



Quality Education: Ensure inclusive and equitable quality education promote lifelong learning opportunities for all

3 December 2023

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Grading the Future: Leveraging Machine Learning for Predictive
Education



Overview

We start on an exciting experience to figure out a complicated chain of factors that decide student achievement. We seek to answer critical questions by taking advantage of the power of machine learning.

We want to know:

- What are the major elements that genuinely influence educational quality?
- How do a student's social life or occupations of their parents influence their educational outcomes?
- Is there a link between educational quality and alcohol consumption?

Our purpose is to show light on these issues, giving useful insights that may help design successful educational policies and practices, eventually helping to the attainment of UN SDG 4 - **Quality Education**.

Data Crafters



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Why? The Sustainable Development Goal 4 - Quality Education

BEFORE COVID-19

PROGRESS TOWARDS
**INCLUSIVE AND EQUITABLE QUALITY
EDUCATION WAS TOO SLOW**



**OVER 200 MILLION CHILDREN WILL
STILL BE OUT OF SCHOOL IN 2030**

COVID-19 IMPLICATIONS



SCHOOL CLOSURES KEPT
90% OF ALL STUDENTS OUT OF SCHOOL
REVERSING YEARS OF PROGRESS ON EDUCATION

**INEQUALITIES IN EDUCATION ARE
EXACERBATED BY COVID-19**

IN LOW-INCOME COUNTRIES,
CHILDREN'S SCHOOL COMPLETION RATE IS



79% IN RICHEST
20% OF HOUSEHOLDS



34% IN POOREST
20% OF HOUSEHOLDS

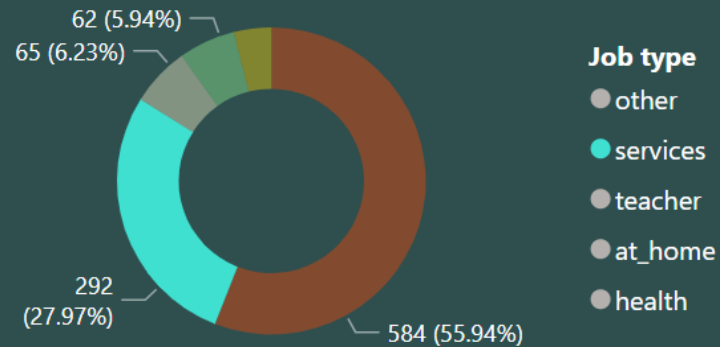
REMOTE LEARNING REMAINS
OUT OF REACH FOR
AT LEAST
500 MILLION STUDENTS



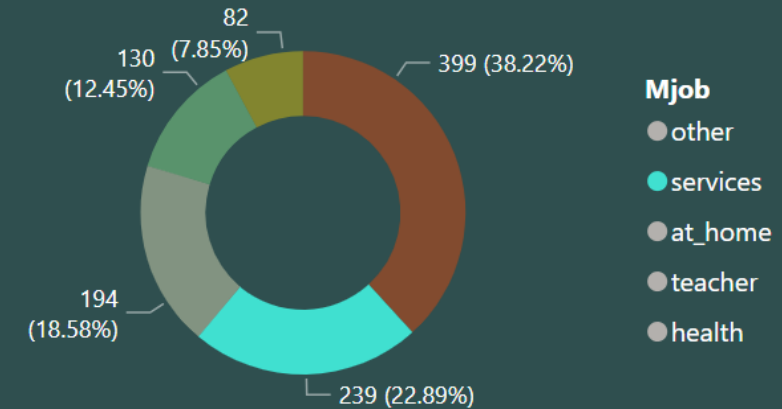
Globally,
around 5.5
million more
girls than boys
of primary
school age
were out of
school in 2018

