C	Gender_C	Tutoring_C	Extracurric...	Gra...	Ethnicity_C
☐ High	Female	No	No	☐ A	☐ African American
☐ Low				☐ B	☐ Asian
☐ Moderate				☐ C	☐ Caucasian
☐ None	Male	Yes	Yes	☐ D	☐ Other
☐ Very High				☐ F	

We added slicers to this page to enhance user interactivity. These include demographic filters such as gender and ethnicity, and other factors like tutoring, parental support, grade level, and participation in extracurricular activities, allowing users to explore their impact on student performance and study habits.

Score Cards

Average Age	Total Students	Year
16.47 Average of Age	2392 Count of StudentID	2024 Year
The average age of students in this data is 16.47.	This data contains records of 2392 Students.	This is the data for the year 2024.

Students by Ethnicity

Ethnicity_C ● Caucasian ● African Amer... ● Asian ● Other

9.28%

19.65%

50.46%

20.61%
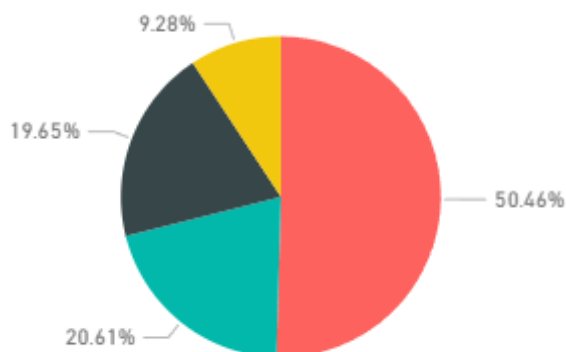
The ethnicity distribution reveals a predominantly Caucasian student population (50.46%), indicating that analyses may reflect trends most strongly from this group, with African American and Asian students forming notable minorities.

# Students by Gender

Gender_C ● Female ● Male

48.91%

51.09%

Gender distribution is nearly balanced, with females slightly outnumbering males (51.09% vs. 48.91%), suggesting an equitable gender representation in the dataset.

Sum of Absences by Gender

The bar graph shows that female students have significantly higher total absences compared to male students.

Volunteering vs ECA vs Tutoring
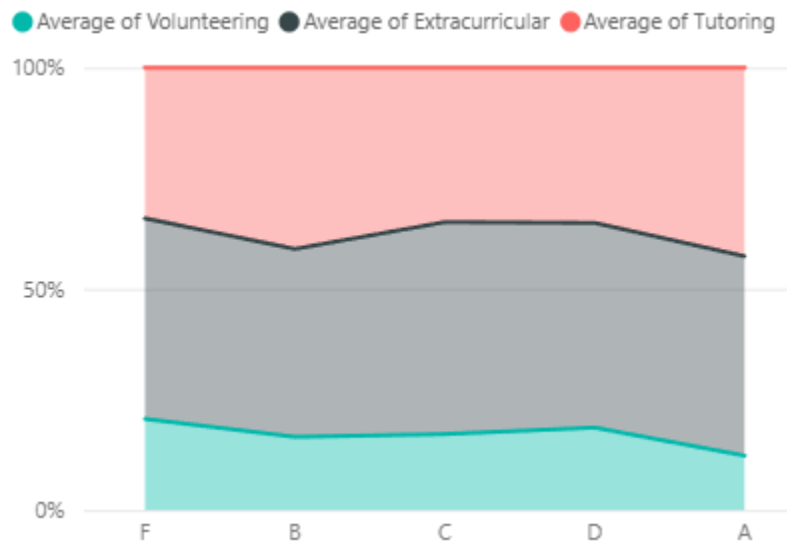
This stacked area chart displays the proportion of students involved in volunteering, extracurricular activities (ECAs), and tutoring. Volunteering has the lowest participation, with fewer than 20% of students involved. The highest number of students take part in ECAs, while a moderate portion attends tutoring. Students are more inclined to engage in ECAs than seek academic help or volunteer.
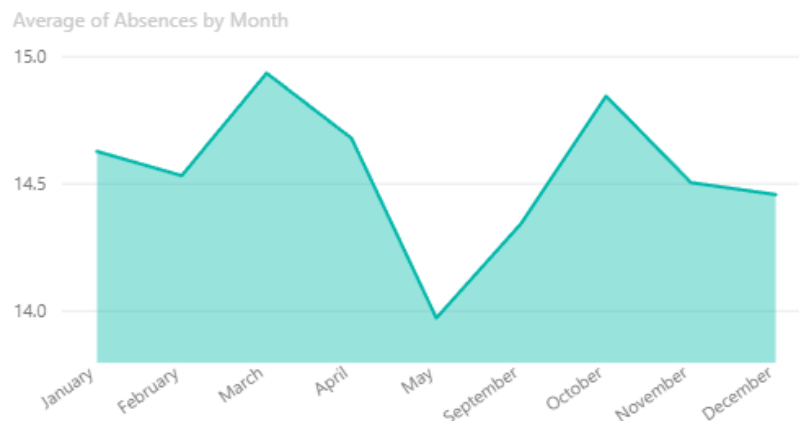
Average Absences over Time

