Part_II_explanatory_template

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1 Part II - Factors affecting student performance on standardized exams

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2 Investigation Overview

I am intersted in the relationships between exam scores and: student belonging at school, parent education, and access to reading material and time spent reading.

2.1 Dataset Overview and Executive Summary

1. The dataset is a subset of a much larger dataset that focuses only on the columns needed for the following visualizations and a random sampling of around 1200 rows.
2. I will show that there is a positive correlation between exam scores and:
    a. Highest level of education achieved by household parents
    b. The time spent reading when the number of books in the home is included as a factor
    c. The student's sense of belonging in school

[1]:
```
# import all packages and set plots to be embedded inline
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

# suppress warnings from final output
import warnings
warnings.simplefilter("ignore")
```

[5]:
```
# load in the dataset into a pandas dataframe
df = pd.read_csv('/Users/amand/WGU/Communicating Data Findings_A Doty_01.20.24/
 ↪student_qqq_sub.csv')

df.head()
```

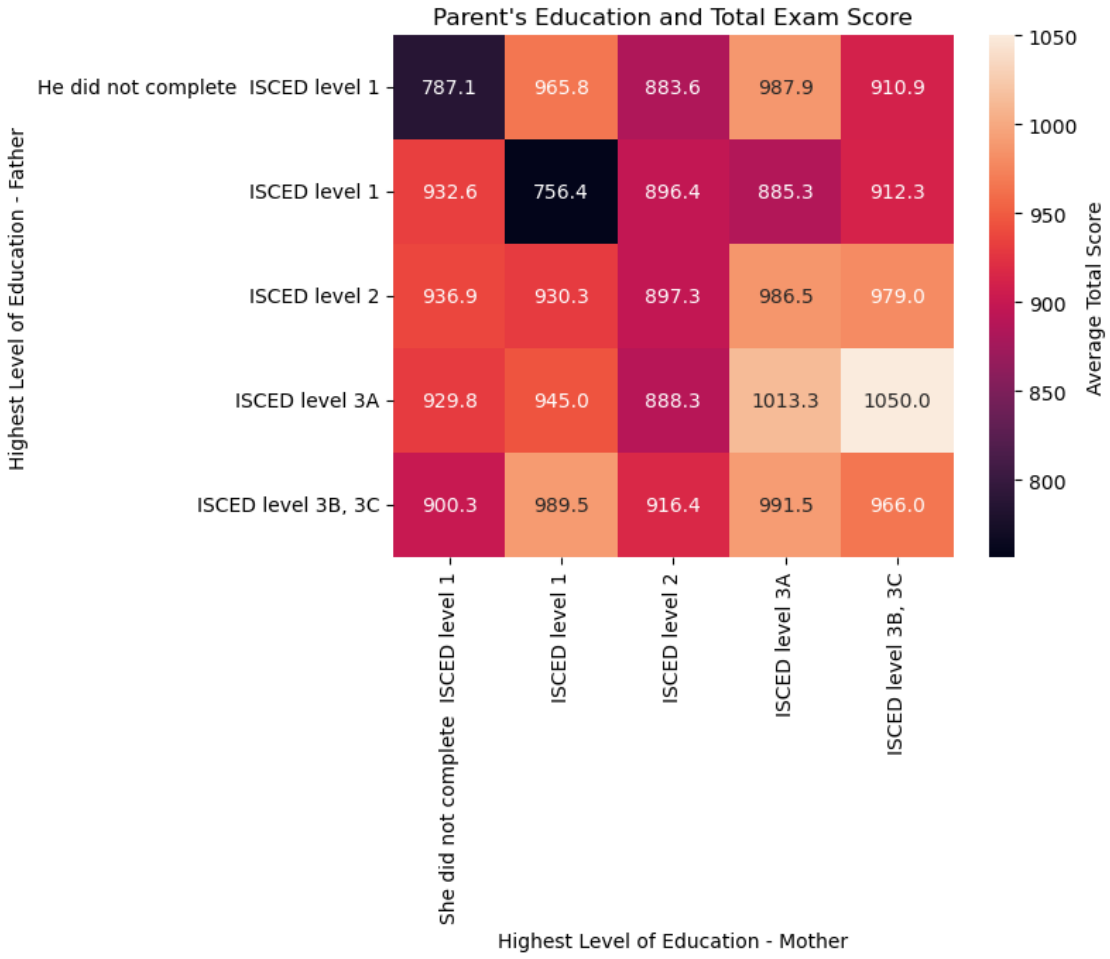
[5]:
```
           mother_edu          father_edu      qty_books   repeated  \
0      ISCED level 3A      ISCED level 3A   26-100 books  No, never
1      ISCED level 3A  ISCED level 3B, 3C   26-100 books  No, never
2      ISCED level 3A      ISCED level 3A    11-25 books  No, never
3  ISCED level 3B, 3C      ISCED level 3A  201-500 books  No, never
4      ISCED level 3A       ISCED level 2  101-200 books  No, never

                  time_reading           outsider    belong  tmins  wealth  \
0    30 minutes or less a day  Strongly disagree     Agree   1650       0
1  I do not read for enjoyment           Disagree  Disagree   1620       0
2    30 minutes or less a day           Disagree  Disagree   1350      -1
3          1 to 2 hours a day  Strongly disagree     Agree   1650       0
4    30 minutes or less a day  Strongly disagree     Agree   1980       0

   pv1math  pv1read  avg_score  tot_score
0  697.233  650.848   674.0405   1348.081
1  501.317  449.588   475.4525    950.905
2  520.497  404.564   462.5305    925.061
3  563.845  522.237   543.0410   1086.082
4  459.993  444.200   452.0965    904.193
```

