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Does "Gender Distribution" in schools affect "School's Performance"?

(An analysis of School's performance in England)

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1 Overview

It is very important to judge schools to know how effective they are in educating the people of a country. This helps us in identifying the schools which are falling short or require additional support and to separate out the good performers from the worst performers. School's performance being highly dependent on the teaching and management quality also depends on how well the student performs after being taught. And from one of the ways to evaluate school's performance is to evaluate the performance of its students.

There can be many factors which can be held responsible for a school performing better or worst. From how well the infrastructure of the school is to how much fees the school charges, all can be investigated to find out some relation with the school's performance.

The intent of this analysis is to investigate whether different gender and their distribution in a school have some effect on the school's performance.

We have considered the data of schools in England and their performance from the UK government website https://www.compare-school-performance.service.gov.uk/ for this specific analysis. We will start with understanding the distribution of boys and girls population in schools in England. Once we understand how the male and female population are distributed across England schools, we will start with analysing the effects of number of male and female pupils in a school. The focus will be to study the effect (if any) of number or fraction of boys/girls in a school to the school's performance.

We will consider two different metrics for evaluation of the school performance. The first is the OFSTED ratings of schools (We will discuss what these are in the later section) and Pupil's performance in Reading, Writing and Mathematics. The pupil's performance metrics will also be combined together to give us an overall pupil's performance. As mentioned earlier, pupil's performance is one of the ways to evaluate a school.

2 The Data used and its relevance

As mentioned in the previous section, we have considered data from the UK Government website https://www.compare-school-performance.service.gov.uk/ for the analysis. The data we have considered are the following:

- **School Information data:** It contains information about the schools such as School-URN (Unique reference number), School-Name, School-Address, Gender (Male, Female, Mixed), OFSTED-Rating. We will discuss OFSTED-Rating (A measure of school's performance) in detail in the later sections.
- **Final key stage 2 Performance data:** It contains data about Primary schools pupils' performance (progress scores) in Reading, Writing and Mathematics. We will discuss what these scores indicate in the later section.
- **Census data of pupil types:** It contains data about pupils in england's schools such as Number of Male pupils on roll, Number of Female students on roll, Percentage of Male pupils on roll, and Percentage of Female pupils on roll.

Note that the data used for pupil's performance is that of Primary schools. Only Primary school data is considered because they are concerned with teaching foundational skills to the students which are then used across all subjects domains. And also because, It is the most effective stage which can be used to assess a child's progress.

3 Boy and Girl pupils in England's Schools

In this section, we will understand how male and female pupils are distributed in schools in England. Here, we will attain this understanding by dividing the section into two parts. First, we will look at how single-sex schools are distributed in England i,e. A comparison of number/percentage of Boys-only schools and Girls-only schools. Second, we will learn what the Boys-Girls ratio is in a school in England on an average.

Let us first understand the schools in England. Schools in England can be classified into the following three categories:

1. **Boys-only schools:** A school with only Boys as students/pupils.
2. **Girls-only schools:** A schools with only Girls as students/pupils.

3. **Mixed schools:** Schools with both Boys and Girls as pupils. Can also be referred as Co-education schools.

Boys-only schools and Girls-only schools can be referred as single-sex schools as they only accommodate pupil of a single sex.

In England the majority of the schools are "Mixed" type schools, meaning the schools which accommodate both male and female pupils. It is amazing that only 2.6% of all schools are single-sex schools rest all are Mixed as can be seen in the figure 1 below.

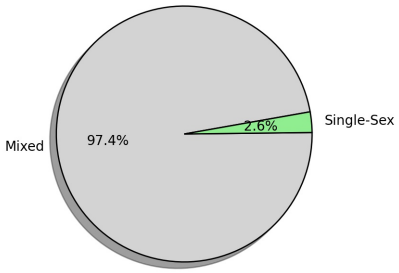

Figure 1: Mixed Vs Single-sex schools in England

3.1 Single-Sex schools

Let us delve deep into understanding how the single-sex schools actually are divided in England between Boys-only and Girls-only schools. We will later also discuss how they perform and which among them performs better than the other.