By Quarter:
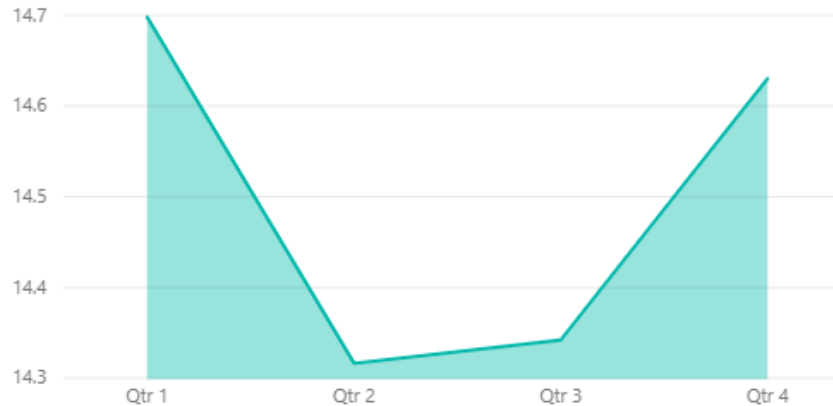
The line graph reveals a slight decline in absences from Q1 to Q4, indicating minor seasonal variations, but overall stability in attendance rates throughout the academic year.
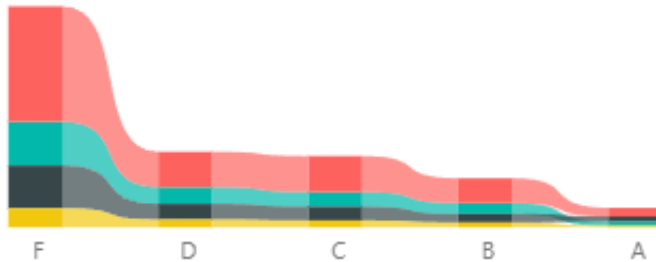
By Months:
(Drill Down)

Monthly trends highlight a dip in absences during April (lowest) and a spike in December (highest), possibly reflecting exam periods, holidays, or seasonal factors influencing student attendance.

Number of Students by Ethnicity and Grade

Ethnicity_C ● African American ● Asian ● Caucasian ● Other


This ribbon chart displays how students are distributed across grade labels within each ethnicity group. The majority of students received an F grade, and the number gradually declines as we move toward higher grades, with the fewest students achieving an A grade. The ethnic composition remains relatively consistent across all grades—Caucasian students consistently make up the largest proportion, while students from other ethnic backgrounds are the least represented.

Parents by their Education Level
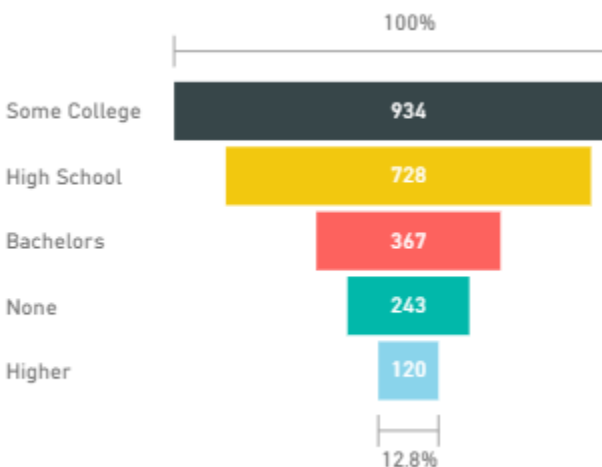
This funnel chart illustrates the number of parents at each education level. The highest count is for parents with some college education, and the number steadily decreases as the education level increases. Very few parents have no formal education. Higher parental education levels are less common, with most parents clustered around mid-level education.

Study Habits Page
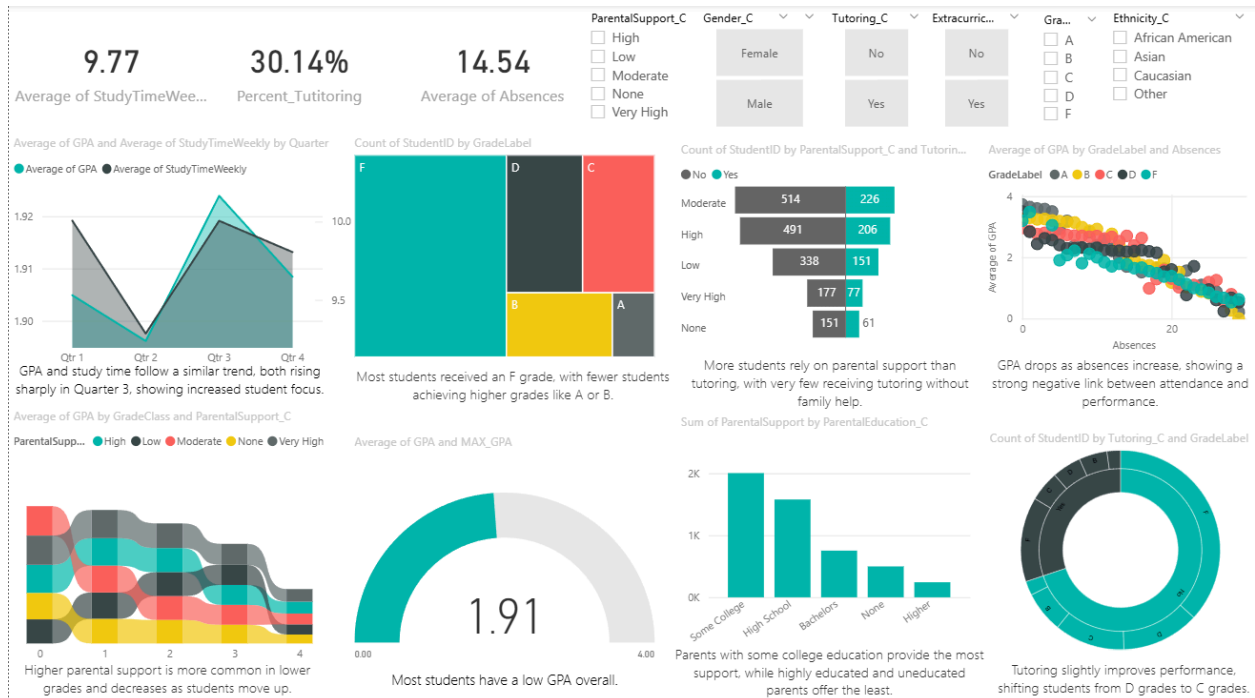
On the Study Habits page, we explored **various factors that influence students' academic performance**, such as study time, absences, tutoring, parental support, and parental education level. Using slicers and different types of visualizations like line charts, scatter plots, ribbon charts, bar graphs, tree maps, and tornado charts, we examined how these factors relate to student outcomes like GPA and grade distribution. The visuals help us compare trends over time, differences across student groups, and the overall patterns in support and study behavior. This page gives a clear picture of how academic effort and external support contribute to student performance.