2.2 The effect of parent education on student exam performance

As can be seen, the more education obtained by household parents, the better students perform on standardized exams. This could be due to several reasons, and is worth further study. For example, do parents who go to school for longer make more money, which could allow for personalized tutoring, or better school districts? Or does more education allow for better access to resources? Because there are several additional factors that could explain this result, I cannot say that parents' education **cause** better scores, but instead they tend to be positively correlated.

[10]:
```
mo_edu=['She did not complete  ISCED level 1','ISCED level 1','ISCED level␣
 ↪2','ISCED level 3A', 'ISCED level 3B, 3C']
mo_classes=pd.CategoricalDtype(ordered=True, categories=mo_edu)
df['mother_edu'] = df['mother_edu'].astype(mo_classes)

cat_means = df.groupby(['mother_edu', 'father_edu']).mean()['tot_score']
cat_means = cat_means.reset_index(name='tot_score_avg')
cat_means = cat_means.pivot(index='father_edu', columns='mother_edu',
                            values='tot_score_avg')
sns.heatmap(cat_means, annot=True, fmt='.1f',
            cbar_kws = {'label' : 'Average Total Score'})
plt.xlabel('Highest Level of Education - Mother')
plt.ylabel('Highest Level of Education - Father')
plt.title("Parent's Education and Total Exam Score")
```

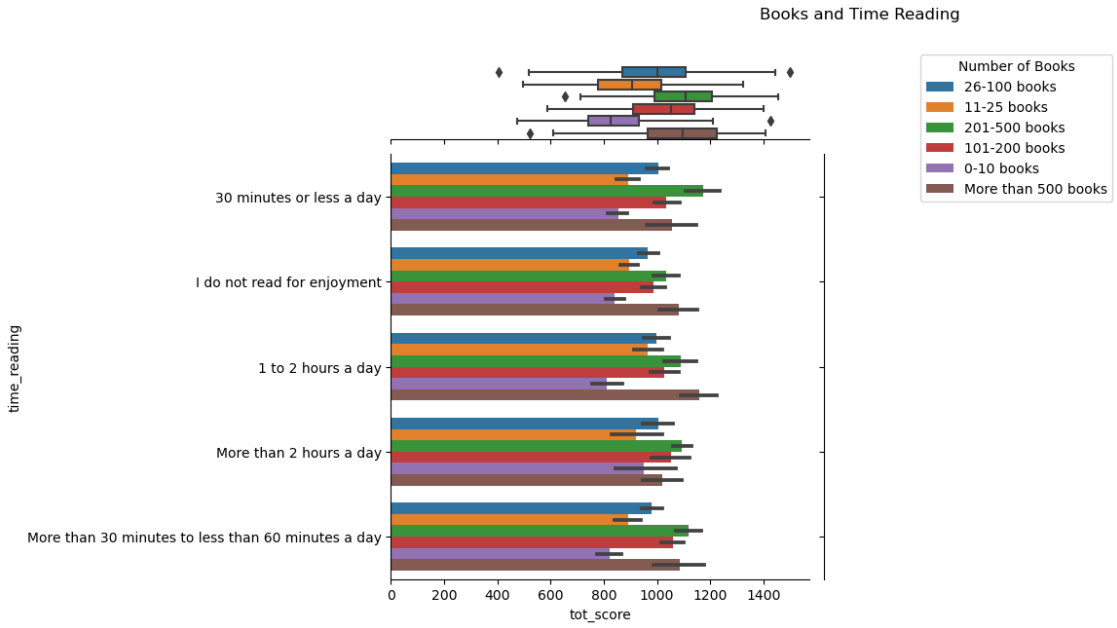
[10]:
```
Text(0.5, 1.0, "Parent's Education and Total Exam Score")
```



