

Exploring the Impact of Parental Influence and Student Well-being on Mathematics Performance in Secondary Education

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A photograph of a woman with dark hair tied back in a ponytail, wearing a green t-shirt and tan shorts, sitting on a light-colored sofa. She is laughing heartily, her head tilted back and mouth wide open. A young boy with dark hair, wearing a blue and white striped t-shirt, is sitting next to her, also laughing and looking towards her. They appear to be sharing a joyful moment. The background shows a bright room with white curtains.

Data science questions to answer

1. How do parental education levels and occupations influence students' mathematics grades in secondary school?
2. What role does students' health and family relations play in their academic performance, specifically in mathematics?

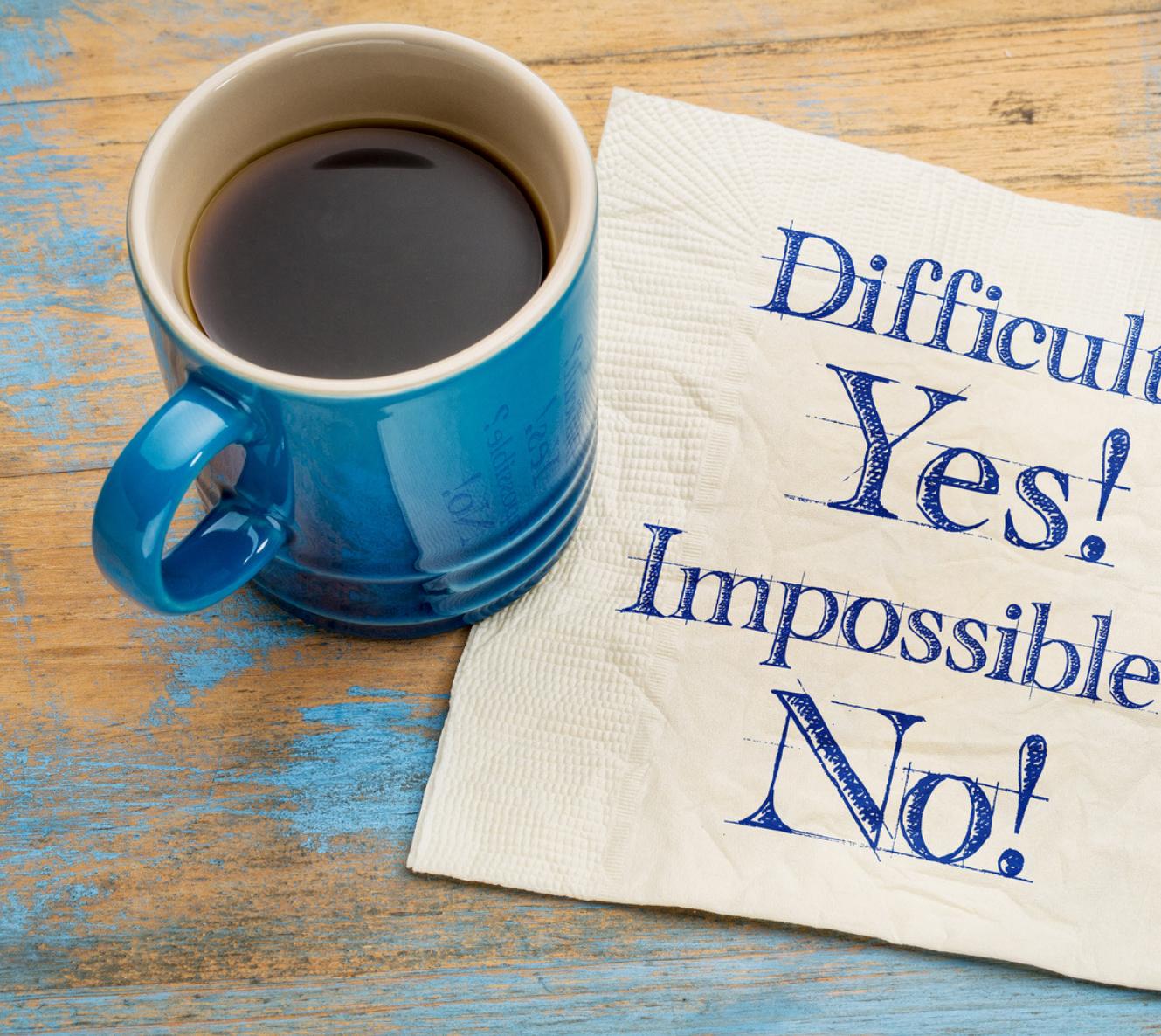
Why the questions are important



Understanding these relationships can guide targeted interventions to improve educational policies and parental involvement, potentially leading to enhanced student performance.

Difficulties in answering the questions

1. Complexity of isolating individual factors' effects due to the multifaceted nature of educational achievement.
2. The potential for unrecorded variables that could influence academic performance, such as personal motivation or external social factors, introduces additional complexity to the analysis



Data available for answering the questions

From Kaggle - Student Performance Dataset

(<https://www.kaggle.com/datasets/devansodariya/student-performance-data?resource=download>)

Numerical Data Description:

	G3	Medu	Fedu	famrel	health
count	395.000000	395.000000	395.000000	395.000000	395.000000
mean	10.415190	2.749367	2.521519	3.944304	3.554430
std	4.581443	1.094735	1.088201	0.896659	1.390303
min	0.000000	0.000000	0.000000	1.000000	1.000000
25%	8.000000	2.000000	2.000000	4.000000	3.000000
50%	11.000000	3.000000	2.000000	4.000000	4.000000
75%	14.000000	4.000000	3.000000	5.000000	5.000000
max	20.000000	4.000000	4.000000	5.000000	5.000000

Categorical Data Description:

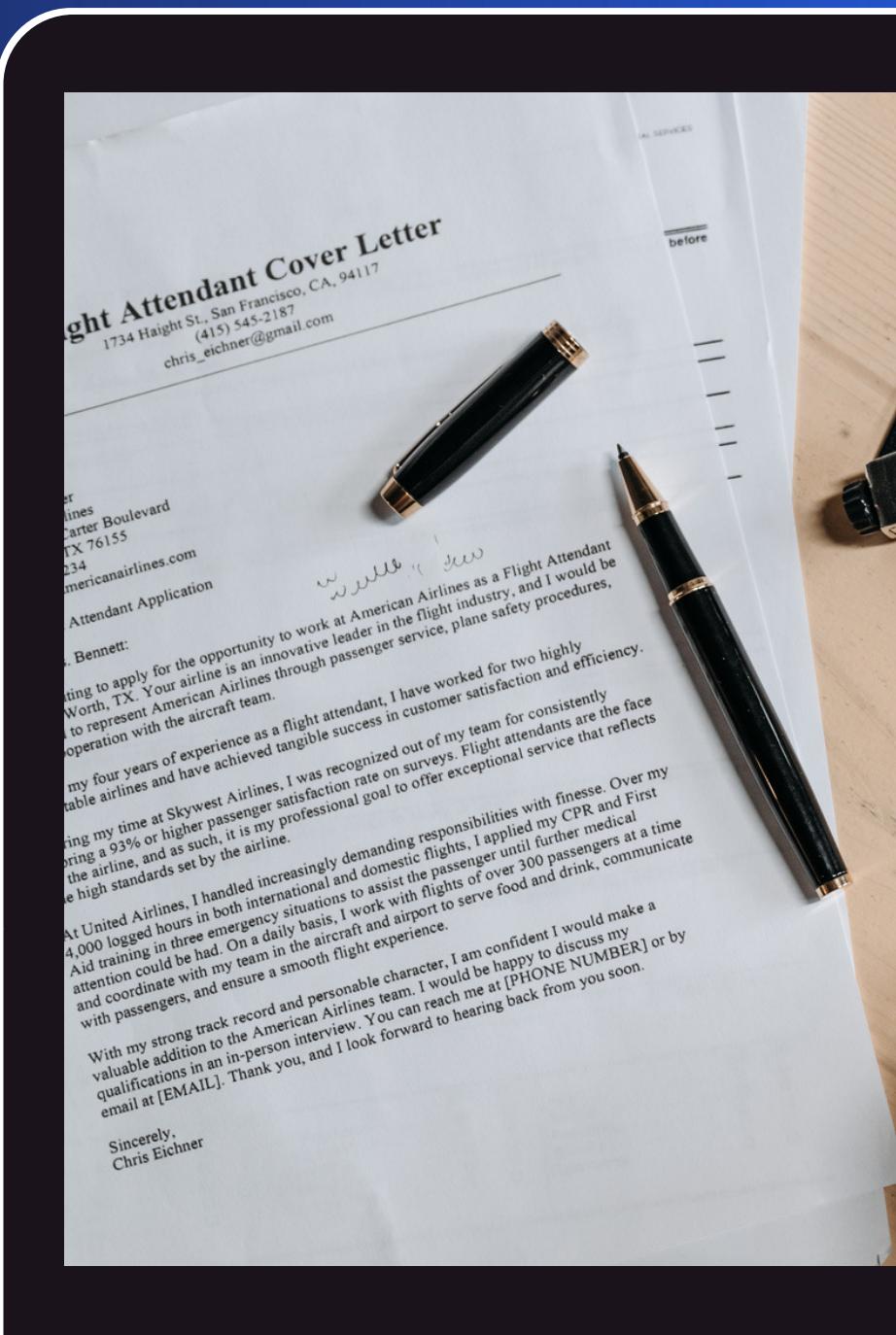
	Mjob	Fjob
count	395	395
unique	5	5
top	other	other
freq	141	217



Existing works that tried to answer or answered the questions

Research focusing on parental involvement, teacher-parent support, stress levels, and students' well-being that affect secondary school mathematics achievement (More information on Acknowledgements and References)

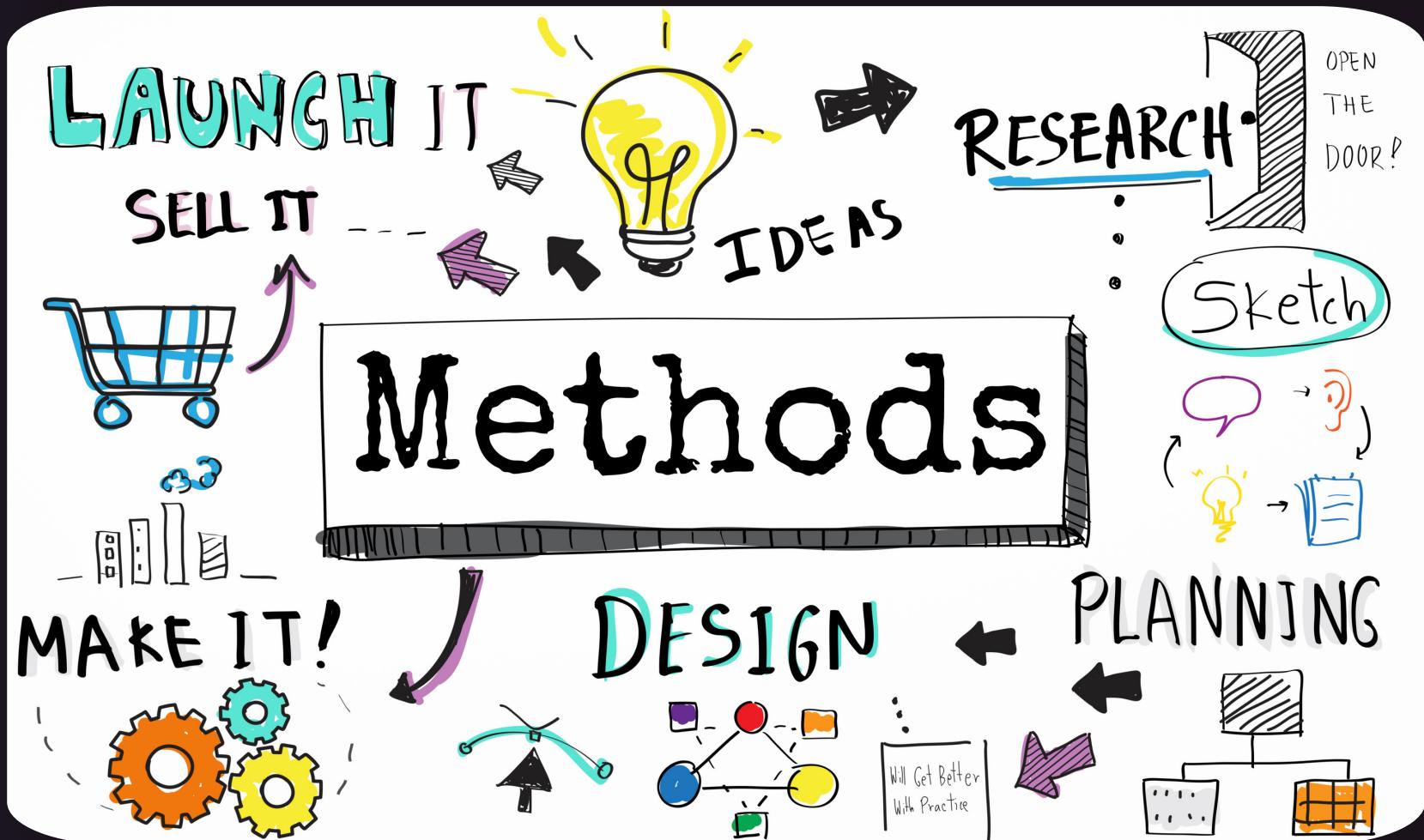
=> studies specifically correlating these factors with secondary school mathematics grades, incorporating both parental occupation and detailed health metrics, are less common