Slicers

ParentalSupport_C	Gender_C ∨	Tutoring_C	Extracurric... ∨	Gra... ∨	Ethnicity_C ∨
☐ High				☐ A	☐ African American
☐ Low	Female	No	No	☐ B	☐ Asian
☐ Moderate				☐ C	☐ Caucasian
☐ None				☐ D	☐ Other
☐ Very High	Male	Yes	Yes	☐ F	

We added slicers to this page to enhance user interactivity. These include demographic filters such as gender and ethnicity, and other factors like tutoring, parental support, grade level, and participation in extracurricular activities, allowing users to explore their impact on student performance and study habits.

Score Cards

Average Study Time	Students taking Tutoring	Average Absences
9.77 Average of StudyTimeWee...	30.14% Percent_Tutitoring	14.54 Average of Absences
On average, students spend approximately 9 to 10 hours per week studying. This suggests a moderate effort from the students.	Around 30.14% of students use tutoring services and seek additional academic support, which suggests classes might not be enough for them.	Students have an average of 14 absences out of 30, missing 50% of their classes, which may negatively impact.

Average GPA

| Factors	Average GPA
The average GPA of **all students** is 1.91. **Insight:** Most students have a low GPA overall.	Average of GPA and MAX_GPA 1.91 0.00 4.00
Students who get **tutoring** and have **strong support from parents** have a higher GPA of 2.39. **Insight:** Extra help and parental support lead to better grades.	Average of GPA and MAX_GPA 2.39 0.00 4.00
Students with **no tutoring** and **no support from parents** have a lower GPA of around 1.49. **Insight**: Lack of help results in poor performance.	Average of GPA and MAX_GPA 1.49 0.00 4.00
Students who got an **A grade** have a high GPA of about 3.10. **Insight:** Top grades match with high GPA.	Average of GPA and MAX_GPA 3.10 0.00 4.00
Students with an **F grade** have a very low GPA, around 1.21. **Insight:** Failing students have the lowest GPA.	Average of GPA and MAX_GPA 1.21 0.00 4.00

GPA and Study time over time
By Quarter:
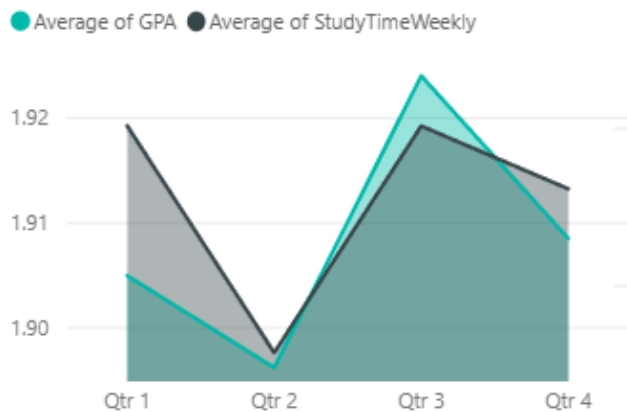
This line graph shows the trend of study time and GPA throughout the year 2024. Both follow a similar pattern, with a dip in Quarter 2 and a sharp rise in Quarter 3. This could suggest that students became more focused during Quarter 3.

At the beginning of the year, study time is high but GPA is low, which may indicate that students were putting in effort but not yet seeing results, possibly due to adjusting to new subjects or teaching styles. After that point, the two trends move more closely together.

By Months:
(Drill Down)
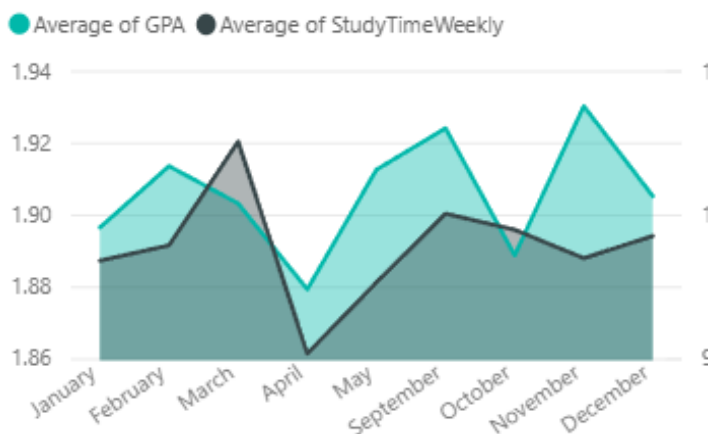
This monthly chart shows that study time and GPA mostly follow the same pattern, both reaching their lowest point in April. Study time peaks in March, but GPA does not. GPA rises again in September and December, even though study time stays low during those months.