Parental Professions: A Key Factor in Quality Education

Father Occupation



Mothers Occupation



4 QUALITY EDUCATION



4.3

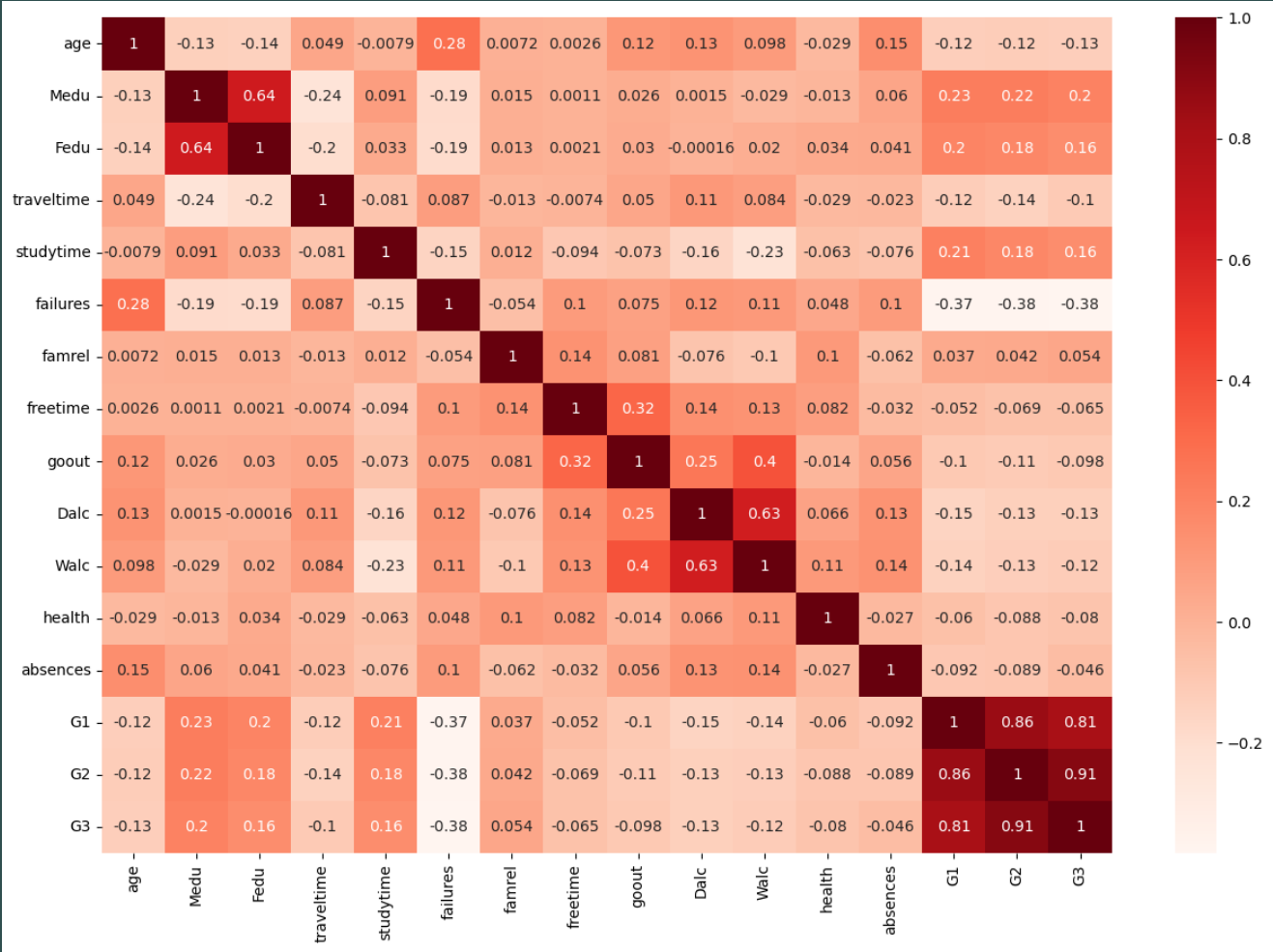
By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university



What matters and **What** doesn't

Which dataset features significantly impact the Quality of Education?