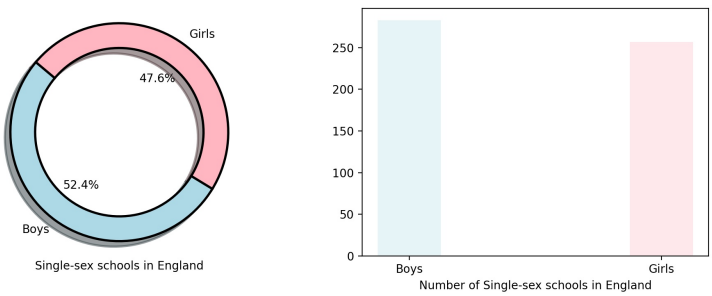

Figure 2: Single-sex schools in England

The figure 2 shows us that when it comes to single-sex schools, both (Boys-only & Girls-only) schools are divided equally. We can see that the approximately half of single-sex schools are Boys-only schools and other half of them are Girls-only schools. Boys-only schools are slightly more than Girls-only schools, by 4.8%.

3.2 Girl/Boy ratio in an average Mixed school

Now let us see how Boys and Girls student population are inside an average Mixed school in England.

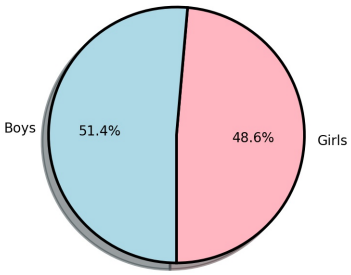

Figure 3: Girls/Boys pupils in a Mixed school on an average

Interestingly, we see that on an average you will find almost half of the students in a school are Boys and rest half are Girls. Also, it is important to note that still on an average there are slightly more boys than girls in a Mixed school, by 2.8%.

This knowledge about Boy and Girl pupils in England's schools is very helpful to give an idea about how reliable we can say our analysis will be, in detecting obvious flaws/errors in the data which may effect the analysis and allow us to have a clear idea about the population in schools in general.

To summarise, we can say that Boys and Girls are almost equally distributed between single-sex schools and within an average Mixed school.

4 The school performance metrics used: OFSTED ratings & Pupil's progress scores

In this section we will briefly discuss what metrics are used to measure the performance of a school and understand what they mean.

The first metric that we have used is the **OFSTED Rating** of schools. Ofsted is the Office for Standards in Education, Children's Services and Skills. They inspect schools for quality and performance. And they grade schools according to the school's quality and performance into the following four categories:

1. Outstanding
2. Good

3. Requires Improvement
4. Inadequate

With Outstanding being the best and Inadequate being the worst.

Another metric that is considered are the **Pupil's progress scores** of pupil in Reading, Writing and Mathematics. Primary schools are further classified into key stages in England, with age group 4-7 years making the key-stage 1 and 7-11 years making key-stage 2. These progress scores tell us the progress made by the pupil at the end of his/her key stage 2 compared to his/her performance at the end of key-stage 1. A progress score more than zero means that the pupil made more progress on an average than pupils who got similar results at the end of key-stage 1 and a progress score less than zero means that the pupil made very less progress on an average than pupils who got similar results at the end of key-stage 1.

Having a brief understanding about these metrics is important for us be confident in our analysis. So now, we begin our analysis.

5 What do Single-sex schools tell us?

So, now we begin our analysis of school-performance with respect to gender and in this section we will look at how different school performance's are between Boys-only schools and Girls-only schools. This will give us some idea about whether gender influence school's performance in some way or not.

For this section we will use OFSTED ratings as a metric to judge school's performance. In the figure 4 below we have combined schools with "Outstanding" and "Good" ratings together as "Fair schools" and schools with "Requires Improvement" and "Inadequate" ratings together as "Poor schools". The comparison is between Boys-only schools and Girls-only schools.

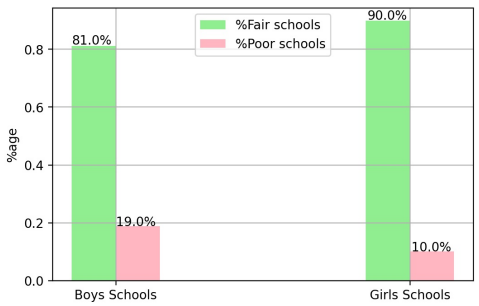

Figure 4: Single-sex schools performance

Figure 4 shows single-sex schools in England along with the ratings they have. The schools are divided into Boys-only and Girls-only schools. For each type you can see the percentage of "Fair schools" and "Poor schools".