Students by Grade Label

The tree map shows that most students got an 'F' grade, indicating a high failure rate. As we move up the grade scale from F to A, the number of students receiving each grade decreases. This suggests that academic performance is skewed toward lower grades, with very few students achieving top performance (A grade). It could be because of less study time, not enough help, or low interest in studies.

Number of Students by Parental Support & Tutoring
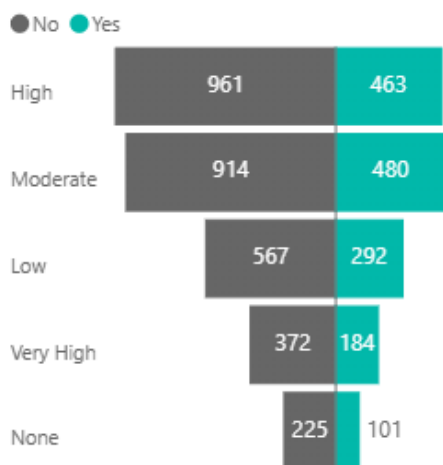
This tornado chart shows how many students get parental support and tutoring. The largest group of students gets high parental support but no tutoring. The second biggest group has moderate support and no tutoring. From the chart's shape, we can see that more students don't take tutoring compared to those who do. The smallest group includes students who have tutoring but no parental support. Most students rely more on parents than on extra academic help, and very few get tutoring without any family support.

## Average GPA by Absences
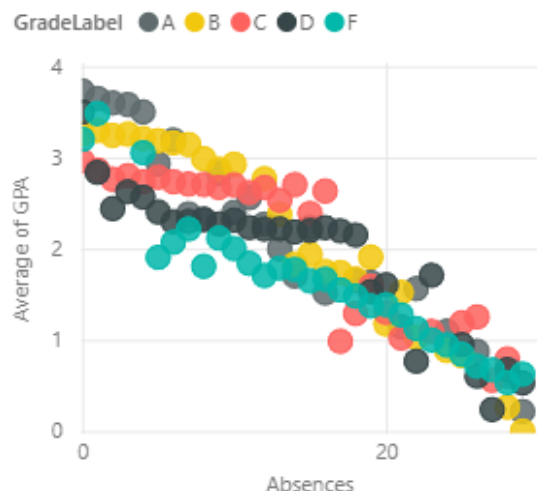
The scatter plot shows that when absences go up, the GPA goes down. This means there is a strong negative relationship between missing classes and student performance. Students who miss more school usually have a lower GPA.

Parental Support by Class
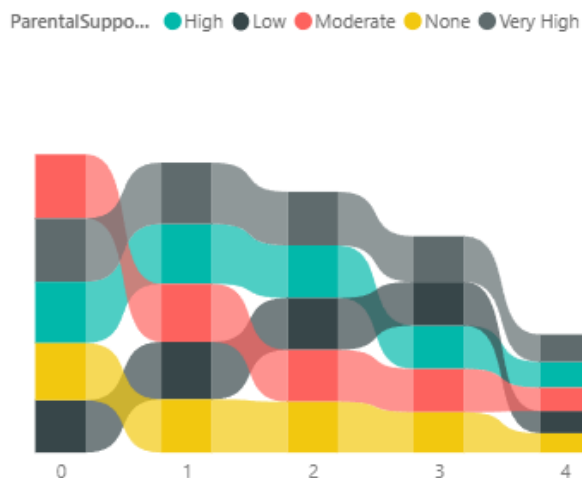
The ribbon chart visualizes the distribution of Parental Support across grade classes from 0 to 4.. At grade 0, a balanced mix of support levels is seen, with noticeable portions of High and Very High support. However, as students advance through grades, the proportion of High and Very High support declines, while Low and None levels gradually increase. Moderate support remains relatively stable across all grades. This trend suggests a decline in parental involvement as students progress.
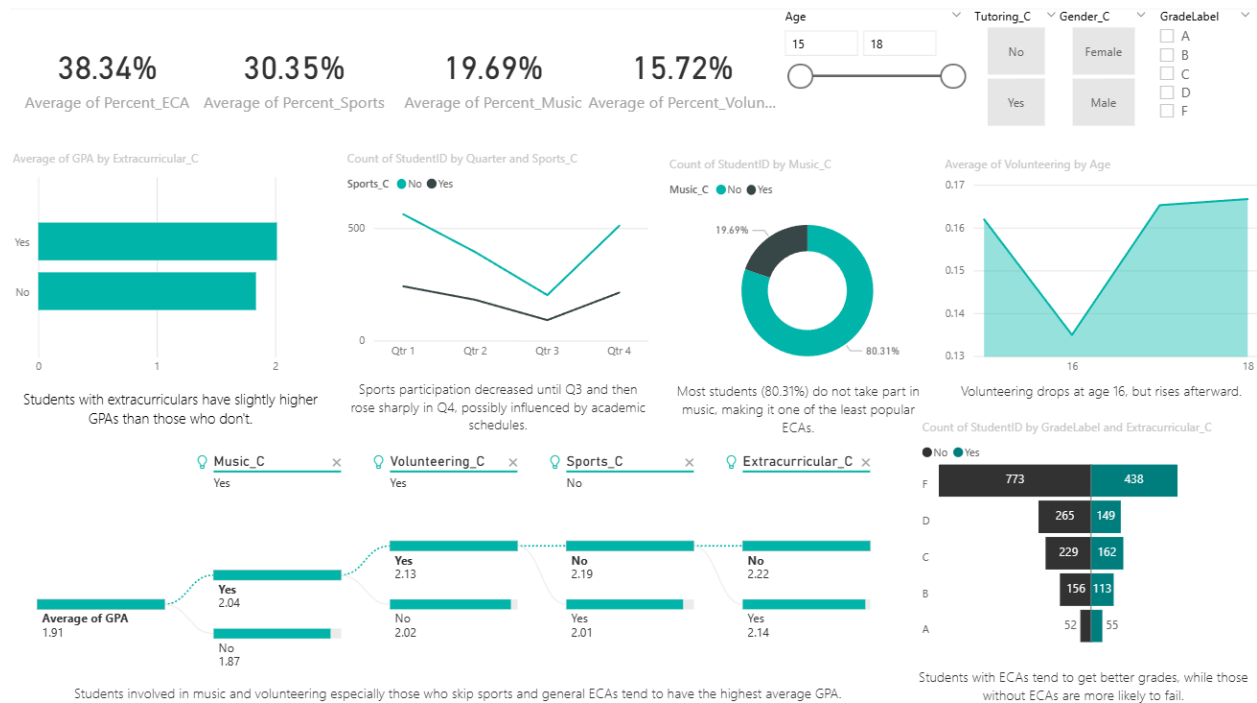
Parental Support by their level of education
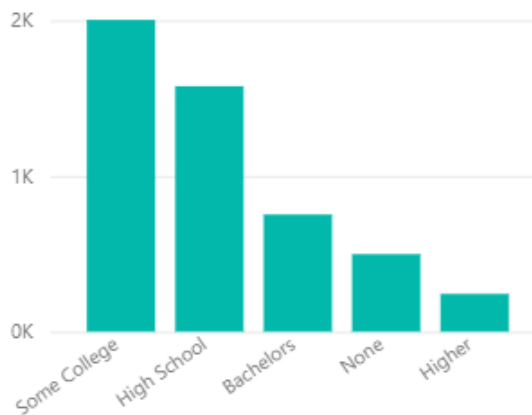
This bar chart shows how much parental support students get based on their parents' education level. Parents with some college education give the most support. As the education level increases, the support decreases. Interestingly, parents with the highest education provide the least support as they may be busy due to their career. Those with no education also give little support.