Methods used

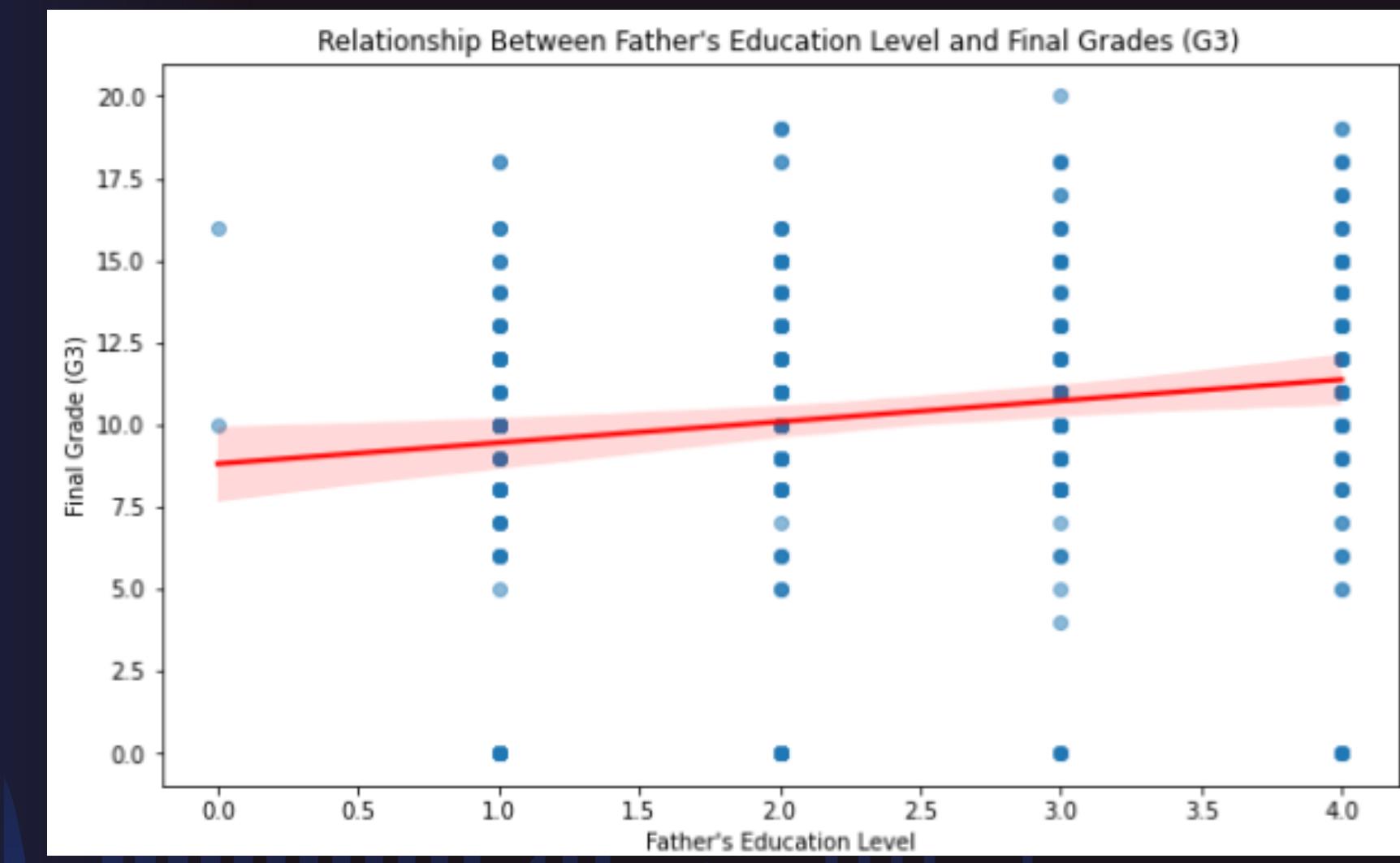
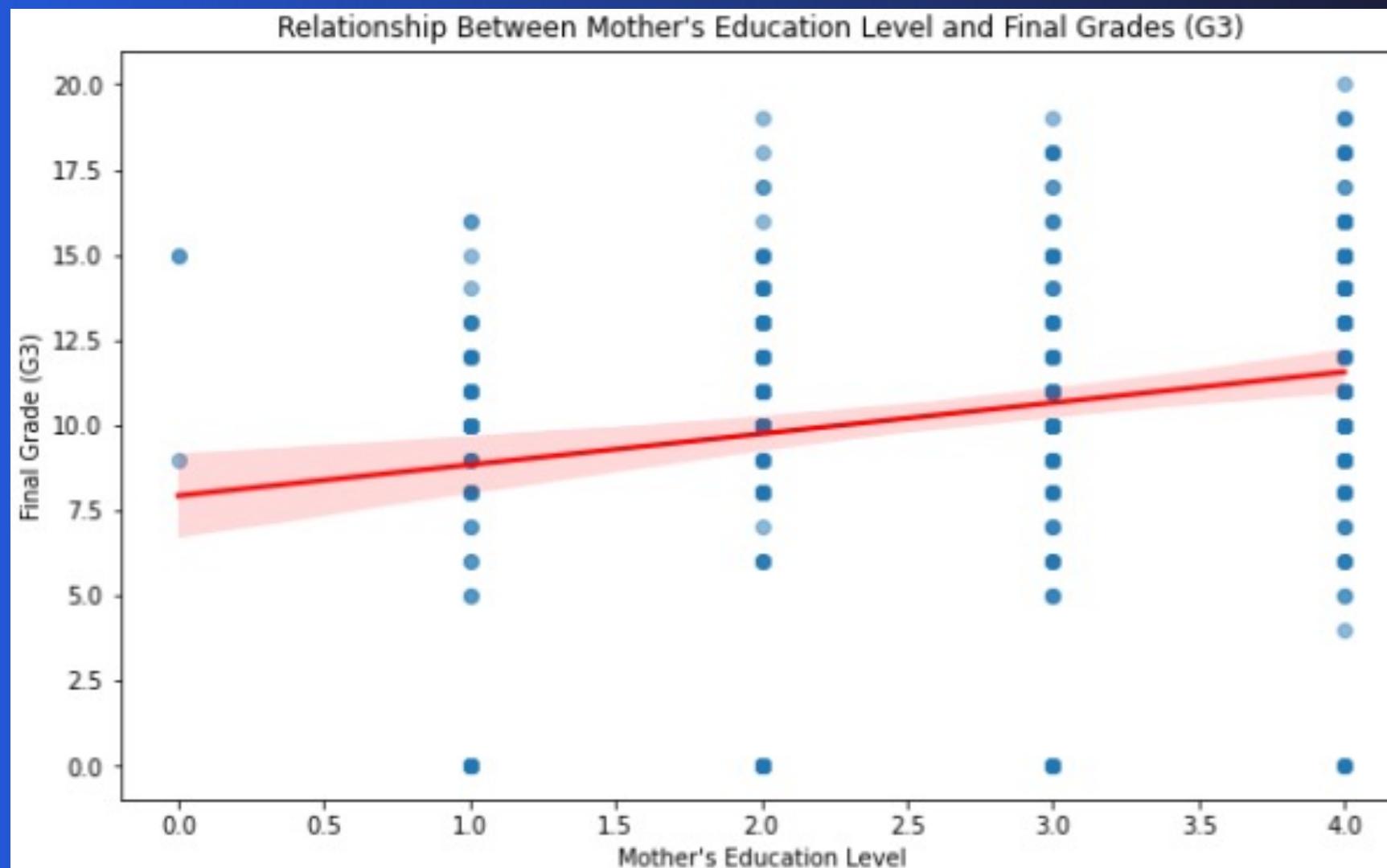
Jupyter Notebook: Python 3.9.12

