Proposal for Annual Student Performance

Contents

Introduction:

The dataset we chose to do our analysis on is a student performance dataset for Mathematics course. Here is a list of the attributes of this dataset with a short explanation:

Name of Attribute	Explanation
school	student's school (binary: 'GP' - Gabriel Pereira or 'MS' - Mousinho da Silveira)
sex	student's sex (binary: 'F' - female or 'M' - male)
age	student's age (numeric: from 15 to 22)
address	student's home address type (binary: 'U' - urban or 'R' - rural)
famsize	family size (binary: 'LE3' - less or equal to 3 or 'GT3' - greater than 3)
Pstatus	parent's cohabitation status (binary: 'T' - living together or 'A' - apart)
Medu	mother's education (numeric: 0 - none, 1 - primary education (4th grade), 2 - 5th to 9th grade, 3 - secondary education or 4 - higher education)
Fedu	father's education (numeric: 0 - none, 1 - primary education (4th grade), 2 - 5th to 9th grade, 3 - secondary education or 4 - higher education)
Mjob	mother's job (nominal: 'teacher', 'health' care related, civil 'services' (e.g. administrative or police), 'at_home' or 'other')
Fjob	father's job (nominal: 'teacher', 'health' care related, civil 'services' (e.g. administrative or police), 'at_home' or 'other')
reason	reason to choose this school (nominal: close to 'home', school 'reputation', 'course' preference or 'other')
guardian	student's guardian (nominal: 'mother', 'father' or 'other')
traveltime	home to school travel time (numeric: 1 - <15 min., 2 - 15 to 30 min., 3 - 30 min. to 1 hour, or 4 - >1 hour)
studytime	weekly study time (numeric: 1 - <2 hours, 2 - 2 to 5 hours, 3 - 5 to 10 hours, or 4 - >10 hours)
failures	number of past class failures (numeric: n if 1<=n<3, else 4)
schoolsup	extra educational support (binary: yes or no)
famsup	family educational support (binary: yes or no)
paid	extra paid classes within the course subject (Mathematics) (binary: yes or no)
activities	extra-curricular activities (binary: yes or no)
nursery	attended nursery school (binary: yes or no)
higher	wants to take higher education (binary: yes or no)
internet	Internet access at home (binary: yes or no)
romantic	with a romantic relationship (binary: yes or no)

famrel	quality of family relationships (numeric: from 1 - very bad to 5 - excellent)
freetime	free time after school (numeric: from 1 - very low to 5 - very high)
goout	going out with friends (numeric: from 1 - very low to 5 - very high)
Dalc	workday alcohol consumption (numeric: from 1 - very low to 5 - very high)
Walc	weekend alcohol consumption (numeric: from 1 - very low to 5 - very high)
health	current health status (numeric: from 1 - very bad to 5 - very good)
absences	number of school absences (numeric: from 0 to 93)
G1	first period grade (numeric: from 0 to 20)
G2	second period grade (numeric: from 0 to 20)
G3	final grade (numeric: from 0 to 20, output target)

Exploring the Data:

In this section we explore the data by plotting 12 different plots based on many factors, to find insights and or issues.

Plots:

Mother and Fathers Job Plot

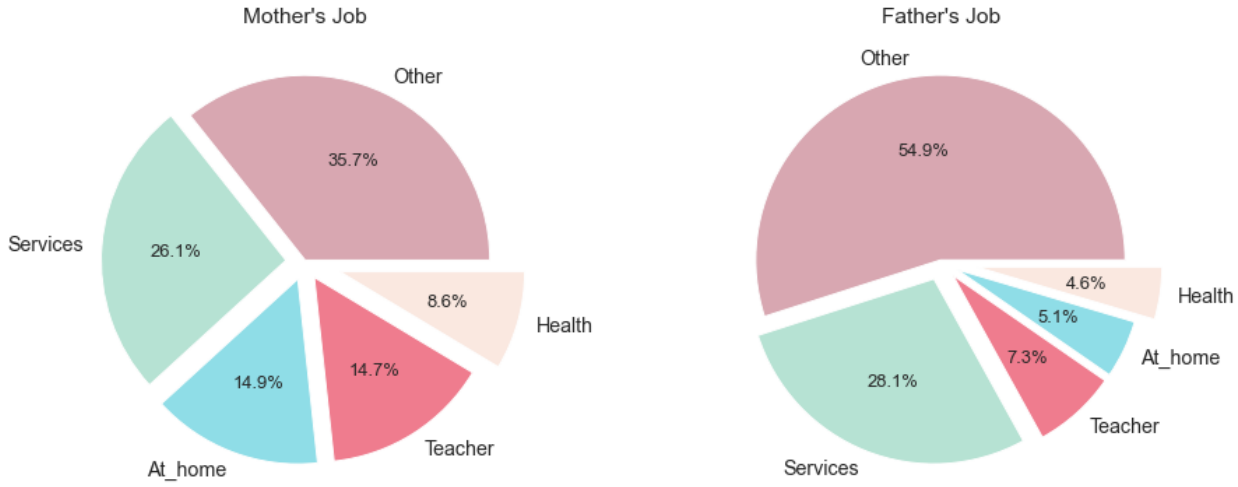

Figure 1: Mother and Father's Jobs.

Insights:

- Fathers are more likely to work in the "other" category.
- There's a higher percentage of stay at home moms than dads by 10%.
- Mothers are more likely to work in the Teaching and Health sectors compared to Fathers.

Students Alcohol Consumption:

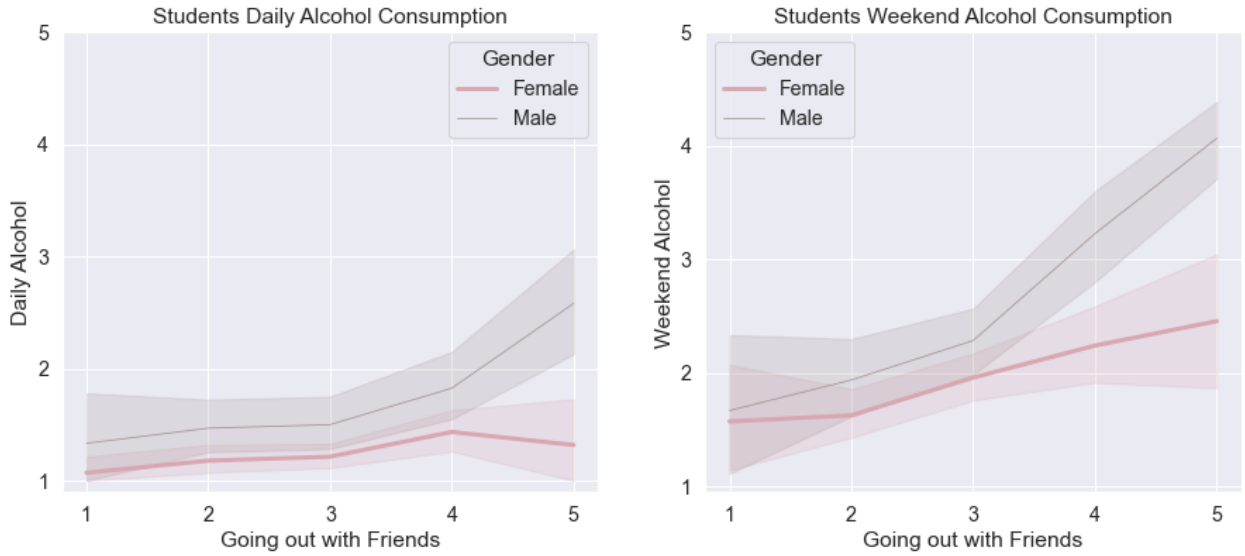

Figure 2: Students Alcohol Consumption (Daily and Weekly).