Number of Students by Tutoring and Grades

The sunburst chart shows that most students do not take tutoring. It also breaks down the grade distribution within each group. In both cases, F is the most common grade. However, there is a noticeable difference between the two groups, among students who do not take tutoring, the second most common grade is D, while for those who do take tutoring, it is C. This suggests that tutoring may help students improve slightly, shifting their performance from lower to better grade.

Extracurricular Activities Page

38.34%
Average of Percent_ECA

30.35%
Average of Percent_Sports

19.69%
Average of Percent_Music

15.72%
Average of Percent_Volun...

Age
15   18

Tutoring_C   Gender_C   GradeLabel
No   Female   ☐ A
                 ☐ B
                 ☐ C
Yes   Male   ☐ D
                 ☐ F

Average of GPA by Extracurricular_C
Students with extracurriculars have slightly higher GPAs than those who don't.

Count of StudentID by Quarter and Sports_C
Sports participation decreased until Q3 and then rose sharply in Q4, possibly influenced by academic schedules.

Count of StudentID by Music_C
Most students (80.31%) do not take part in music, making it one of the least popular ECAs.

Average of Volunteering by Age
Volunteering drops at age 16, but rises afterward.

Students involved in music and volunteering especially those who skip sports and general ECAs tend to have the highest average GPA.

Count of StudentID by GradeLabel and Extracurricular_C
Students with ECAs tend to get better grades, while those without ECAs are more likely to fail.

On the extracurricular activities page, we explored **student involvement in various non-academic areas** such as volunteering, sports, and music. Using a mix of visualizations like line charts, tornado charts, donut charts, and tree diagrams, we analyzed participation rates, age-wise trends, and the relationship between ECAs and academic performance. These visuals helped us understand how different combinations of extracurriculars may influence GPA and how participation patterns shift over time. This section gives a well-rounded overview of student engagement beyond academics.

Slicers

Age

| 15 | 18 |

Tutoring_C

No

Yes

Gender_C

Female

Male

GradeLabel

☐ A
☐ B
☐ C
☐ D
☐ F

The slicers on this page enhance user interactivity. These include demographic filters such as gender and age, and other factors like tutoring, and grade labels, allowing users to explore their impact on the extracurricular activities of the students.

Score Cards

Students with extracurriculars	Students who play Sports	Students with Music	Students who volunteer
38.34% Average of Percent_ECA	**30.35%** Average of Percent_Sports	**19.69%** Average of Percent_Music	**15.72%** Average of Percent_Volun...
38.24%, that is less than half the students are involved in extracurriculars.	30.35% of students play sports. Sports is the most common activity among students.	19.69% of students have music. Music participation is much lower than sports.	15.72% of students volunteer. Volunteering is the least popular activity among students.