2.3 Access to books, time spent reading, and exam score

The below visual shows a positive correlation between the number of books in the home and time spent reading, which in turn has a slight positive correlation to exam scores. Again, there are many other factors that could also be playing a role in this correlation, primarily wealth. Books are a luxury item, and as such, households that have many books are likely to be wealthier, and therefor able to afford better schools, tutoring, or other educational luxuries that could positively impact a student's performance.

[12]:
```
g = sns.JointGrid(data=df, x="tot_score", y="time_reading", hue="qty_books");
g.plot_joint(sns.barplot)
sns.boxplot(data=df, y=g.hue, x=g.x, ax=g.ax_marg_x);

sns.move_legend(g.ax_joint, "upper left", title='Number of␣
 ↪Books',bbox_to_anchor=(1.25, 1.25))

plt.title('Books and Time Reading',y=1.0,pad=100.0);
```



2.4 School relationships and exam scores

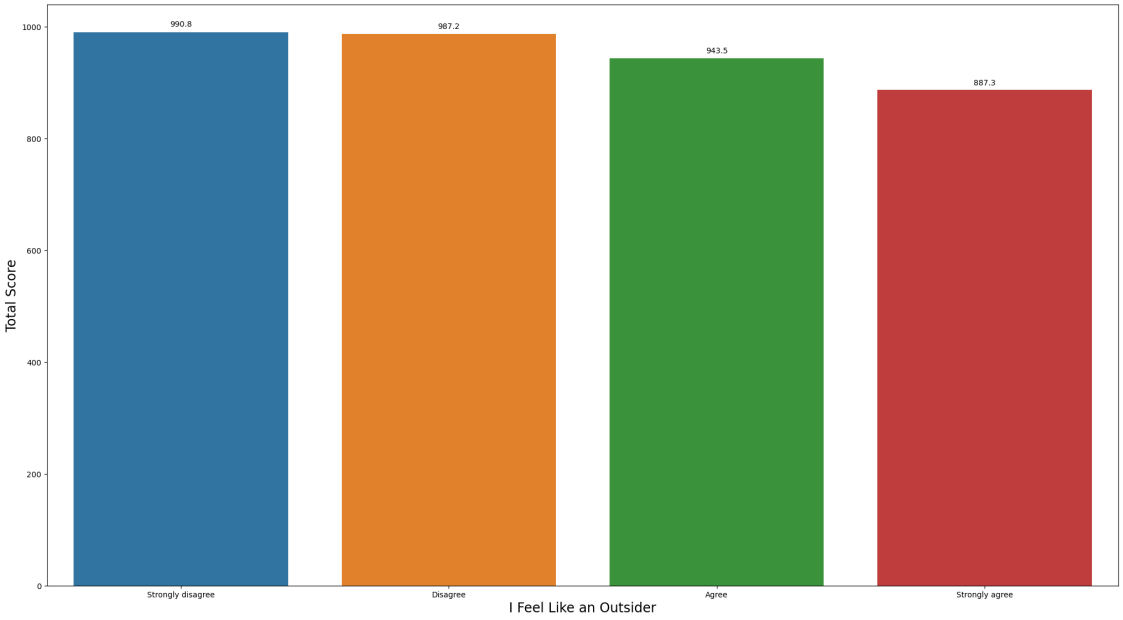
There is a definite correlation between a sense of belonging and test scores. This could be to several factors, including extra curricular activies, attendance, behavior, teacher attention, and peer relationships. As such, I cannot declare a causal relationship, but there does appear to be a significant positive correlation between feeling safe and happy at school and exam scores.

