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EQUITY IN EDUCATION: INVESTIGATING REGIONAL DISPARITIES IN TEACHERS' ACADEMIC APTITUDE

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Do all Australian children have the same access to high-aptitude teachers? We investigate this question using data on the location and academic aptitude of high-school teachers in NSW. We find that high-aptitude teachers are less likely to work in disadvantaged areas where students perform poorly in NAPLAN and where their impact on educational outcomes could be largest. This uneven distribution of high-aptitude teachers has the potential to worsen educational inequalities.

Educational inequality is a pressing problem in Australia. Despite a series of recent reforms (Productivity Commission, 2022), students from rural and low socioeconomic status (SES) areas continue to perform well below their peers (OECD, 2018). These disparities are partly driven by unequal access to education inputs, such as school facilities and teachers (OECD, 2022).

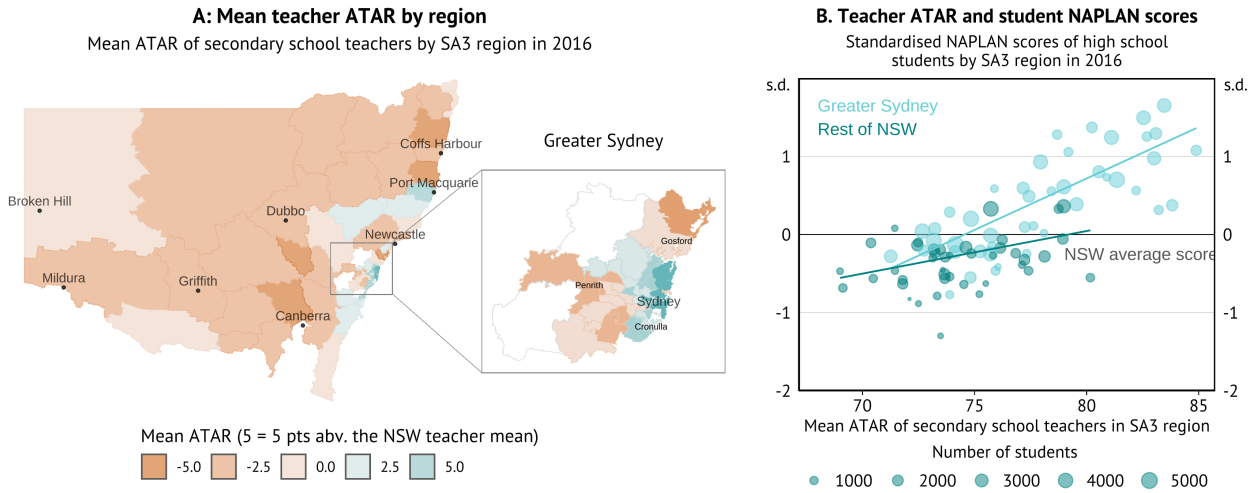
In this note, we analyse the spatial distribution of one of the most important of these education inputs: high-quality teachers (Chetty et al., 2014; Jackson, 2018). To do so we examine the prior academic achievement (ATAR) of teachers, which is one of the most consistent predictors of academic aptitude and teacher quality (Hanushek et al., 2019; Leigh & Ryan, 2008).[1]

We focus our attention on NSW secondary school teachers. We use their ATAR scores as a measure of academic aptitude and Census data to determine their place of work.[2] We combine this information with school-level NAPLAN results to compare the distribution of teachers with the achievement of students.[3] Appendix A.1 provides further details on our empirical approach.

High-aptitude teachers tend to work in areas with higher students' performance

We find that teachers with high ATARs are more likely to work in the eastern areas of metropolitan Sydney and on the mid-north coast of NSW (Figure 1 panel A). There is also a strong positive correlation (ρ = 0.79) between the average ATAR of teachers in a given area and the average NAPLAN scores of students in that area (Figure 1 panel B).[4] Notably, this correlation is much stronger within Greater Sydney (ρ = 0.82) than the rest of NSW (ρ = 0.40).