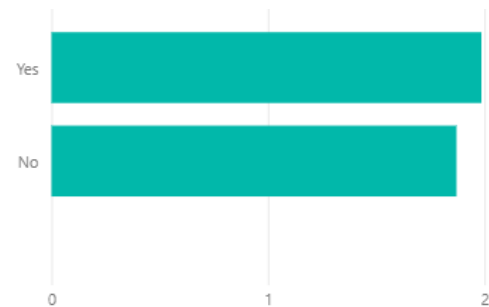# Average GPA with ECA hierarchy

With ExtraCurricular Activities:
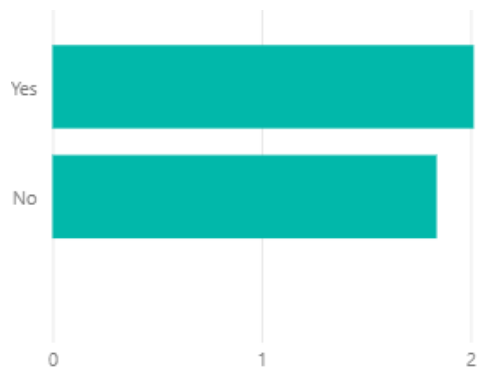
Students with extracurriculars have slightly higher GPAs than those who don't.
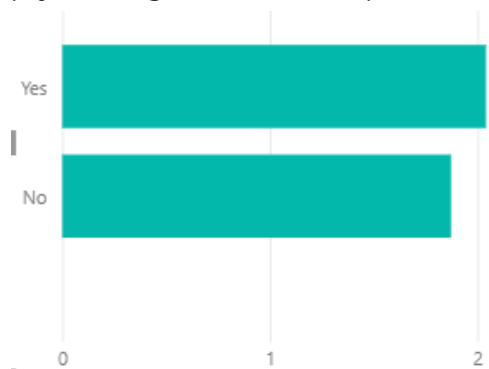
With Sports:
(By drilling down)

Similar to the ECAs, students who play sports also have slightly higher GPAs than those who don't.

With Music:
(By drilling down further)

Similar to others in the hierarchy, students participating in Music also have slightly higher GPAs than those who don't.

With Volunteering:
(By drilling down further)

No difference can be observed between the GPAs of the students who do and don't volunteer.

Age by Volunteering

In this line chart, we can see the effect of age on volunteering. At age 16, volunteering is at its lowest, possibly because students are focused on academics or exams during that year. After 16, involvement in volunteering increases and then remains steady, suggesting older students may have more time, maturity, or opportunities to engage in such activities.

Number of Students by Grade and ECAs
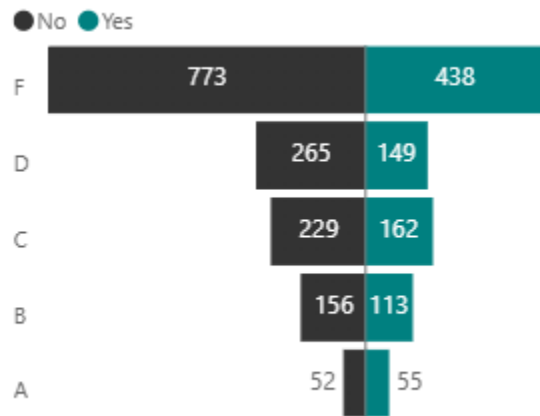
We can see from this tornado chart the effect of ECAs on Grades. Students without ECAs are much more likely to fail, while those who participate in ECAs show better performance overall. For top grades like A, more students are involved in ECAs, suggesting a positive link between extracurricular activities and academic success.

Number of Students With Music
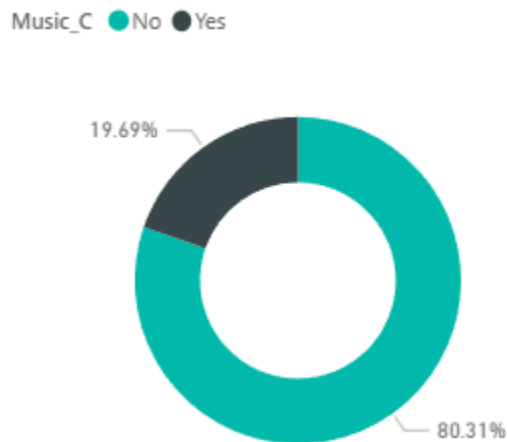
This donut chart shows that a large majority of students, around 80.31%, do not participate in music-related activities. This shows that music is not a common extracurricular choice among the students.

Maximizing Average GPA by ECA hierarchy
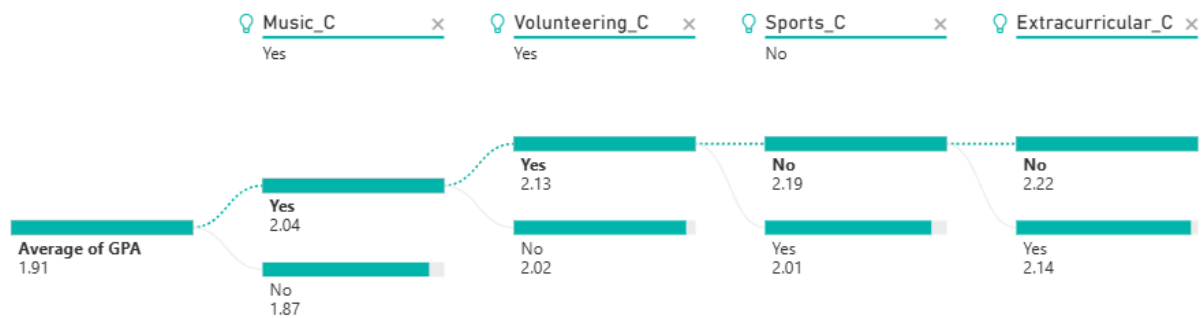
This tree diagram shows how different combinations of extracurricular activities (ECAs) relate to the average GPA of students, and it helps identify the paths that lead to higher academic performance. Starting from the overall average GPA of 1.91, the tree splits based on whether a student participates in Music. Students involved in music have a higher average GPA of 2.04, compared to 1.87 for those who are not. Among music participants, those who also volunteer have an even higher GPA (2.13), and if they do not play sports, their GPA rises to 2.19. Finally, within this group, students who do not participate in general extracurricular activities achieve the highest average GPA of 2.22.