Libraries: numpy, pandas, seaborn,
matplotlib.pyplot, scipy.stats



Findings corresponding to the question 1

How do parental education levels and occupations influence students' mathematics grades in secondary school? Ans: positive correlation between mother's education and student grades, and also father's education and student grades.



Findings corresponding to the question 1 (cont')

How do parental education levels and occupations influence students' mathematics grades in secondary school?

```
from scipy.stats import t

correlation = df['Medu'].corr(df['G3'])
n = df['Medu'].count() # sample size

t_value = correlation * np.sqrt((n-2) / (1 - correlation**2))

p_value = 2 * (1 - t.cdf(np.abs(t_value), df=n-2))

# Print the results
print(f'Correlation coefficient: {correlation}')
print(f't-value: {t_value}')
print(f'p-value: {p_value}')
```

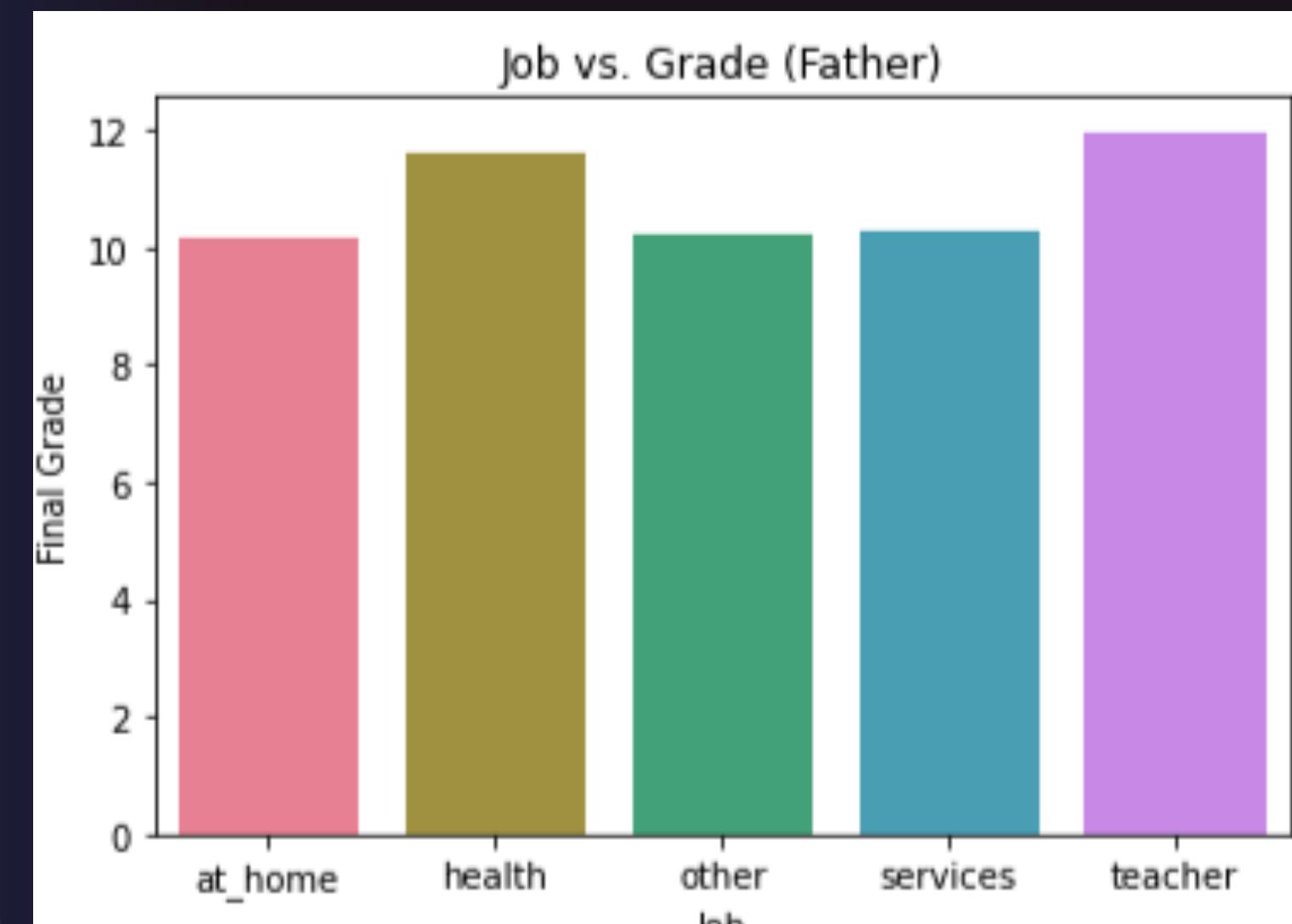
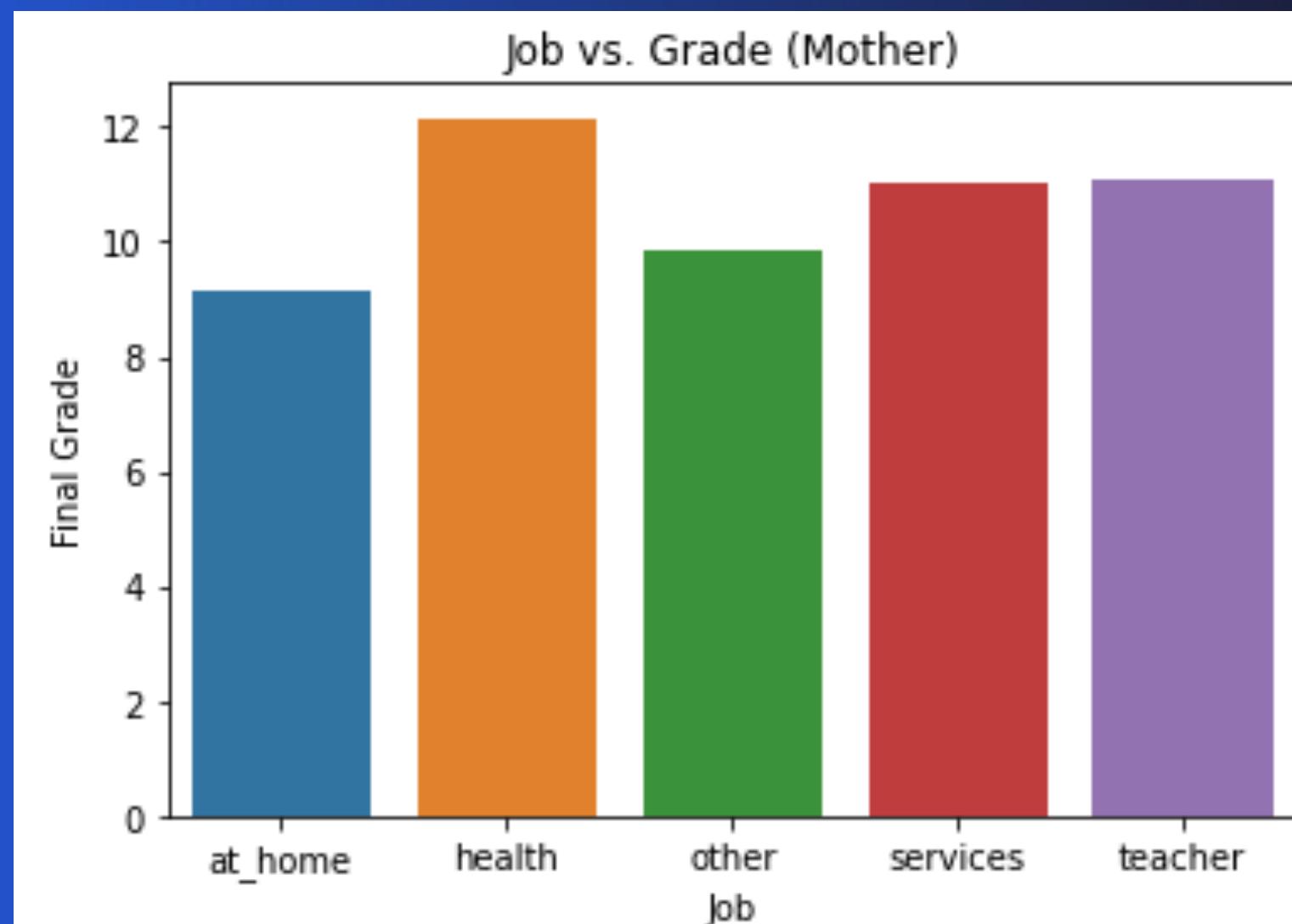
Correlation coefficient: 0.217147496138606
t-value: 4.4100094867378745
p-value: 1.3361073236906051e-05

Although the correlation coefficient of 0.217 suggests a weak linear relationship, The p-value < 0.05 (95% confidence level), there is a significant positive correlation between mother's education and student grades.