Keeping in mind from the previous section that single-sex schools in England are almost equally divided amongst Boys-only and Girls-only schools, It is interesting to note how Girls-only schools have a higher percentage of "Fair schools" than the Boys-only schools. Also, it can be seen that the Girls-only schools have lesser "Poor schools" as compared to Boys-only schools.

In order to say that a particular type is performing good or is better than the other, we expect a higher percentage of "Fair schools" or fair performing schools and a lower percentage of "Poor schools" or poor performing schools. In our case above we can see that Girls-only schools seems to perform better than Boys-only schools in England.

Let us have a closer look at their performance before concluding our analysis. Below in figure 5 you can see a similar plot without merging OFSTED ratings but keeping them as they are for both types of schools.

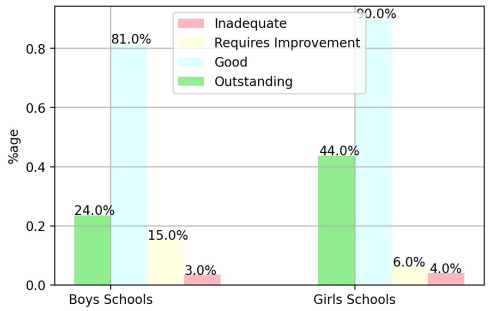

Figure 5: Single-sex schools performance (OFSTED)

In the figure 5 above we can see the distribution of ratings for Boys-only schools and Girls-only schools. Before we study this plot and conclude anything from it, the following must be understood:

1. A higher number of schools with "Outstanding" rating is a good sign for a category. The more "Outstanding" schools it has the better.
2. Outstanding schools are then followed by Good schools. More number of "Good" schools is also acceptable and desirable. A Good school does not mean it is better than an Outstanding school but is still desired.
3. High number of schools with "Requires Improvement" rating is not desirable for any category. The less number of schools with "Requires Improvement" rating the better.

4. The worst rating is the "Inadequate" rating. Therefore the less number of schools with this rating the better for any category.

Once we understand the ratings properly, and we understand how we will interpret the plot to judge between Boys-only schools and Girls-only schools, we can summarise the plot in the following points:

- Girls-only schools have higher percentage of "Outstanding schools" than Boys-only schools. And Girls-only schools also have a lower percentage of schools with "Requires Improvement" rating when compared to Boys-only schools. Judging by these two ratings we can say that Girls-only schools are performing better generally.
- On the other hand, Boys-only schools seem to have higher percentage of "Good schools" than Girls-only schools. Also, the percentage of "Inadequate schools" is lower for Boys-only schools than Girls-only schools. If we judge based on these two ratings then maybe we conclude that Boys-only schools are better performing generally.
- It is also important to note that the percentage difference in the "Inadequate" rated schools between the two categories is very low (just 1%). So we can maybe not consider any of them to be better than the other based on this.
- The difference in the "Outstanding" schools between the two categories is considerably high (i,e 20%). Which makes Girl-only schools to be in a much better position when comparing.

Based on what was analysed above we can say that even though Boys-only schools may have a higher percentage of "Good" schools than Girls-only schools, overall the Girls-only schools perform better than the Boys-only schools in England.

6 What does Boy/Girl ratio in schools tell us?

In this section, we will take Mixed schools in England for analysis as they make up for 97% of schools in England (see figure 1). The aim is to understand if Percentage/Number of pupils of any gender have any impact on the school performance.

The metrics that we will use to judge school performance here will be the pupil's progress scores in Reading, Writing and Mathematics.

6.1 Comparing schools which have different Boys/Girls population

The aim will be to compare schools performance by dividing schools into two categories of schools:

- **Category A:** Schools with Girls more than Boys (%Girls > %Boys)
- **Category B:** Schools with Boys more than Girls (%Boys > %Girls)

The motive here will be to find whether the dominance of a specific gender in schools can actually lead to a better school performance or not.