Students playing or not playing sports over time

This line chart tracks how student participation in sports changed across the four quarters of 2024. Participation dropped steadily from Q1 to Q3, reaching its lowest point mid-year, then rebounded sharply in Q4. Non-participation followed a similar but less dramatic trend, suggesting seasonal or academic factors may have influenced engagement levels.

Student Performance Page

(Drill down Page)
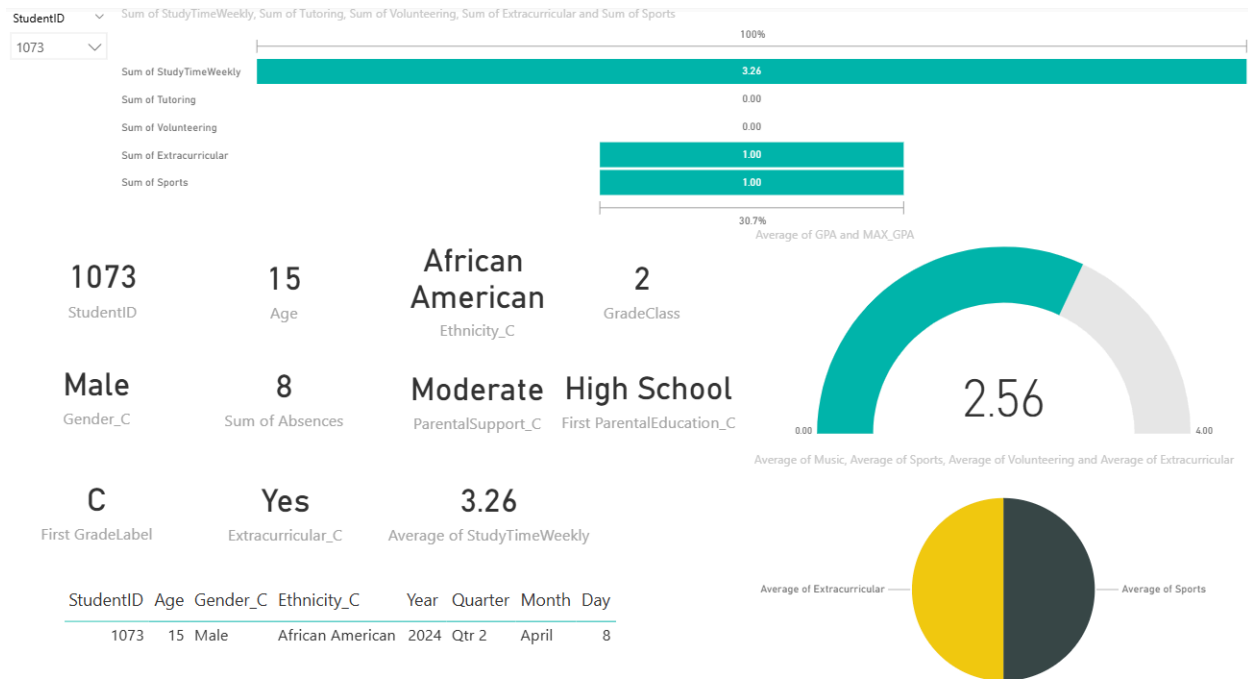
The Student Performance page is a **drill-down** interface designed to present comprehensive, student-specific insights. It includes an interactive drop-down slicer that allows users to select a student by their ID. Once selected, a set of scorecards displays detailed demographic and academic information for that student, such as gender, age, ethnicity, parental education, academic performance, absences, and participation in support programs. A KPI card highlights the student's GPA on a 4.00 scale. Visualizations such as pie charts and funnel charts are used to show the student's involvement in extracurricular activities and compare their study time with their ECA participation. This page offers a personalized and complete snapshot of each student's academic journey and background.
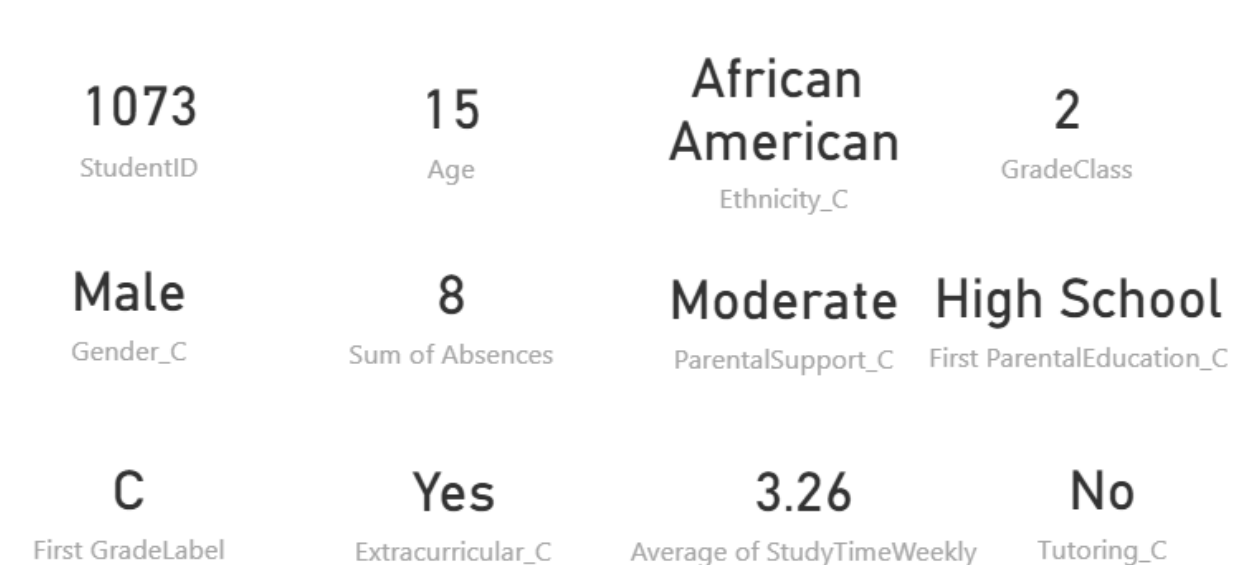
Slicer

StudentID

| 1073 | ∧ |

- ☐ 1001
- ☐ 1002
- ☐ 1003
- ☐ 1004
- ☐ 1005

This page contains a drop-down slicer, you can select a student by their student ID to see their information.