Insights:

- Students are more likely to consume more alcohol during the weekend.
- The number of females that drink is higher than males, but when the males drink, they drink more (quantity) than females.
- The more the students go out with friends the more likely they are to drink, we can see this as a positive linear progression in the second chart.

Family's Support and Student's Absence:

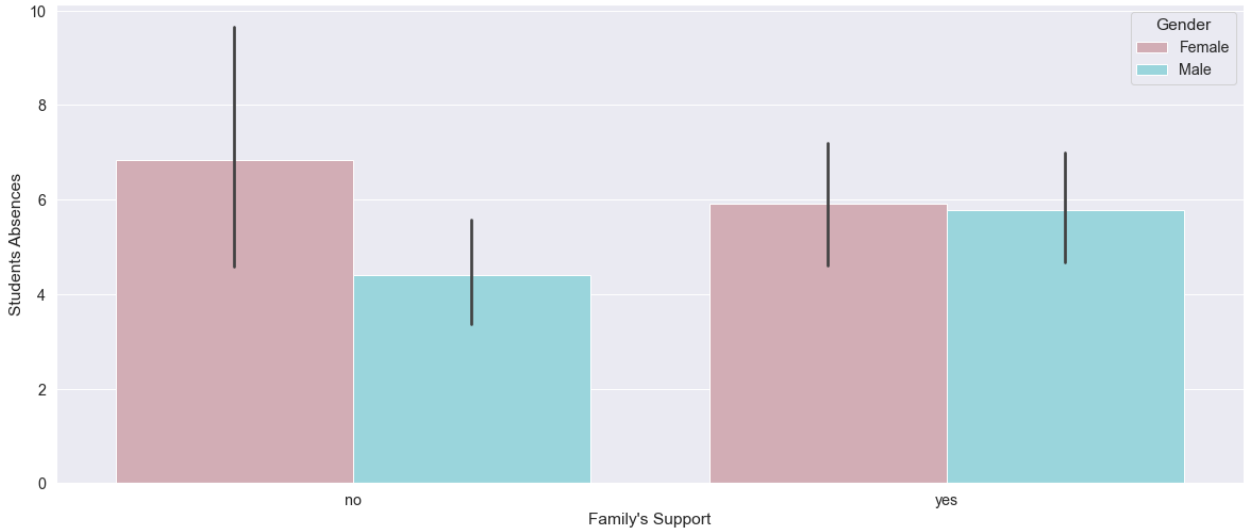

Figure 3: Family's Support effects on Student's Absence.

Insights:

- Females who lack their families support tend to be absent more.
- Males who lack family support tend to have better attendance than their peers who have family support.
- The attendance for students of both genders tend to be the same with the family's support.

Family's status and students' grades:

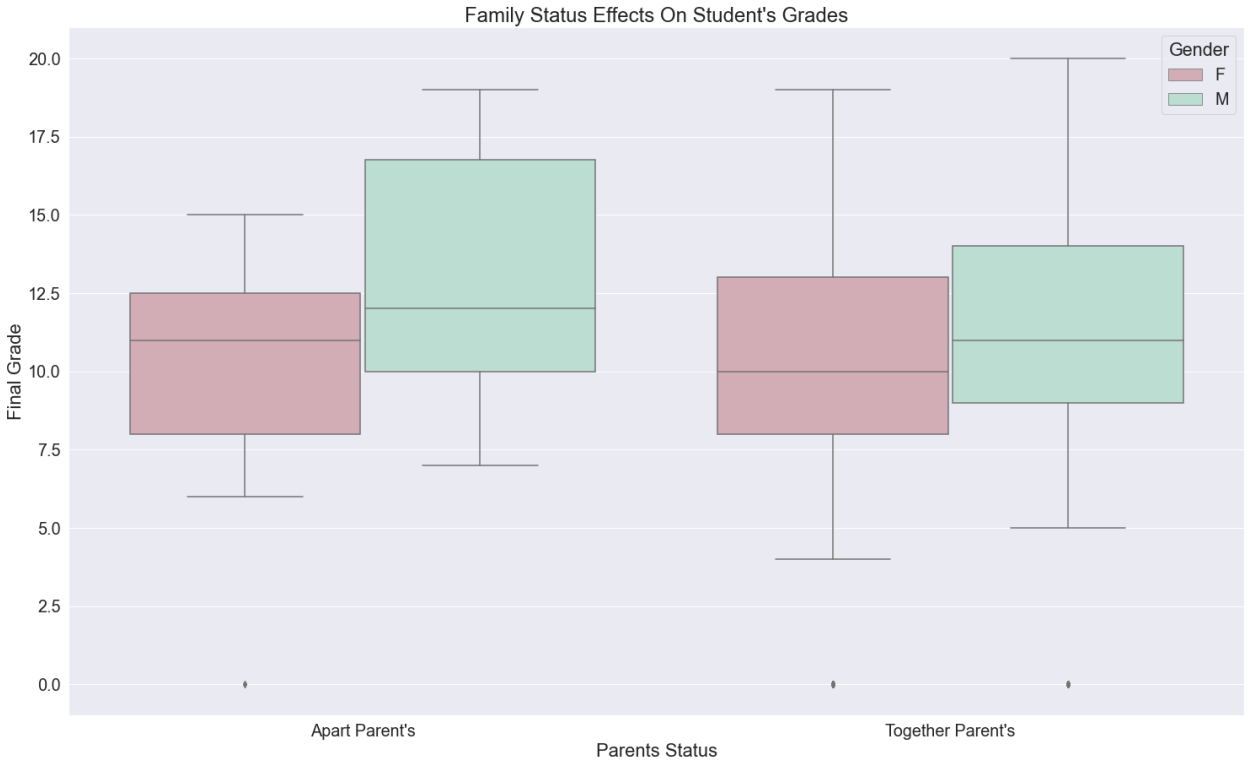

Figure 4: Family's Living Status and its effects on students' grades.

Insights:

- Males minimum grade is higher than females for overall in math course.
- The apart parents have a more negative impact on females than males.
- The maximum grade was in students with parents who lives together.
- Males tend to have higher grades than females.

Students past failures:

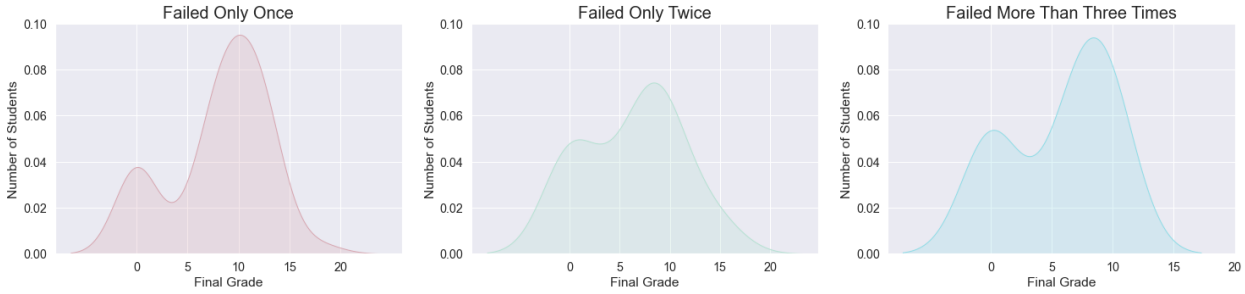

Figure 5: Students past failures and its effects on their current final grade.

