Australia's (Possible) Educational Divide

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Abstract

A comparative study of the effect of student dispositions on mathematics literacy in Australia between public and private schools.

Introduction

The data for this report comes from the Programme for International Student Assessment (PISA) 2012 results. PISA occurs every three years and tests 15 year-old students around the world in math, science, and reading (OECD 2017). The data collected includes test scores, school information, and student and parent information. Part of PISA includes a questionnaire for students with questions ranging from demographics to psychological dispositions.

I am interested in looking at the effect of student disposition on mathematics literacy in Australia between public and private schools. In this case, student disposition can be thought of as the way a student feels about mathematics and his or her mindset and confidence towards solving math problems. There have been a few interesting findings relating to the effects of student dispositions that show a student's self-efficacy has a noticeable effect on math scores (Gabriel, Signolet, and Westwell 2017). Another study conducted in Australia found "private schools achieve better results than public schools" (Buckingham 2000). Buckingham's measures of achievement included test scores and high school graduation percentages. Since PISA contains a plethora of useful information, we can expand on previous research to see if differences in psychological dispositions between public and private school students could help explain the performance gap that Buckingham and others have talked about.

Methods

The statistical analyses in this paper were all done using R (R Core Team 2017). The following R packages were used: h2o (team 2017), data.table (Dowle and Srinivasan 2017), ggplot2 (Wickham 2009), kableExtra (Zhu 2017), and magrittr (Bache and Wickham 2014).

The machine learning approach in this report is heavily influenced by a paper produced by my professor Jason Signolet and his colleagues (Gabriel, Signolet, and Westwell 2017). A gradient boosted machine (GBM) was used to determine possible variables of importance and k-folds was used for cross-validation. 22 of the survey questions relating to student disposition were used as features for the GBM. The survey questions chosen fell into 3 categories: math self-efficacy, math anxiety, and perceived control. The mathematics literacy scores were calculated as the aggregate of the 5 plausible values (PV1MATH, PV2MATH, PV3MATH, PV4MATH, PV5MATH) weighted by the final student weight (W_FSTUWT).

Results

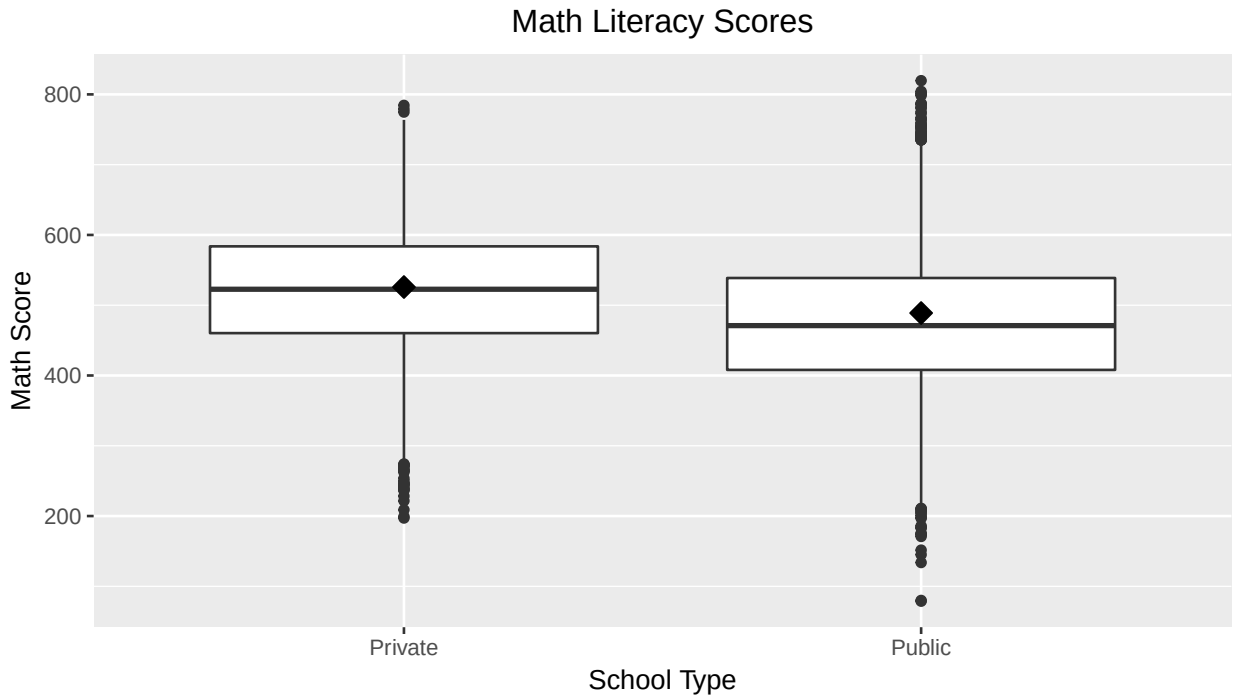


Figure 1: Breakdown of mathematics literacy scores based on school type. The diamond represents the weighted average.