Score Cards

1073	**15**	**African American**	**2**
StudentID	Age	Ethnicity_C	GradeClass

Male	**8**	**Moderate**	**High School**
Gender_C	Sum of Absences	ParentalSupport_C	First ParentalEducation_C

| **C**	**Yes**	**3.26**	**No**
First GradeLabel	Extracurricular_C	Average of StudyTimeWeekly	Tutoring_C

These scorecards provide detailed individual-level information for each student, combining both demographic and academic data. The demographic section includes attributes such as gender, age, ethnicity, and the educational background of the parents. On the academic side, the scorecards display essential details like student ID, class level, grade label, and the number of absences. Additionally, they cover involvement in extracurricular activities (ECAs), participation in tutoring programs, and the presence or absence of parental support. Together, these elements offer a holistic view of each student's background and educational engagement.
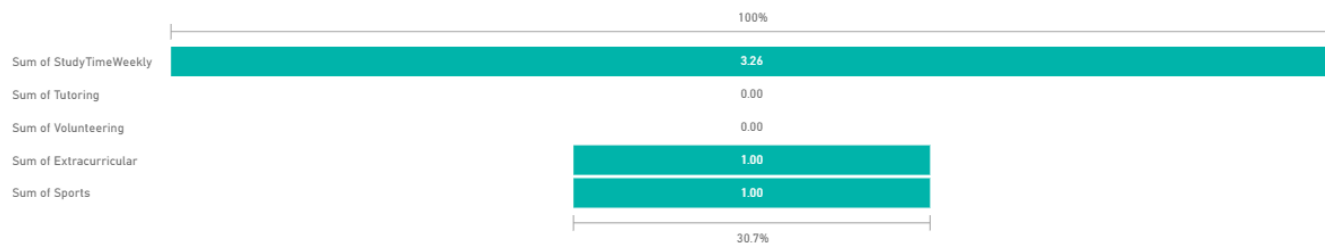
GPA of the student
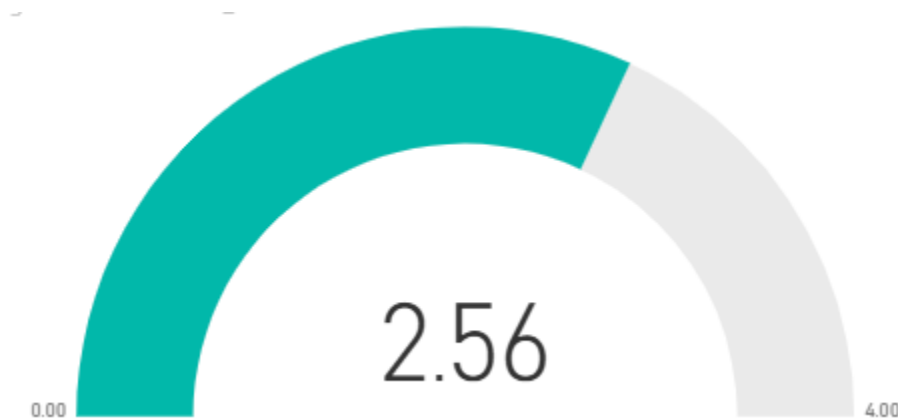
This shows the GPA of a student out of 4.00; for this case, the student has a GPA of 2.56.

Extracurricular Activities of the Student
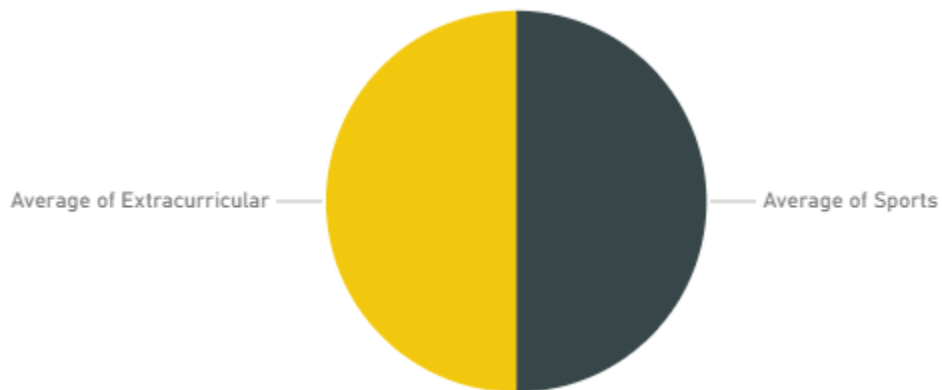
This pie chart shows the distribution of extracurricular activities of the student. In this case, the student participates in extracurricular activities and plays sports.

Study Vs ECAs

	100%
Sum of StudyTimeWeekly	3.26
Sum of Tutoring	0.00
Sum of Volunteering	0.00
Sum of Extracurricular	1.00
Sum of Sports	1.00
	30.7%

This funnel chart shows the students' study time and their engagement in extracurricular activities. This student studies for 3 hours a week and plates sport as well as engages in other extracurricular activities.