Heatmap :



Parental Education (Medu, Fedu):

The education level of parents can influence the quality of education their children receive

More

- Resources
- Knowledge
- skills to support their children's education

However, the correlation is not very strong (0.2 for Medu and 0.16 for Fedu)

Study Time:

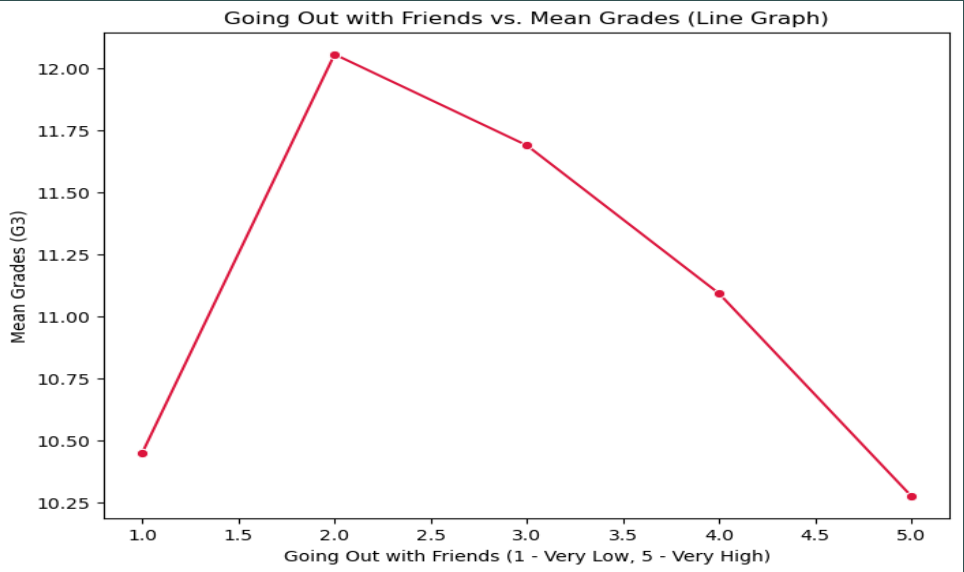
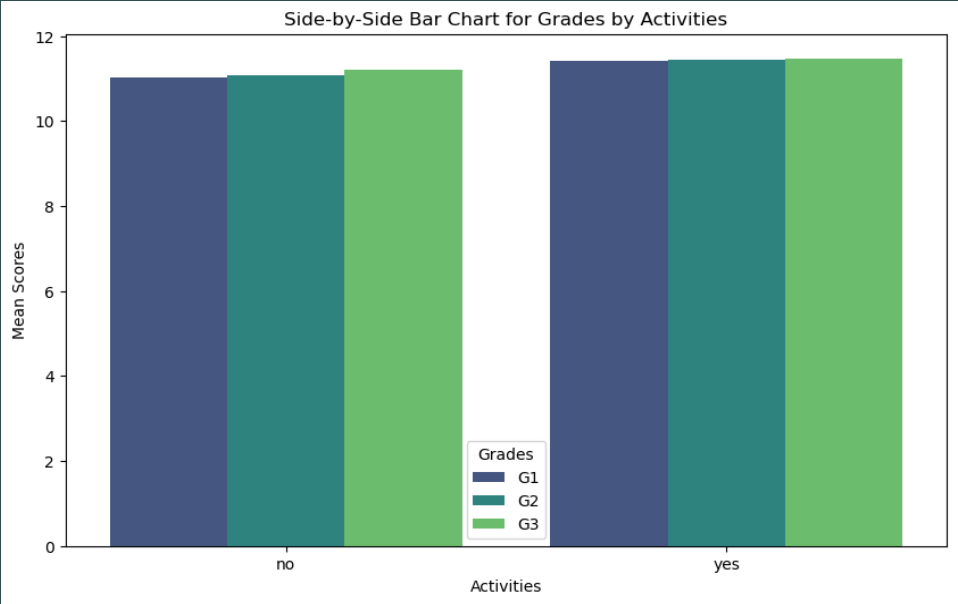
The amount of time students spend studying outside of school can also affect their academic performance

The correlation is also not very strong (0.16), which suggests that the quality of study time might be more important than the quantity.

How does a student's social life affect the quality of education?

Slight increase in grades with an increase in extracurricular activities

- 1.Skill Development:** Extracurricular activities often help students develop important skills such as time management, problem-solving, teamwork, and leadership, which can also be beneficial for their academic work.
- 2.Motivation and Engagement:** Students who are engaged in extracurricular activities may also be more engaged in school in general, leading to better academic performance.
- 3.Positive Peer Influence:** Extracurricular activities often involve interaction with peers who may also value academic success, leading to a positive influence on a student's academic performance.