Insights:

- Most of the students that only failed once got a score of 10 on the final grade.
- Most of the students that failed twice got a score between 0 and 8 on the final grade.
- Most of the students that failed more than three times got a score between 0 and 7 on the final grade.
- Students who only failed once have an overall better performance than those who failed more than twice.
- There is a dip that starts from 1 until 3 in all charts.

Final grades based on gender:

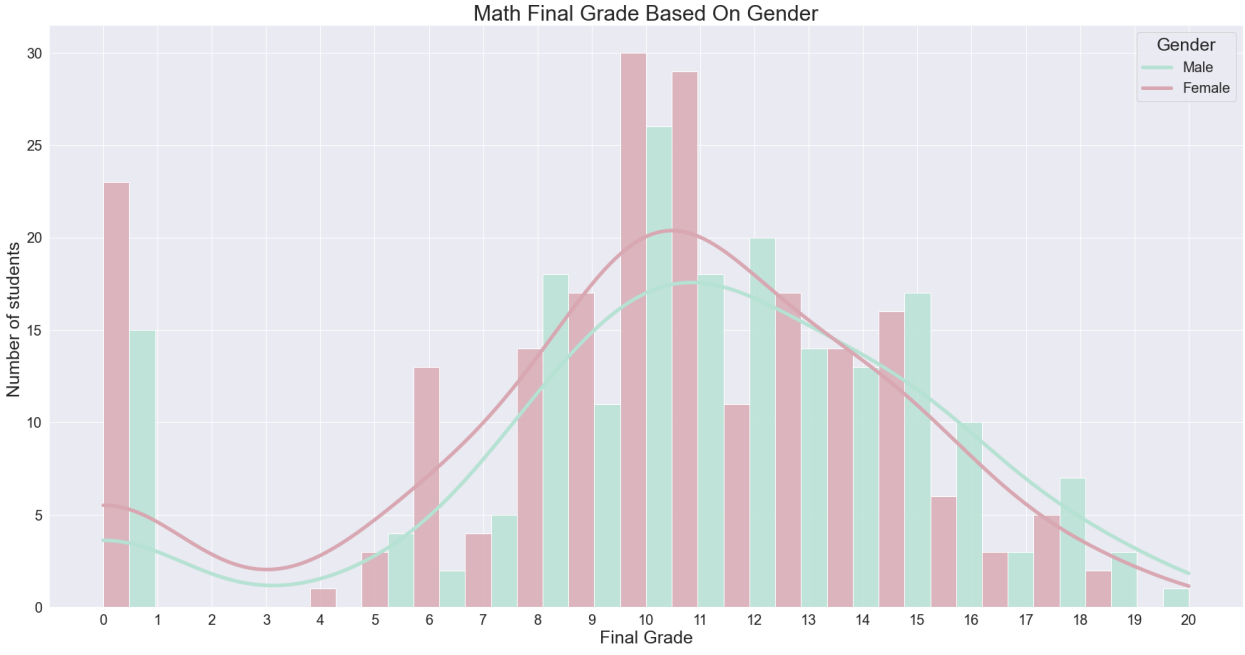

Figure 6: Math Final grade based on gender (Female and Male).

Insights:

- Only one male student succeeds in getting a full mark.
- For grades higher than 15 males got higher grading than females.
- Most of the students got grades between 8 and 12.

- Huge number of students got zero for final grades.
- The dip insight from the previous charts is explained here in more detail, it was caused by no students having a score between 1 and 3.