Figure 1: Teacher ATAR and high school student NAPLAN performance



* Standardised NAPLAN scores are calculated at the student-year-domain level (e.g. 1 = 1 s.d. above the NSW mean for that student year and test domain). Scores are aggregated to the SA3 level by taking a weighted mean based on the number of students in each year/domain who sat the test. The mean ATAR of teachers is calculated using Census 2016 place of work information and HEIMS data on all domestic students enrolled in an Australian university from 2005 onwards. Lines of best fit are calculated using weighted OLS.
Sources: ABS; e61

1 Appendix A.2 provides a more detailed discussion of the literature which explores the link between teacher cognitive skills and student outcomes.
2 The Australian Tertiary Admission Rank (ATAR) is used to determine admission to tertiary education in Australia. Students entering university receive their ATAR at the end of grade 12. ATAR is a number between 0 and 99.95 that indicates a student's position relative to others in their age group.
3 The National Assessment Program – Literacy and Numeracy (NAPLAN) is an annual assessment for students in Years 3, 5, 7 and 9.
4 Pearson correlation coefficient weighted by the number of students in each SA3 area. SA3 areas have populations between 30,000 and 130,000 people and represent the area serviced by a regional city or the area serviced by a major transport and commercial hub in a major city.

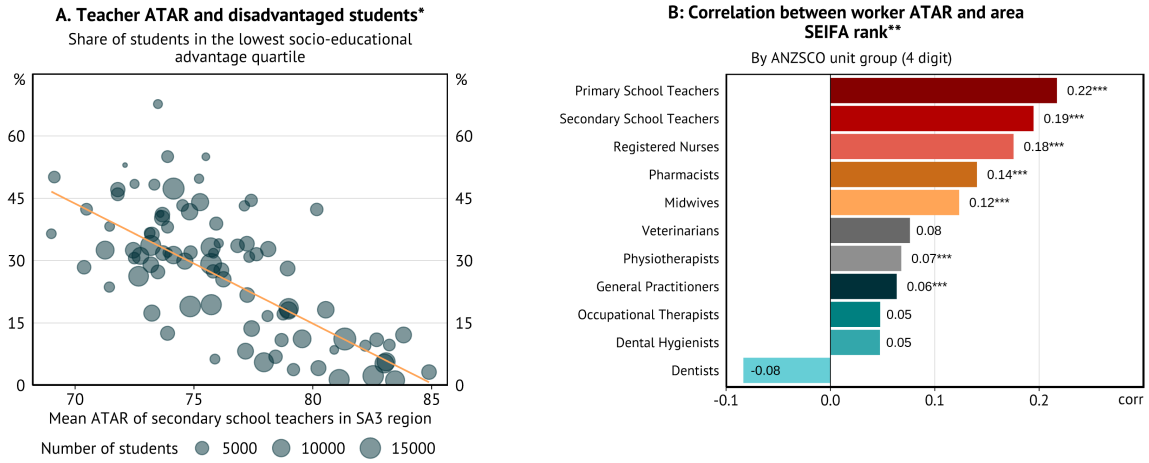
We also find a strong negative correlation ($\rho = -0.75$) between the share of students in the lowest socio-educational advantage quartile and the average ATAR of teachers in an area (Figure 2 panel A). This suggests that lower-aptitude teachers tend to work in disadvantaged areas where students perform poorly in NAPLAN, while higher-aptitude teachers tend to work in less disadvantaged areas where students perform well in NAPLAN.

Why do high-aptitude teachers work in areas where students perform well? There are at least two potential reasons. First, international evidence suggests that high-aptitude teachers improve the performance of their students.[5] Unfortunately, there is currently a lack of comparable causal evidence to determine the scale of this effect in Australia. Future e61 research will aim to fill this gap. Second, high-aptitude teachers may choose to work in high SES areas where non-school-related factors (e.g. parental education and income) help lift student performance.

Is this sorting behaviour unique to teachers?

Perhaps unsurprisingly, higher-ATAR workers in many occupations choose to work in more affluent areas (Figure 2 panel B).[6] But the effect is much stronger for teachers. One explanation is that high-aptitude teachers may be more likely to have grown up in affluent areas and may exhibit a 'home bias' when choosing where to work (Ederer, 2023). Another potential explanation is that teaching in disadvantaged schools may be more demanding, but generally pays a similar amount (NSW IRC, 2022).

Figure 2: Correlation between worker ATAR and SEIFA rank of the area of work



* The share of students in the lowest socio-educational advantage quartile is calculated using school profile data from ACARA for secondary and combined schools. The mean ATAR of teachers is calculated using Census 2016 place of work information and HEIMS data on all domestic students enrolled in an Australian university from 2005 onwards. Lines of best fit are calculated using weighted OLS.
** SEIFA percentiles are sourced from Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia, 2016 data. Teacher ATAR scores are calculated using Census 2016 place of work information and HEIMS data on all domestic students enrolled in an Australian university from 2005 onwards. * p < 0.10, ** p < 0.05, *** p < 0.01
Sources: ABS; e61

Why is the distribution of high-quality teachers so important?