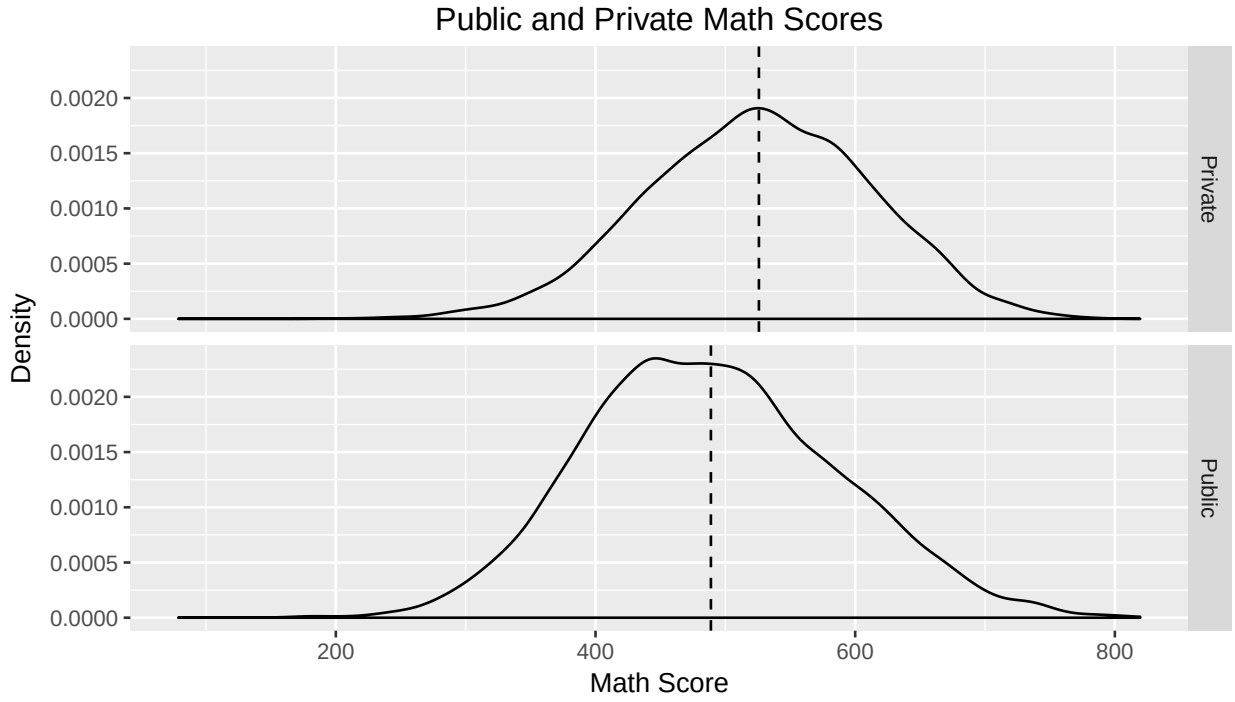


Figure 2: A density plot for public and private schools. The dashed line represents the weighted average.