Correlation coefficient: 0.15245693890425902
t-value: 3.0580897766133335
p-value: 0.0023799726323396886

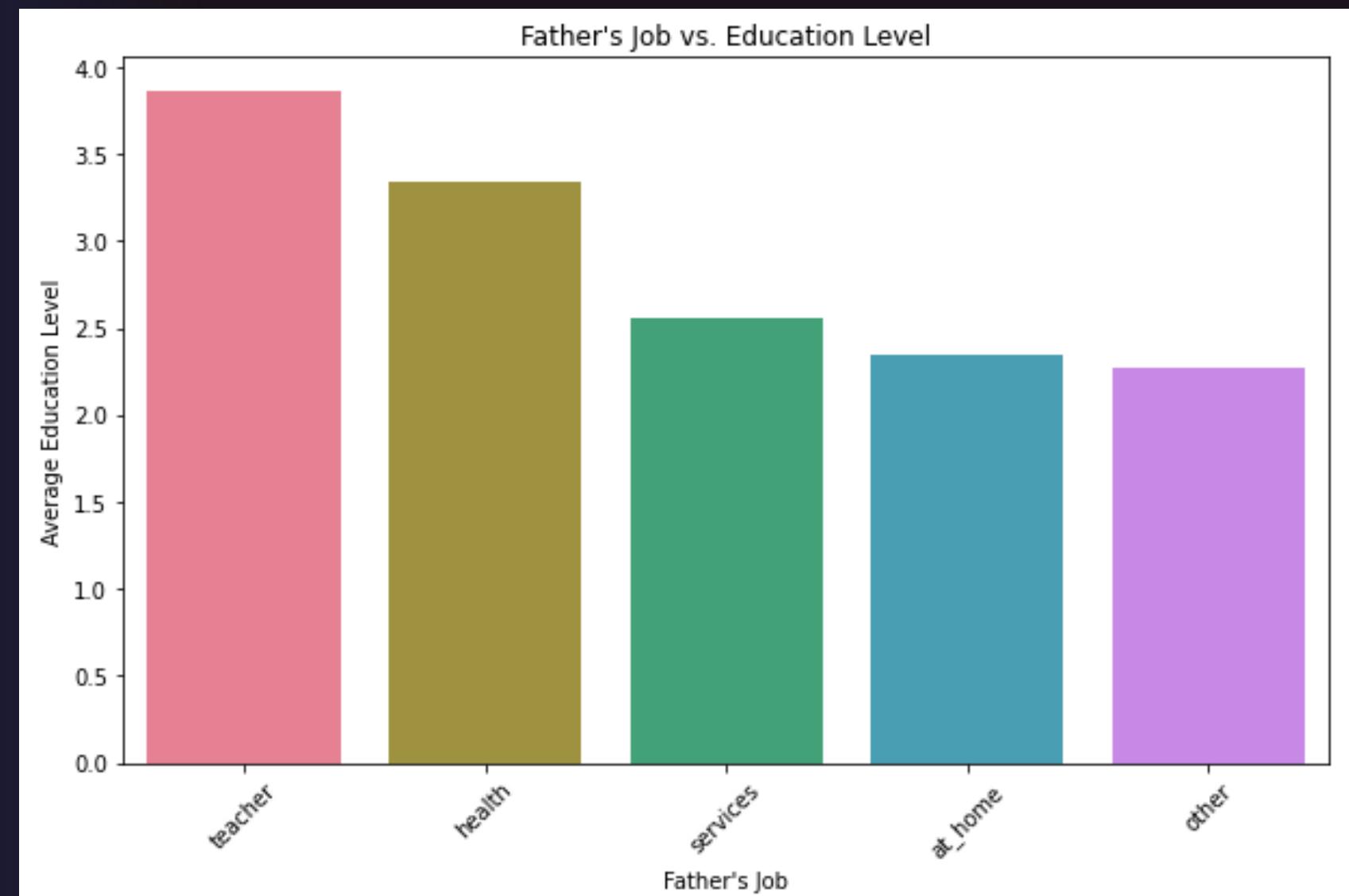
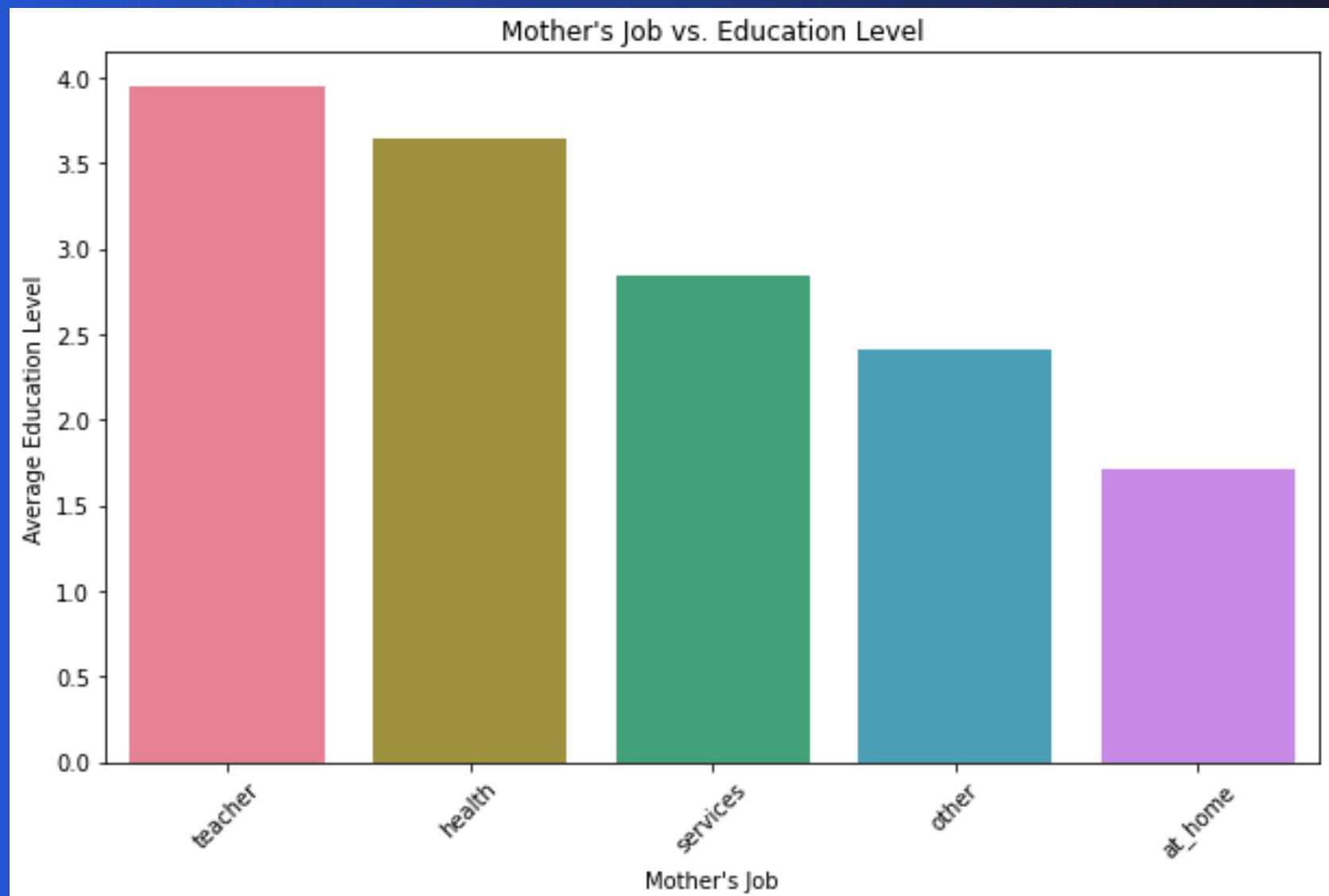
Findings corresponding to the question 1 (cont')

How do parental education levels and occupations influence students' mathematics grades in secondary school?



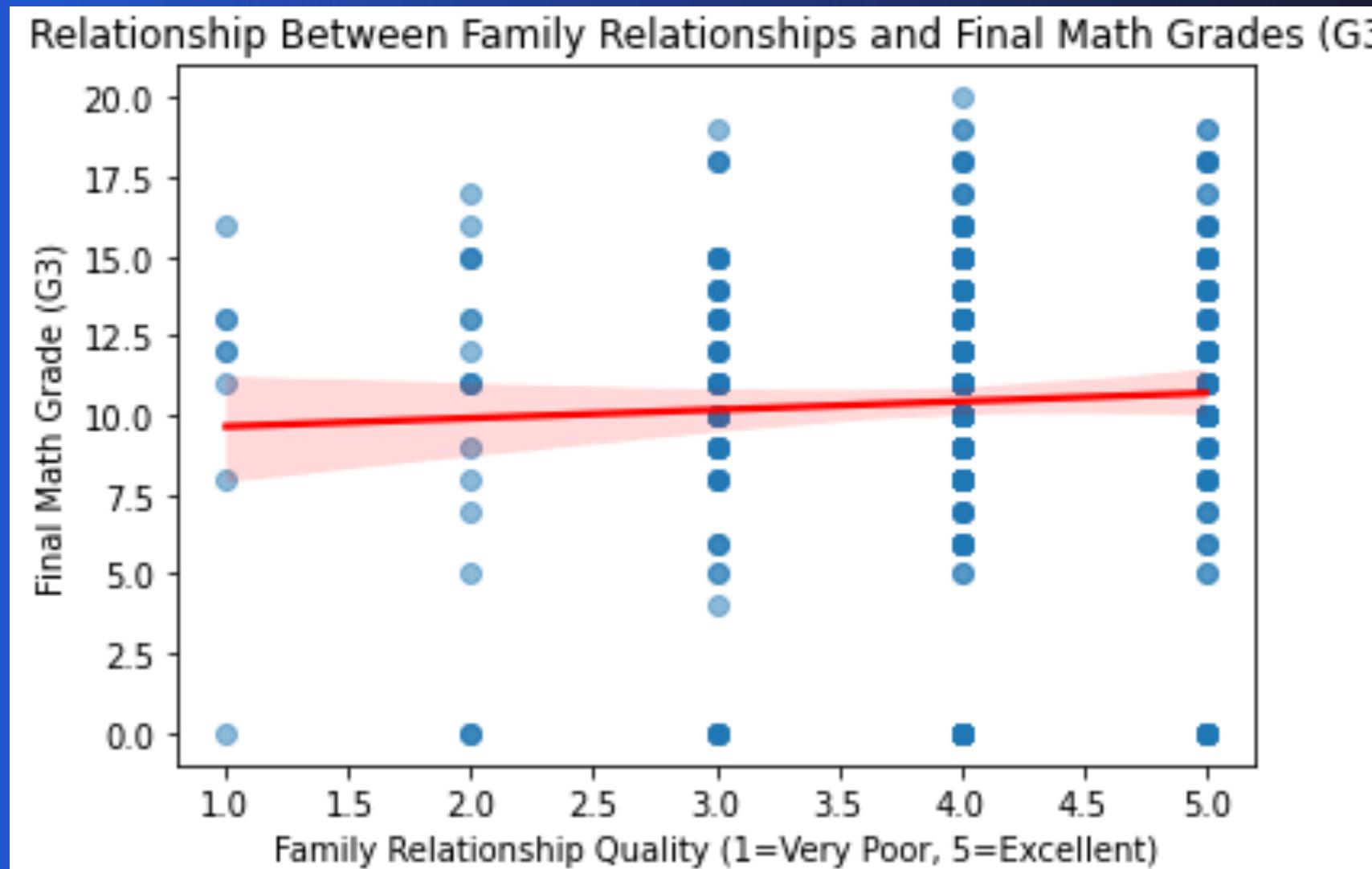
Findings corresponding to the question 1 (cont')

How do parental education levels and occupations influence students' mathematics grades in secondary school? (Relationship between education level and occupation)



Findings corresponding to the question 2

What role does students' health and family relations play in their academic performance, specifically in mathematics?