Amount of time a student spends going out with friends and their academic grades:

Initially, the graph increases, indicating that students who have a balanced social life tend to have better grades

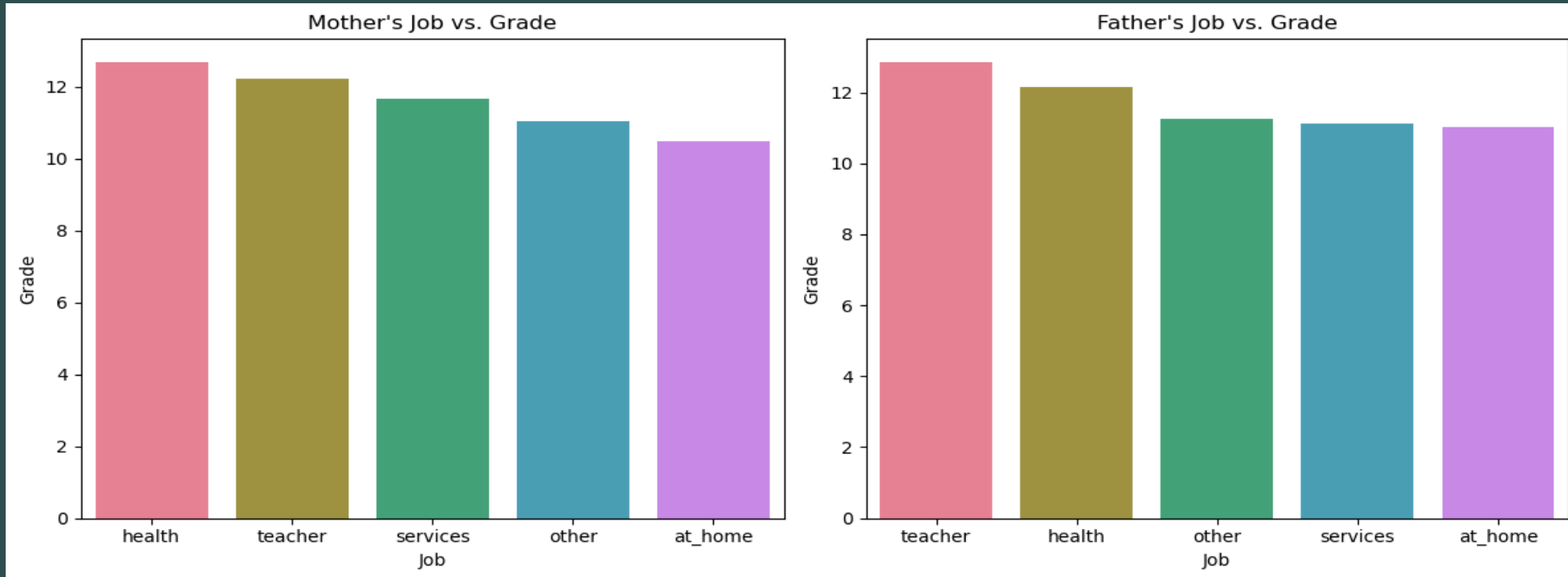
- improved mental health,
- increased motivation
- the development of important social skills

After a certain point, the graph starts to fall

If students spend too much time going out with friends, it might start to interfere with their study time and focus, leading to a decrease in grades

“law of diminishing returns”

What is the impact of parents' jobs on the student's education?