So we begin with comparing the average progress scores (Reading, Writing and Mathematics) between the two categories of schools mentioned above. See figure 6 below:

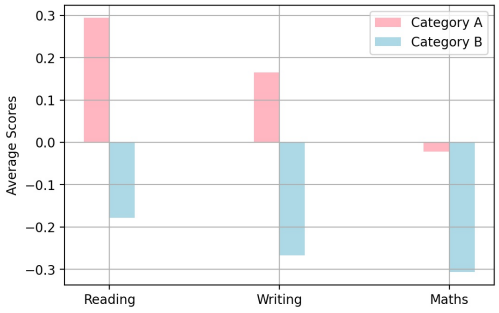

Figure 6: Progress scores in Schools with different Boys/Girls population

Figure 6 shows bar-charts containing average of all the scores in each area (Reading, Writing and Mathematics) for both categories (Schools with High %Boys & Schools with High %Girls).

The plot can be summarised in the following points:

1. Category A seem to perform better than Category B in Reading. The average score of Category A is the highest in Reading as compared to its average score in other evaluation areas (Writing & Mathematics). The average score of Category B on the other hand is also the highest in Reading as compared to its average score in other evaluation areas (Writing & Mathematics).
2. Category A seem to perform better than Category B in Writing. The average score of Category A is still good when compared with their performance in Mathematics but is not as good as their performance in Reading and the same can be said about Category B.

3. Category A seem to perform better than Category B in Mathematics. The average score of Category A is the worst as compared to its average score in other evaluation areas (Reading & Writing) and the same can be said about Category B.

It is clear that the average of scores scored by schools with higher girl percentage (Category A) is better than that of schools with higher boys percentage (Category B) in all three evaluation areas. This is an interesting finding. It actually looks like if girls are more in school the chances of the school performing better is high, We will delve deep into this relationship now.

6.2 Effect of Number of Boys/Girls on Progress scores

Let us see now the affect of "Number of Boys/Girls pupil on-roll in schools" on the "Progress scores" in Reading, Writing and Mathematics.

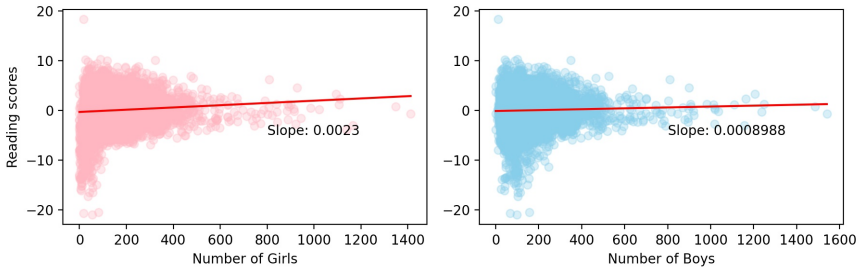

Figure 7: Number of Boys/Girls - Reading scores

Figure 7 summarises the relationship between **"Reading"** progress scores and the Number of Boys/Girls in the schools. In both the plots a positive correlation can be seen between the number of pupils and progress score. A line of best fit is fitted to the scatter plot in both the cases.

It can be seen from the line of best fit that the Number of Girls influence Reading scores more than Number of Boys. This is because the higher the slope of best-fit line is, the more linear the relationship between the two variables become.

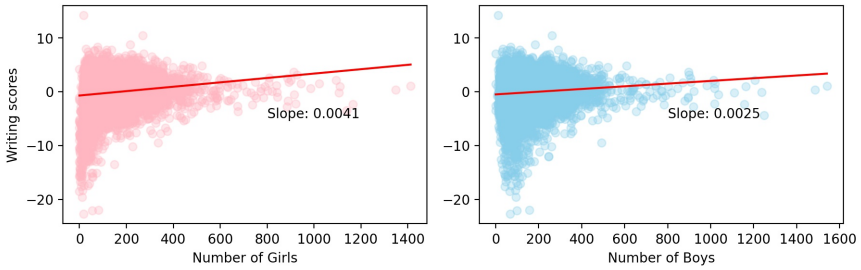

Figure 8: Number of Boys/Girls - Writing scores

Figure 8 summarises the relationship between **"Writing"** progress scores and the Number of Boys/Girls in the schools. In both the plots a positive correlation can be seen between the number of pupils and progress score. A line of best fit is fitted to the scatter plot in both the cases.