Understanding the geographic distribution of high-quality teachers is important because of the key role they play during the pivotal early stages of children's lives. High-quality teachers are the single most important school-related determinant of student achievement (Hanushek & Rivkin, 2010). They often possess strong subject matter knowledge, a passion for teaching and are more likely to use effective teaching strategies (Hanushek & Rivkin, 2010). These traits are especially beneficial for disadvantaged students.[7]

Policy implications

Our research highlights a concerning relationship between the academic aptitude of teachers and the socioeconomic status and academic performance of students. This relationship has the potential to perpetuate educational inequality. Despite previous attempts by policymakers to tackle teacher shortages in specific areas (for example, by using financial incentives to attract teachers to hard-to-staff schools (Hunter et al., 2022)), little attention has been paid to regional disparities in teacher quality. To address this issue, policymakers should consider additional incentives to attract high-quality teachers to areas in need. This could help achieve a more efficient and equitable allocation of educational resources. Detailed, dis-aggregated data on students, classes and teachers will also be crucial to understanding the effectiveness of such policies.

5 Appendix A.3 provides a simple example of the potential scale of the effect of higher aptitude teachers based on international evidence.
6 We compare teachers to a selection of other occupations which also (largely) require a university qualification and where workers are not concentrated in a single part of the state (e.g. the Sydney CBD, agricultural or heavy industrial areas), but are spread relatively evenly throughout.
7 Disadvantaged students improve the most, academically, when they have higher-quality teachers (Bobba et al., 2021).

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A.1. Data construction

A.1.1 Teacher data

We focus our analysis on teachers employed in 2016 who attended university between 2005 and 2016. We estimate the mean ATAR of teachers in a given SA3 area by combining Census 2016 data and Higher Education Information Management System (HEIMS) data. The Census 2016 data allows us to identify secondary school teachers using information on their occupation and their place of work (SA2 area). We then link this data to HEIMS data that includes the Australian Tertiary Admission Rank (ATAR) of domestic students who enrolled in an Australian university from 2005 onwards. With this information, we calculate the mean ATAR of secondary school teachers working in each SA3 area in NSW. One limitation of this approach is that we are only able to identify the ATAR of teachers who attended university between 2005 and 2016 because the HEIMS data begins in 2005 and we rely on Census 2016 place of work data.

A.1.2 NAPLAN data

We use school-level NAPLAN results from the Australian Curriculum, Assessment and Reporting Authority to calculate the mean standardised NAPLAN score for all secondary schools in a given SA3 area. To do so we first calculate standardised NAPLAN scores at the school-grade-domain level by subtracting the average NAPLAN score across NSW for a given grade-domain (e.g. Year 9 Numeracy) and dividing by the standard deviation of that grade-domain's scores across NSW. This produces a standardised score for each school-grade-domain level score (e.g. 1 = 1 s.d. above the NSW mean for that student grade and test domain). We then aggregate these scores to the SA3 level by taking a weighted mean using the number of students in each grade-domain who sat the test.

A.1.3 Sorting and SEIFA data

To compare the sorting behaviour of teachers with other occupations we extend our analysis of ATAR scores to include other similar occupations. We select these occupations based on two criteria:

- Does the job require a university qualification?
- Are workers in this occupation spread fairly evenly across the population? (i.e. they are not clustered in the CBD like bankers or lawyers or in regional areas like mining engineers or geologists)

Using these two criteria we select a group of largely health-related occupations for comparison.

A.2. Prior academic performance and teacher quality

Of all the commonly used measures of teacher quality, teacher cognitive ability and prior academic achievement have been the most consistently related to student outcomes (Hanushek et al., 2019). However, the results have not been entirely consistent. A review of the literature by Hanushek et al. (2019) suggests that among the early estimates, 37 per cent of studies found positive and statistically significant effects and 27 per cent found positive, but statistically insignificant effects. In comparison, 10 percent found negative and statistically significant effects and 15 percent found negative and statistically insignificant effects. However, they note that most studies in this area have relied on small and idiosyncratic data sets and that more recent, higher-quality work has identified a cleaner link between teacher cognitive ability and student performance (Hanushek et al., 2019).

There is also a precedent for using prior academic performance as a measure of teacher aptitude in Australia. For instance, Leigh and Ryan (2008) use PISA data to examine trends in the aptitude of individuals studying teaching at university. More broadly, it is well understood that ATAR is the single most consistent predictor of university performance (Manny et al., 2019), and in most other occupations, higher ATAR workers earn more on average, suggesting that they are more productive (Dwyer et al., forthcoming).