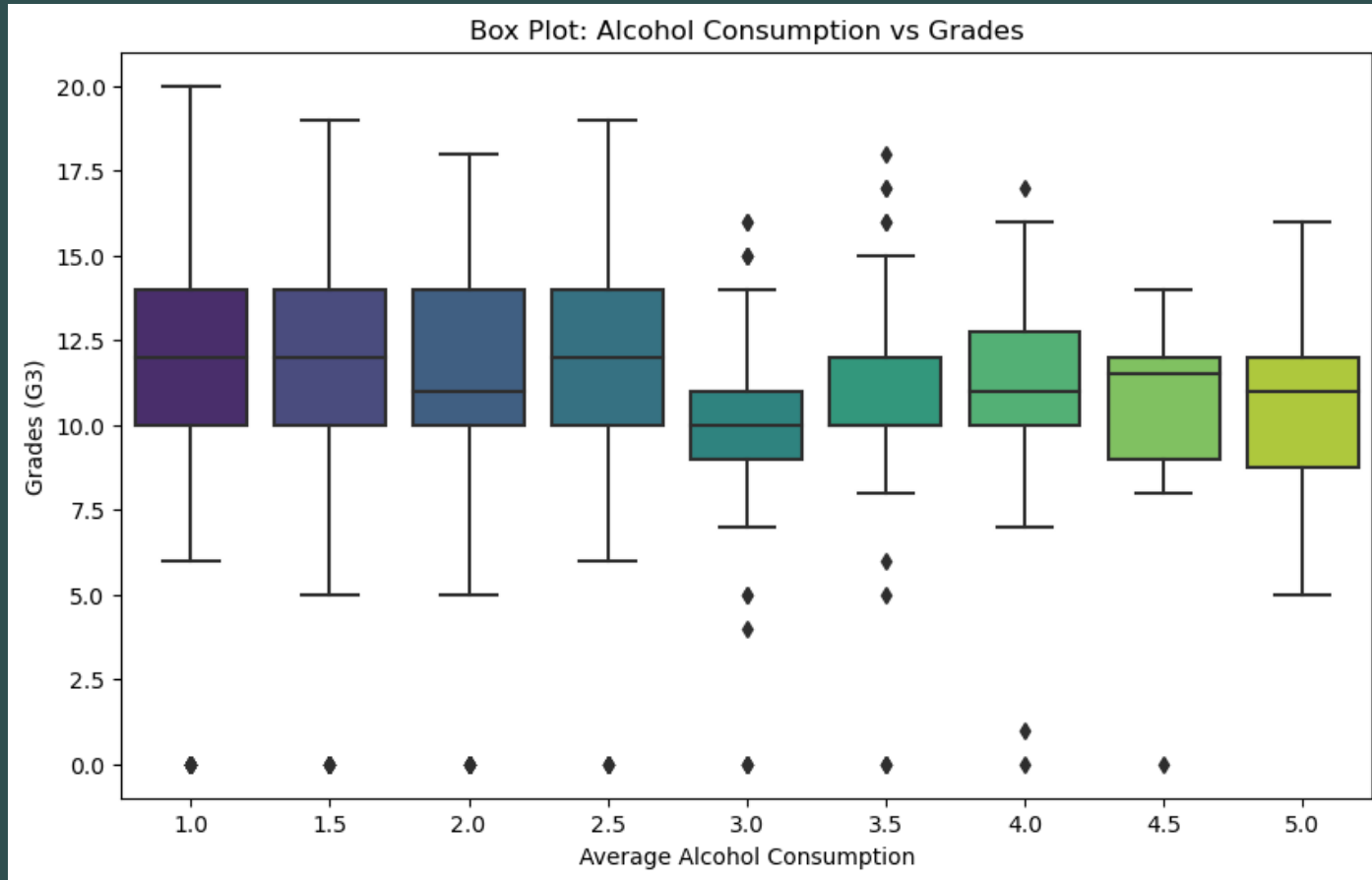
Educational Support at Home

Socioeconomic Status

Role Modelling

Expectations and Aspirations

Does Quality of education have a positive or negative relationship with consuming alcohol?