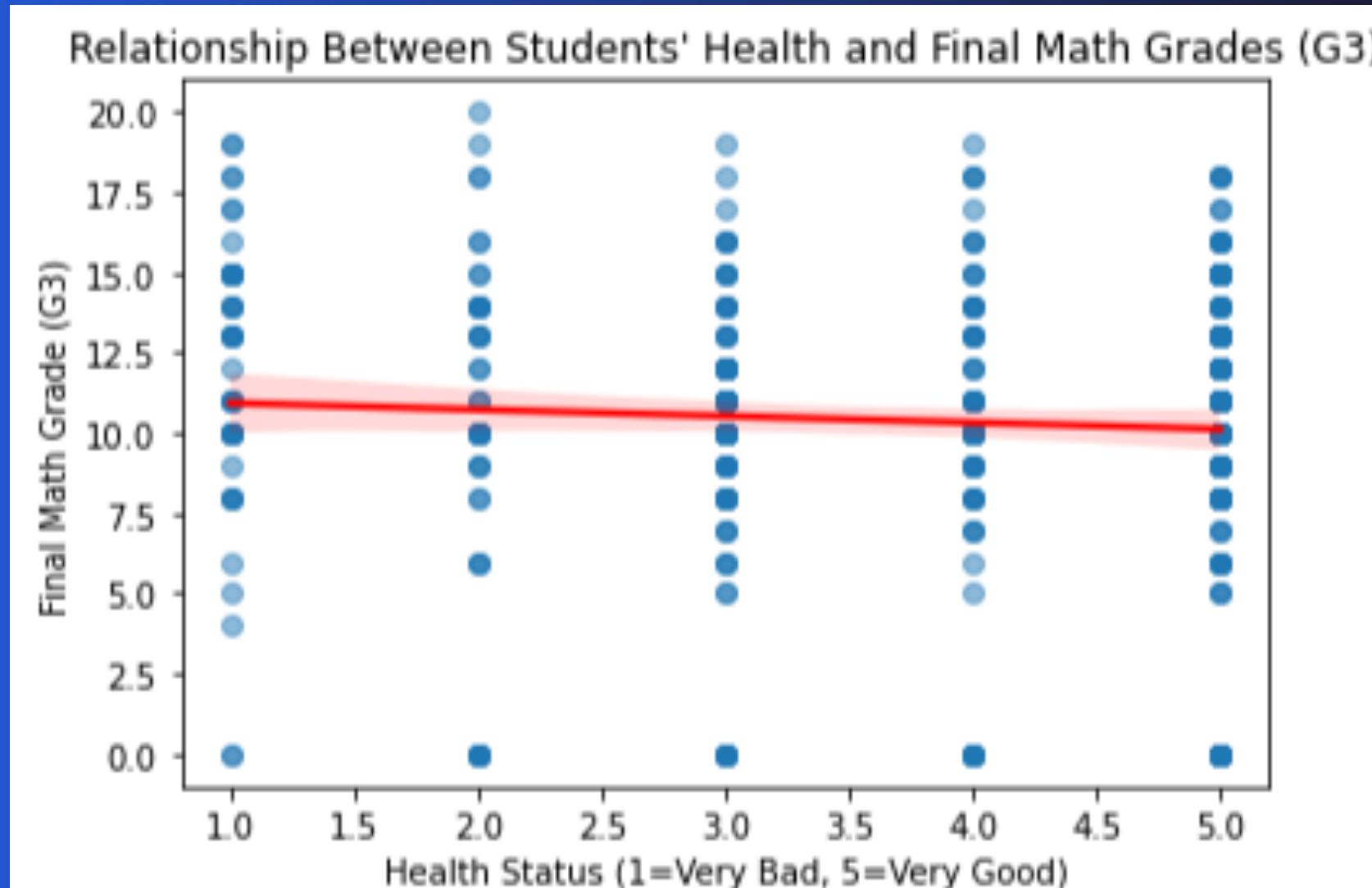


Weak correlation.
Generally, a higher quality of family relationships value is associated with a higher final grade, vice versa

Correlation coefficient between quality of family relationships and final grades: 0.051363428881282175
p-value: 0.3085520210463087

Findings corresponding to the question 2 (cont')

What role does students' health and family relations play in their academic performance, specifically in mathematics?



Weak correlation.
Generally, a higher health value is associated with a lower final grade, vice versa

Correlation coefficient between health and final grades: -0.06133460487712129
p-value: 0.22387701011517758

Key solutions

1. Schools could develop programs that equip parents with tools to support their children's homework and learning processes aimed at increasing parental engagement, especially tailored for parents with lower educational attainments.
2. Establish community learning centers that offer educational resources and tutoring services. These centers can serve as hubs where parents receive guidance on supporting their children's educational paths.

Conclusion

1. There is a significant positive correlation between father & mother's education and student grades. Occupation would affect the mathematic performance, this can also relate to the education level.
2. A higher quality of family relationships value is associated with a higher final grade, vice versa
A higher health value is associated with a lower final grade, vice versa



Future works

1. Consider the impact of the school environment, neighborhood characteristics, and access to educational resources on student outcomes.
2. Develop and test specific educational interventions designed to mitigate the disadvantages faced by students from lower educational backgrounds. These could include parental training programs, enhanced after-school tutoring, or digital learning tools.



Acknowledgements and References:

1. Cripps, K., & Zyromski, B. (2009). Adolescents' Psychological Well-Being and Perceived Parental Involvement: Implications for Parental Involvement in Middle Schools. *RMLE Online*, 33(4), 1–13.
<https://doi.org/10.1080/19404476.2009.11462067>
2. Widlund, A., Tuominen, H., & Korhonen, J. (2018). Academic Well-Being, Mathematics Performance, and Educational Aspirations in Lower Secondary Education: Changes Within a School Year. *Frontiers in Psychology*, 9. <https://doi.org/10.3389/fpsyg.2018.00297>
3. Wilson Fadiji, A., & Reddy, V. (2023). Well-being and mathematics achievement: What is the role of gender, instructional clarity, and parental involvement? *Frontiers in Psychology*, 13.
<https://doi.org/10.3389/fpsyg.2022.1044261>
4. Wijaya, T. T., Rahmadi, I. F., Chotimah, S., Jailani, J., & Wutsqa, D. U. (2022). A Case Study of Factors That Affect Secondary School Mathematics Achievement: Teacher-Parent Support, Stress Levels, and Students' Well-Being. *International Journal of Environmental Research and Public Health*, 19(23), 16247.
<https://doi.org/10.3390/ijerph192316247>
5. Dataset - Kaggle - Student Performance Dataset
(<https://www.kaggle.com/datasets/devansodariya/student-performance-data?resource=download>)



*Thank
you!*