Private School Variables of Importance

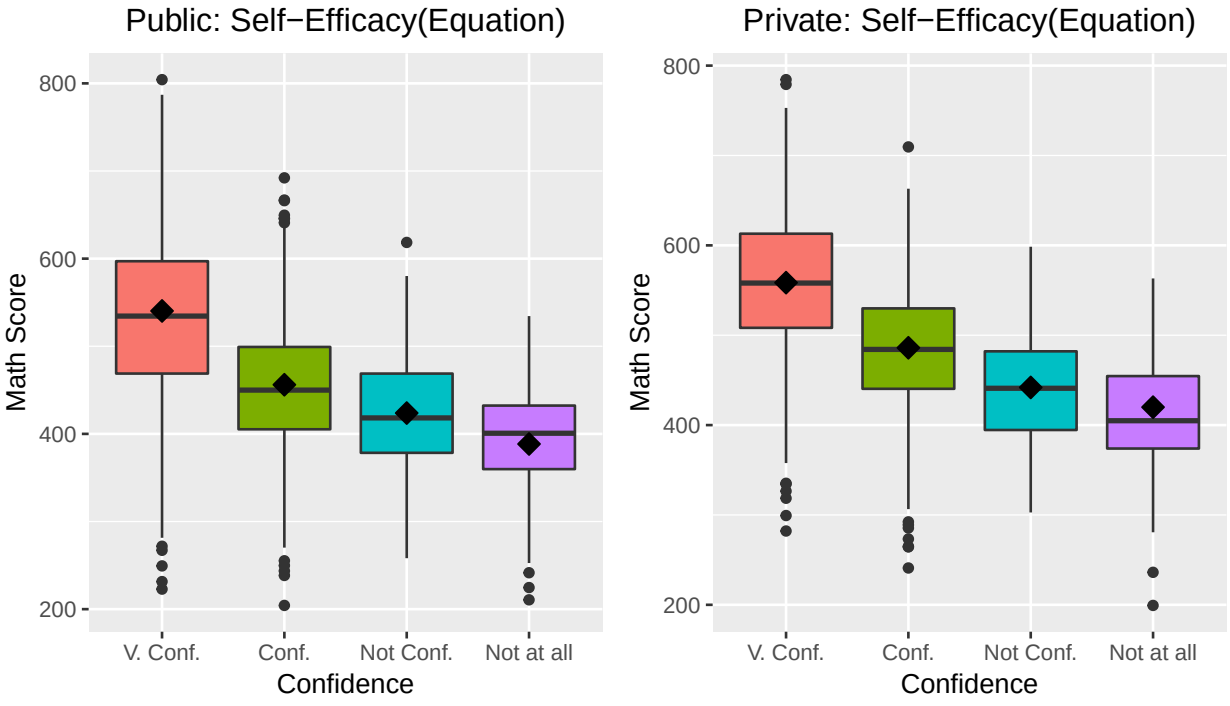
variable	relative_importance	scaled_importance	percentage
ST37Q05	52953232	1.0000000	0.2845634
ST42Q02	22098394	0.4173191	0.1187537
ST37Q06	17623804	0.3328183	0.0947079
ST43Q06	14371999	0.2714093	0.0772331
ST37Q07	13307177	0.2513006	0.0715109
ST37Q04	8040667	0.1518447	0.0432094

Table 1:

Public School Variables of Importance

variable	relative_importance	scaled_importance	percentage
ST37Q05	88113232	1.0000000	0.2597299
ST37Q04	59034352	0.6699828	0.1740145
ST42Q02	33932372	0.3850996	0.1000219
ST43Q06	24762620	0.2810318	0.0729923
ST37Q06	16903930	0.1918433	0.0498274
ST42Q04	13466584	0.1528327	0.0396952

Table 2:



Public: Confidence in Solving Equation

Private: Confidence in Solving Equation

Figure 3:

Self_Efficacy	percent
Very confident	0.4530841
Not very confident	0.1446729
Confident	0.3708411
Not at all confident	0.0314019

Self_Efficacy	percent
Very confident	0.6070196
Confident	0.2934407
Not very confident	0.0834292
Not at all confident	0.0161105

Table 3:

Figure 4:

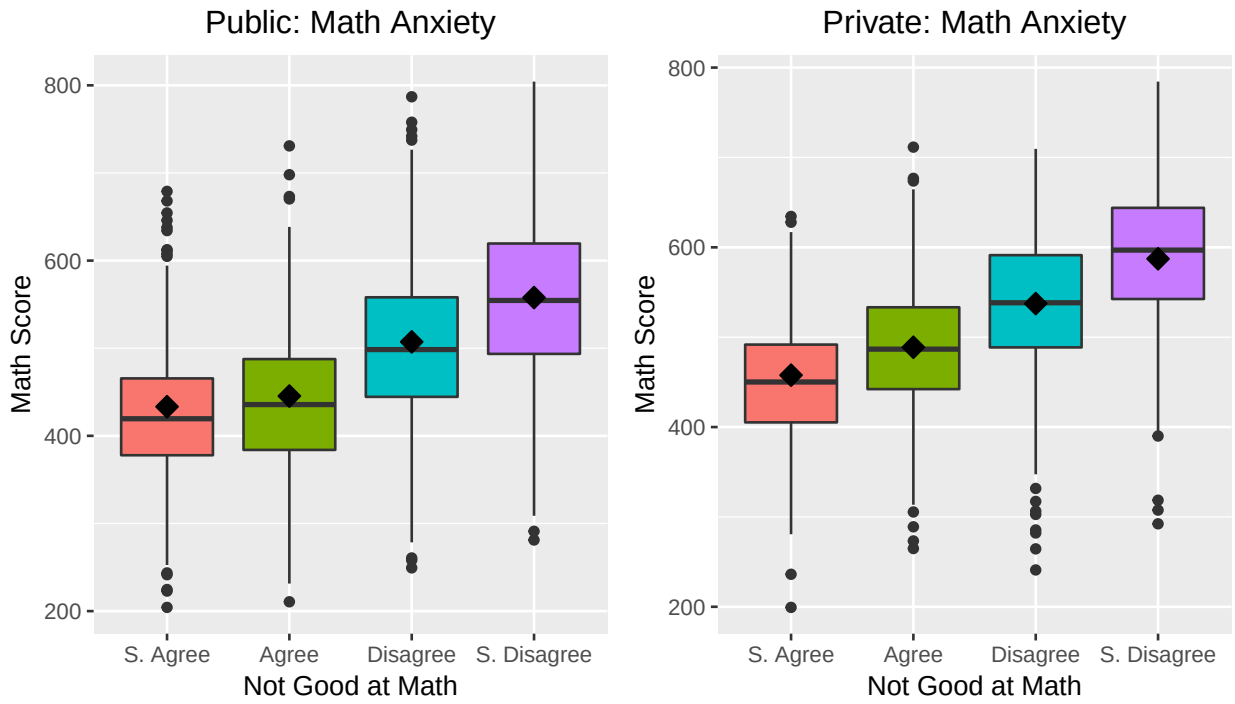


Figure 5:

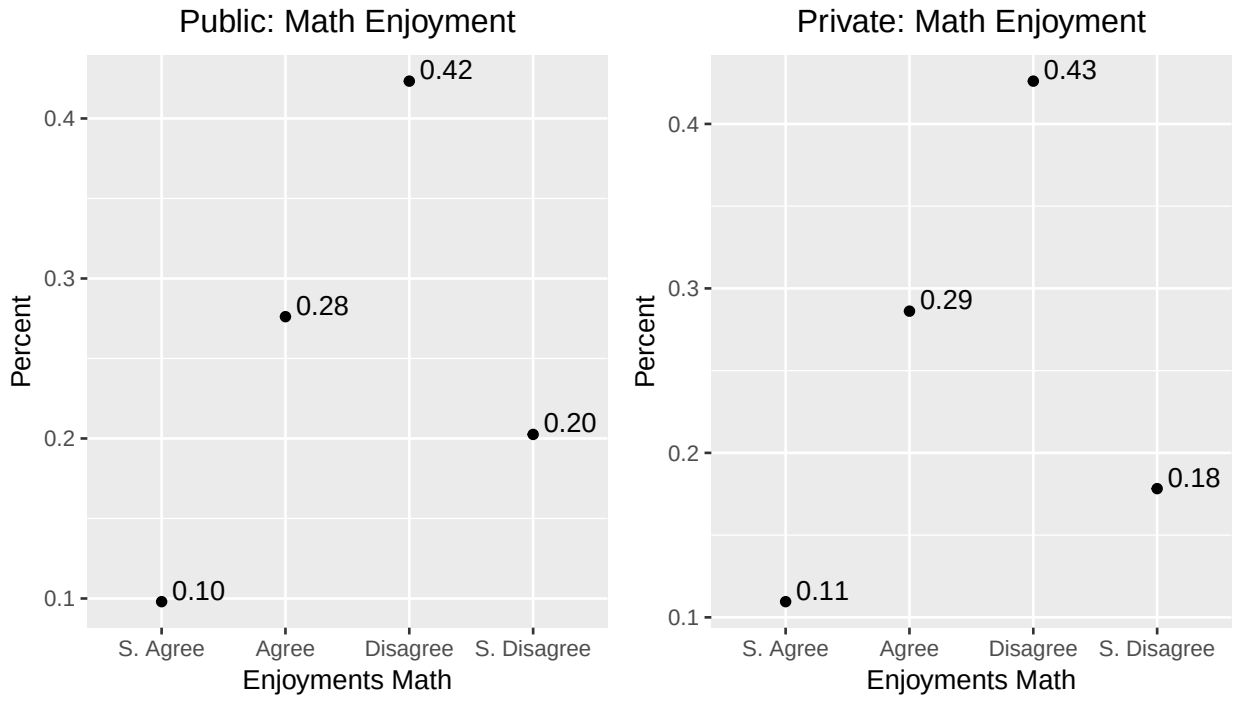


Figure 6:

Discussion

Include towards end of discussion or in the conclusion some of the results from other paper (Buckingham 2000).

Australia's national average: 504.
Average score for public schools: 489.
Average score for private schools: 526.

Conclusion

What are the main points to draw from the discussion? Is there further investigation warranted?

References

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