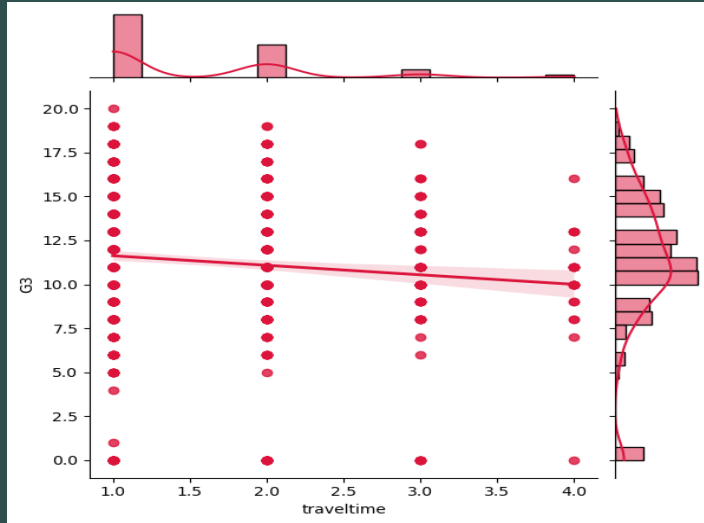


Box plot tells that there might not be a significant change in the grades of students with different levels of parental alcohol consumption.

- The effect might be non-linear or complex, with different effects at different levels of alcohol consumption.
- There might be other factors that have a stronger influence on children's education, overshadowing the effect of parents' alcohol consumption.

Grades VS Various Attributes

Travel time vs Grades:



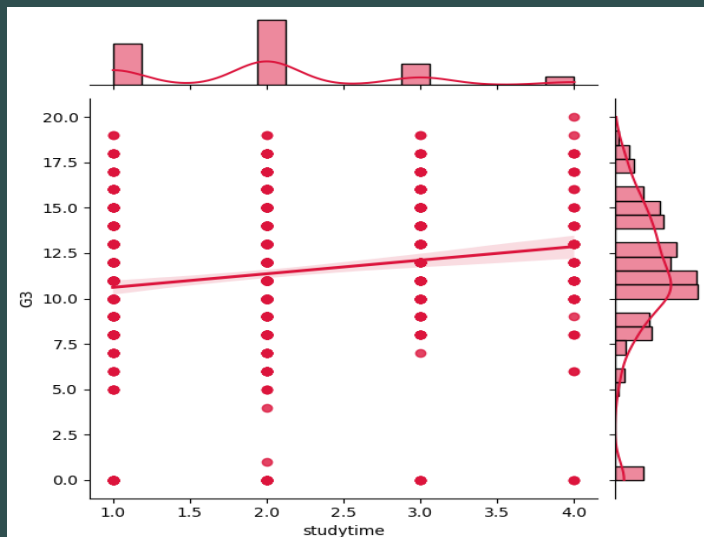
Travel time vs Grades:

- There is a negative correlation of approximately -0.10 between 'travel time' and 'G3'.
- This implies that, on average, students with longer travel times tend to achieve slightly lower grades.

Study time vs Grades:

- There is a positive correlation of approximately 0.16 between 'study time' and 'G3'.
- This suggests that, on average, students who spend more time studying tend to achieve higher grades.

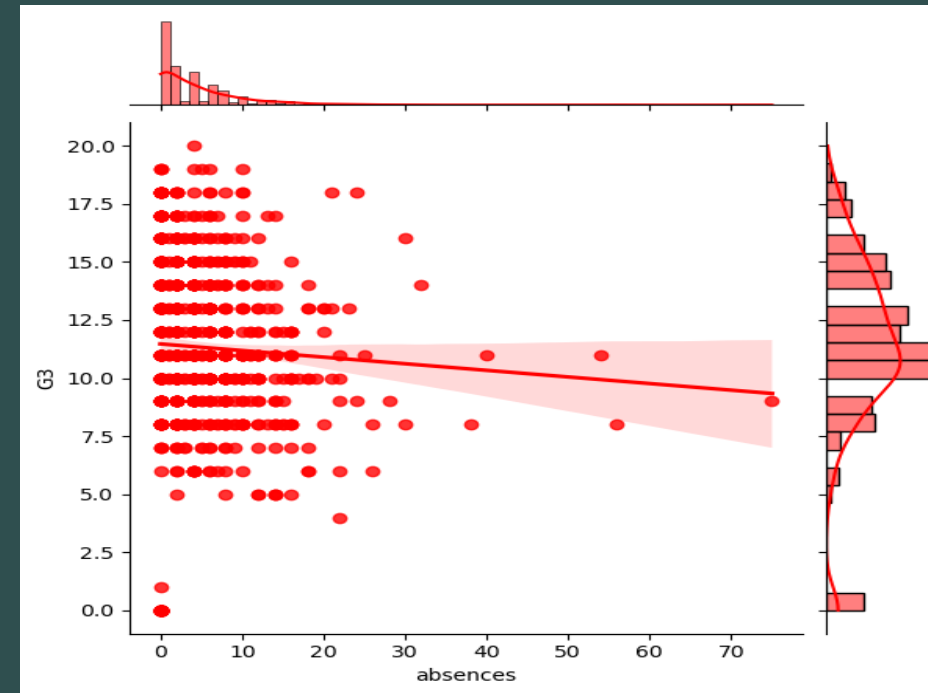
Study time vs Grades:



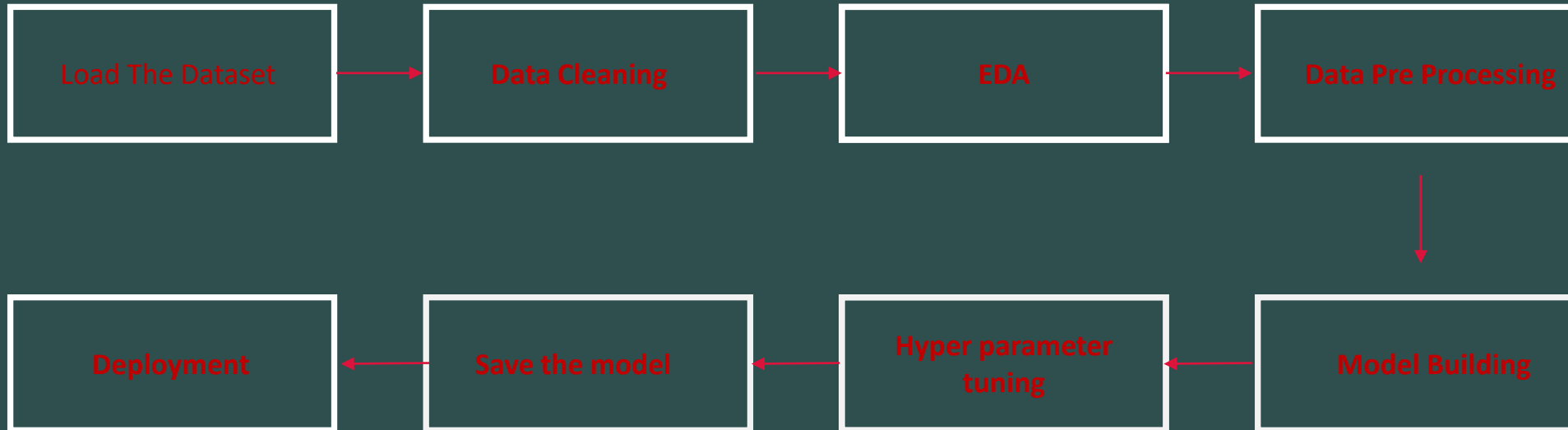
Absence vs Grades:

- It appears that there is no apparent correlation between the number of absences and academic grades.
- students who take leaves might compensate by obtaining study materials from their peers or making up for missed content

Absence vs Grades:

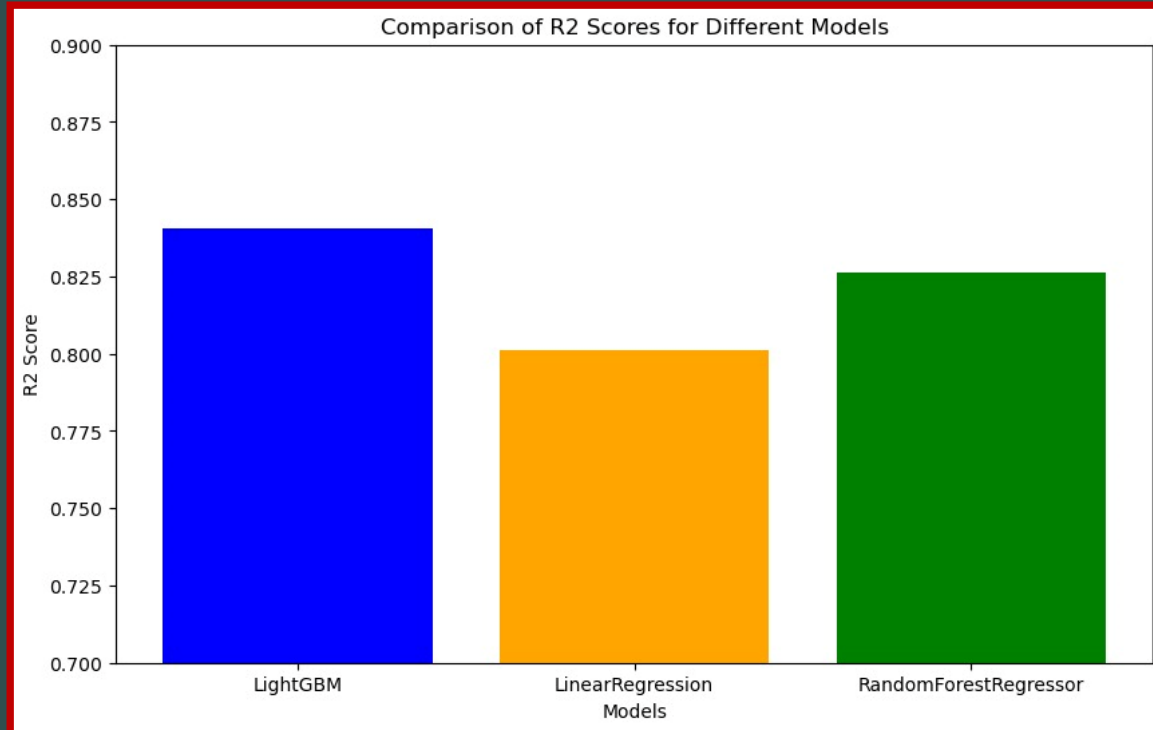


Project Pipeline



Model Selection

Model Comparison graph



Model	Adjusted R-Squared	R-Squared	RMSE	Time Taken
HistGradientBoostingRegressor	0.83	0.86	1.36	1.31
LGBMRegressor	0.83	0.86	1.37	0.13
GradientBoostingRegressor	0.82	0.84	1.44	0.39
XGBRegressor	0.81	0.84	1.46	0.28
BaggingRegressor	0.81	0.84	1.47	0.20
RandomForestRegressor	0.80	0.83	1.49	1.54
HuberRegressor	0.80	0.83	1.49	0.05
LarsCV	0.80	0.83	1.51	0.11
LassoLarsCV	0.80	0.83	1.51	0.10
LassoCV	0.80	0.83	1.51	0.23
LassoLarsIC	0.80	0.83	1.51	0.05
ExtraTreesRegressor	0.79	0.83	1.52	1.49
ElasticNetCV	0.79	0.83	1.52	0.26
AdaBoostRegressor	0.79	0.82	1.52	0.22
OrthogonalMatchingPursuitCV	0.79	0.82	1.53	0.04
BayesianRidge	0.79	0.82	1.53	0.03
RidgeCV	0.79	0.82	1.53	0.04
Ridge	0.79	0.82	1.53	0.03
Lars	0.79	0.82	1.53	0.04
TransformedTargetRegressor	0.79	0.82	1.53	0.03
LinearRegression	0.79	0.82	1.53	0.03
LinearSVR	0.79	0.82	1.53	0.04
SGDRegressor	0.79	0.82	1.54	0.03
OrthogonalMatchingPursuit	0.79	0.82	1.54	0.03
Lasso	0.73	0.78	1.72	0.02
LassoLars	0.73	0.78	1.72	0.04
DecisionTreeRegressor	0.73	0.78	1.72	0.05
PoissonRegressor	0.70	0.75	1.82	0.05
RANSACRegressor	0.70	0.75	1.82	0.25
MLPRegressor	0.70	0.75	1.83	1.31
PassiveAggressiveRegressor	0.70	0.75	1.84	0.03
ElasticNet	0.67	0.72	1.91	0.03

Quality Of Education MATTERS!!

What can we Do?

Ask our governments to place education as a priority in both policy and practice. Lobby our governments to make firm commitments to provide free primary school education to all, including vulnerable or marginalized groups.