It can be seen from the line of best fit that the Number of Girls influence Writing scores more than Number of Boys. This is because the higher the slope of best-fit line is, the more linear the relationship between the two variables become.

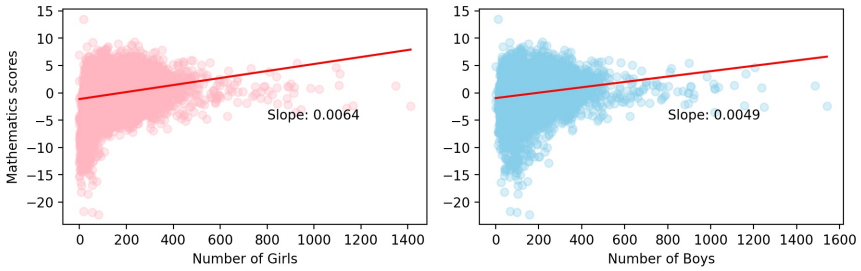

Figure 9: Number of Boys/Girls - Mathematics scores

Figure 9 summarises the relationship between **"Mathematics"** progress scores and the Number of Boys/Girls in the schools. In both the plots a positive correlation can be seen between the number of pupils and progress score. A line of best fit is fitted to the scatter plot in both the cases.

It can be seen from the line of best fit that the Number of Girls influence Mathematics scores more than Number of Boys. This is because the higher the slope of best-fit line is, the more linear the relationship between the two variables become.

To summarise, we found that "Number of Girls" in a school actually affect the progress scores positively and even more than "Number of Boys". So, we can say that the higher number of girls a school has the more likely it is to perform good.

6.3 Summary

In this section we summarise our findings from the previous two sections. Let us look at Girl/Boy ratio in a school directly and see how it affects the progress.

The variable Girl/Boy ratio simply stands for number of girls on-roll in the school divided by number of boys on-roll in the school. If the value of this variable is less than 1 then it means that the number of boys on-roll are greater than the number of girls on-roll in the school. If the value of this variable is more than 1 then this means otherwise.

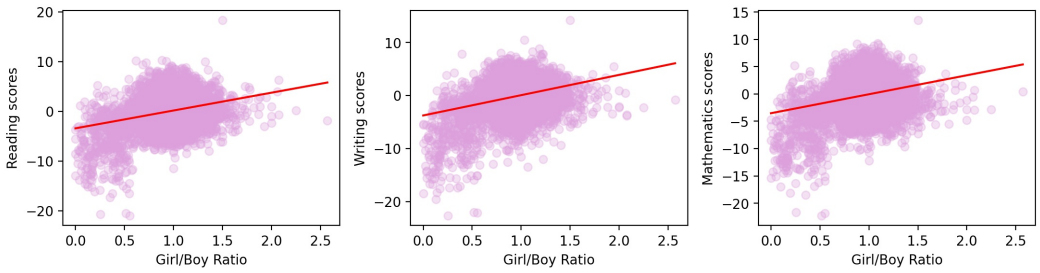

Figure 10: Boy/Girl Ratio - Progress scores

From figure 10 we can see again that as number of girls increase the progress scores tend to increase. The plots above shows progress scores for Reading, Writing and Mathematics and in all the three plots same trend can be seen.

Another interesting point to note here is that for cases where Boys are more than Girls, i.e, where Girl/Boy ratio is less than 1, there is a cluster of negative scores. These negative scores seem to reduce and disappear as we go along with increasing Girl/Boy ratio.

7 Conclusion

A brief summary of what was done and what was found are stated in the following points:

1. We saw that in England the majority of the schools are Mixed-schools and only a few are single-sex schools.
2. We found that Girls-only schools and Boys-only schools are almost divided equally in England.
3. Girl/Boy ratio in an average mixed-school in England is also almost the same.

4. We tried to see how Single-sex schools in England perform and found that Girls-only schools seem to perform better than Boy-only schools.

5. We then compared school performance based on Boy/Girl distribution in schools. And we found that those schools tend to perform better which have higher Girl% than Boys%.

Based on our analysis we can say that varying gender distribution in schools have varying effect on the school's performance with Number of Girl pupils affecting school performance more positively than Boy pupils in the school.