Issues:

From the previous plot we found the issue of a large number of students scoring a zero on their math test, we further investigated this by looking into the data:

```
1 grade0.describe()
```

	age	Medu	Fedu	traveltime	studytime	failures	famrel	freetime	goout	Dalc	Walc	health	absences	G
count	38.000000	38.000000	38.000000	38.000000	38.000000	38.000000	38.000000	38.000000	38.000000	38.000000	38.000000	38.000000	38.0	38.00000
mean	17.078947	2.315789	2.289474	1.605263	1.973684	0.921053	3.842105	3.131579	3.210526	1.342105	1.921053	3.605263	0.0	7.52631
std	1.302421	1.016227	1.112773	0.789782	0.914946	1.075063	1.000711	0.875216	1.318433	0.534047	1.171314	1.284828	0.0	1.81192
min	15.000000	1.000000	1.000000	1.000000	1.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.0	4.00000
25%	16.000000	2.000000	1.000000	1.000000	1.000000	0.000000	3.000000	3.000000	2.000000	1.000000	1.000000	3.000000	0.0	6.00000
50%	17.000000	2.000000	2.000000	1.000000	2.000000	1.000000	4.000000	3.000000	3.000000	1.000000	2.000000	4.000000	0.0	7.00000
75%	18.000000	3.000000	3.000000	2.000000	2.000000	1.750000	4.750000	4.000000	4.000000	2.000000	2.000000	5.000000	0.0	9.00000
max	19.000000	4.000000	4.000000	4.000000	4.000000	3.000000	5.000000	5.000000	5.000000	3.000000	5.000000	5.000000	0.0	12.00000

```
1 grade0.describe(exclude=np.number)
```

	school	sex	address	famsize	Pstatus	Mjob	Fjob	reason	guardian	schoolsup	famsup	paid	activities	nursery	higher	internet	romantic
count	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38
unique	2	2	2	2	2	5	4	4	3	2	2	2	2	2	2	2	2
top	GP	F	U	GT3	T	other	other	course	mother	no	yes	no	yes	yes	yes	yes	yes
freq	34	23	28	31	36	14	21	19	25	37	23	30	21	28	32	30	20

We decided to further explore these 6 factors based on what we saw in the previous tables:

famsup	family educational support (binary: yes or no)
paid	extra paid classes within the course subject (Mathematics) (binary: yes or no)
activities	extra-curricular activities (binary: yes or no)
health	current health status (numeric: from 1 - very bad to 5 - very good)
freetime	free time after school (numeric: from 1 - very low to 5 - very high)
schoolsup	extra educational support (binary: yes or no)

We plotted all these variables as you can see below:

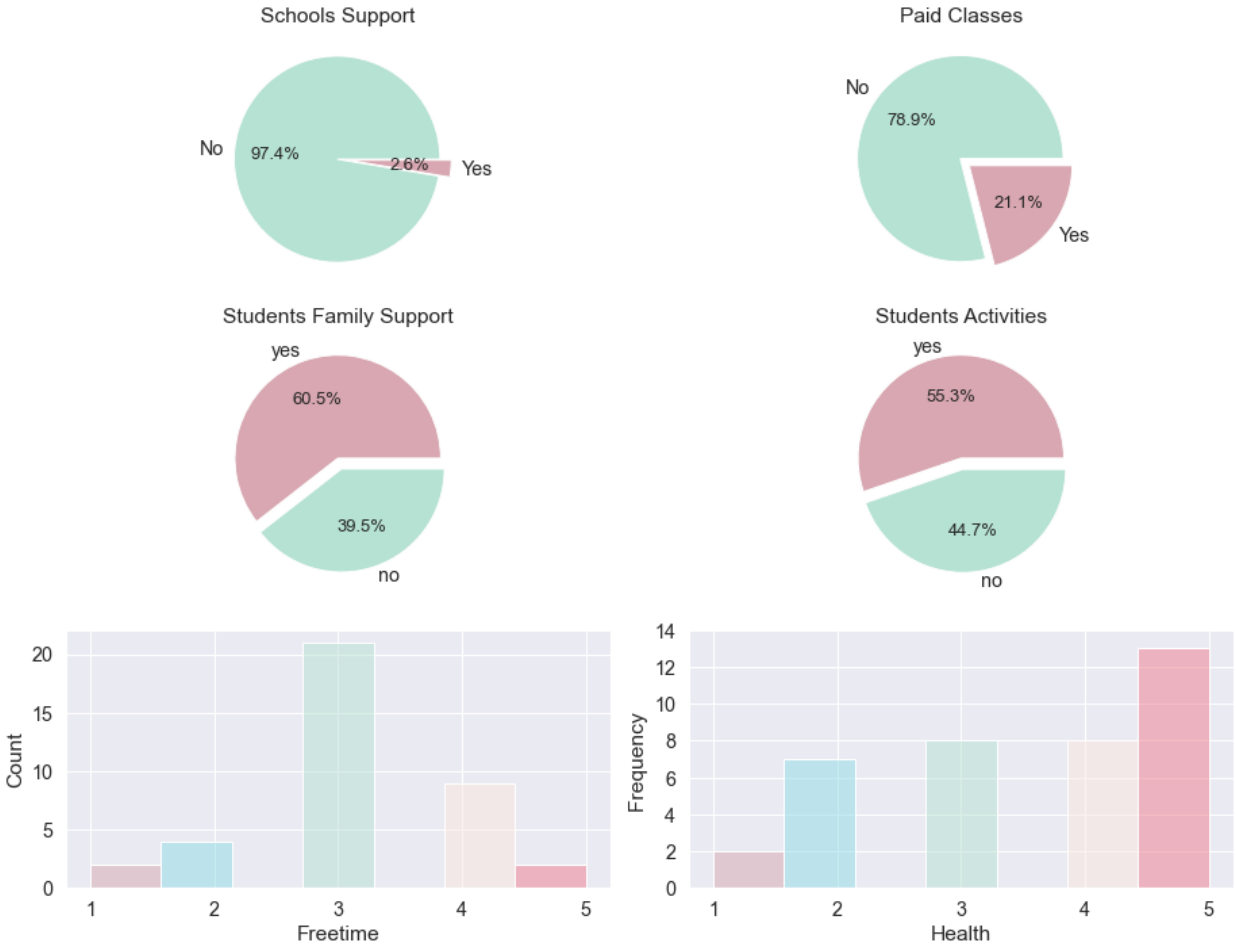

Figure 7: A deeper look into students who scored zero in regards to: (school support, paid classes, family support, student activities, free time, and health).

Issues:

1. School Support Pie chart
    - The overwhelming majority of students who got zero on their final grade do not have the Schools support.
2. Paid Classes Pie chart
    - 80% of the students who got zero on their final grade did not have extra paid classes.
3. Student Free-time Histogram
    - Most of the students who got zero on their final grade do have sufficient free-time.
4. Family Support Pie chart
    - 39.5% of the students that got zero on the finales don't have a supportive family.
5. Extracurricular Activity Pie chart
    - 44.7% of the students that got zero on the finales don't have extracurricular activities.
6. Student Health Histogram
    - Most of the students lie between 2 and 4, with 4 being the healthiest and 2 being the least healthy.

Define the solution:

From the free-time histogram chart we can see that the students have an ample amount of free-time to implement these following solutions:

1- Increase the school support for students who scored zero on their exams, more support can include:
   - More monitoring of the students' performance.
   - An after-school program that includes tutoring and one-on-one mentoring to help the students who are behind. To decrease the load on the school's teachers, this can be done by volunteers or people who need extra work experience on their resumes.
   - Establish a reward system for all students to increase overall performance, this can include coupons, movie tickets, gift cards or sending a survey to the students to see their preferred rewards.
   - Create a summer school program, where students can take extra classes.
   - Give extra support to the students who lack family support.
2- Create a paid classes scholarship program for students who scored zero on their exams.
3- Students with health issues could take the exams online, or have a re-take chance.

Conclusion:

In conclusion we hope this proposal aids the school in improving the student's overall performance and in particular the students who scored zero on their math exam. This was a very important analysis as the youth are our future.

We would like to Thank you for taking your time and reading this report, if you have any questions or concerns please contact the power puff girls' team at:

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