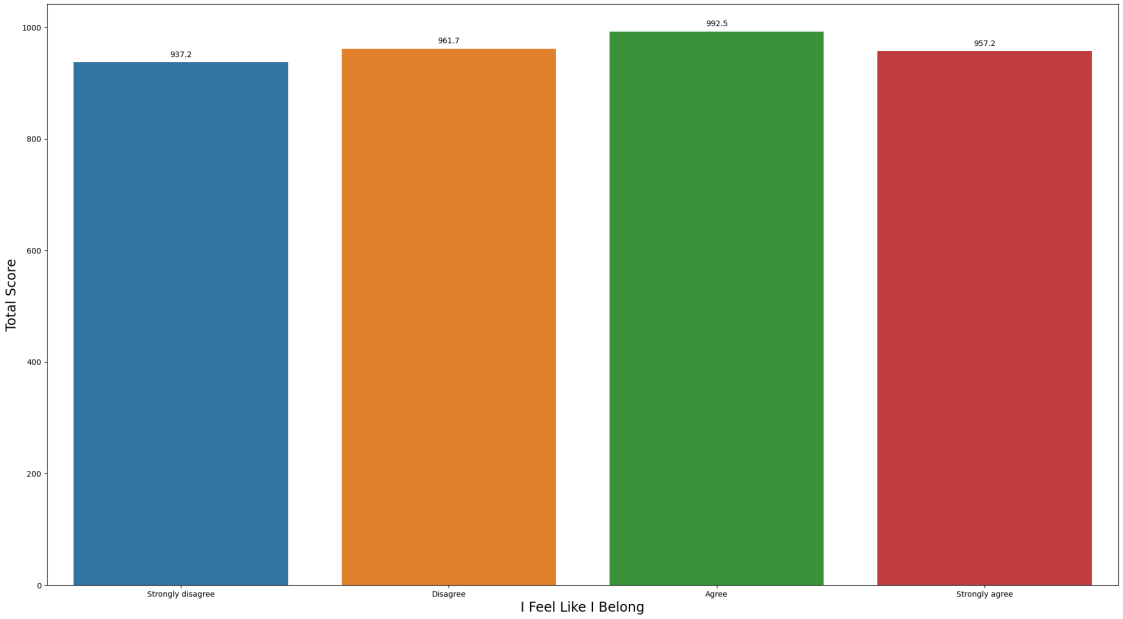
[31]:
```
def show_values(axs, orient="v", space=.01):
    def _single(ax):
        if orient == "v":
            for p in ax.patches:
                _x = p.get_x() + p.get_width() / 2
                _y = p.get_y() + p.get_height() + (p.get_height()*0.01)
                value = '{:.1f}'.format(p.get_height())
                ax.text(_x, _y, value, ha="center")
        elif orient == "h":
            for p in ax.patches:
                _x = p.get_x() + p.get_width() + float(space)
                _y = p.get_y() + p.get_height() - (p.get_height()*0.5)
                value = '{:.1f}'.format(p.get_width())
                ax.text(_x, _y, value, ha="left")

    if isinstance(axs, np.ndarray):
        for idx, ax in np.ndenumerate(axs):
            _single(ax)
    else:
```

```
        _single(axs)
```

[61]:
```
outsider=['Strongly disagree','Disagree','Agree','Strongly agree']
out_classes=pd.CategoricalDtype(ordered=True, categories=outsider)
df['outsider'] = df['outsider'].astype(out_classes)

belong=['Strongly disagree','Disagree','Agree','Strongly agree']
belong_classes=pd.CategoricalDtype(ordered=True, categories=belong)
df['belong'] = df['belong'].astype(belong_classes)

fig, ax = plt.subplots(2,1,figsize=(25,30))
plt.suptitle('Sense of Belonging and Total Exam Score',size='xx-large');

a = sns.barplot(data=df, x="outsider", y="tot_score", ci = None, ax=ax[0]);
show_values(a);
ax[0].set_xlabel('I Feel Like an Outsider', size='xx-large');
ax[0].set_ylabel('Total Score',size='xx-large');

b = sns.barplot(data=df, x='belong',y='tot_score', ci=None,ax=ax[1]);
show_values(b)
ax[1].set_xlabel('I Feel Like I Belong',size='xx-large')
ax[1].set_ylabel('Total Score',size='xx-large');
```

Sense of Belonging and Total Exam Score





[ ]: