

What actually predicts an HSC result

Every forecasting product makes a choice about what to feed the model. This paper sets out the choices Avantus made, the evidence behind each one, and what your school gets because of them. That includes the inputs we deliberately refuse to use.

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The short version: **a student's own prior marks carry the overwhelming majority of the signal**. Socio-economic background adds very little once you know them, and the ways it is commonly measured in Australia would actively damage an individual projection. So Avantus projects from prior attainment, at subject level, against your school's own history. Other factors widen the band. They do not move the number.

01

Prior attainment carries the signal

The single most important design question is what the model is allowed to know. We tested the obvious candidate, socio-economic background, against the evidence. The answer is consistent across independent sources, including two drawn from NSW data.

The NSW Department's own Centre for Education Statistics and Evaluation has modelled this relationship on the government school estate, following students from Year 9 through to Year 12. Its value-added model reports **prior achievement at a standardised coefficient of 0.77** and **student socio-economic status at 0.08**.^[1] Prior attainment is close to an order of magnitude the stronger term.

Three things about that source should be stated plainly rather than left for a reader to find. The outcome modelled is the **Tertiary Entrance Score**, a research construct, not the ATAR itself. CESE built the model to measure **value added by schools**, not to forecast individual results. And in the same table, **school-level socio-economic status enters at 0.13**, larger than the student-level term, though still far below prior achievement.

An independent line of evidence points the same way. Dr John DeCourcy, then principal of a Catholic secondary school in Western Sydney, ran multilevel models across 125 NSW Catholic secondary schools for the Catholic Education Commission.^[2] His decomposition of variance in the 2004 Tertiary Entrance Score, read from the figures in that paper:

FACTOR	SHARE OF VARIANCE (2004 TES)
Year 10 prior achievement	~52%
Gender	10–14%
School attended	~3%
Student and school socio-economic status	~3–4% combined
Unexplained	~30%

DeCourcy's own summary of the socio-economic component is that "SES is related to only a tiny proportion of the variance in aggregate results", quantified in his text as **1.9% for a student's postcode-based measure and 1.1% for a school-level index**.^[2] The shares above are read from charts rather than a printed table, so we present them as approximate.

The same conclusion now has stronger support than either source. Gary Marks, analysing population-scale Australian data, reports the overwhelming importance of prior achievement, and argues that adding socio-economic covariates to a value-added model changes little once prior achievement is properly accounted for.^[3]

AN HONEST NOTE ON A LIVE DEBATE

The size of the socio-economic effect in Australian schooling is **actively contested**, and Marks's position has been challenged in the peer-reviewed literature. We side with the prior-attainment evidence for the reasons given here, and would rather say so than present a live argument as settled. Our design does not turn on winning it: even on estimates at the higher end, prior attainment remains the dominant term, and Section 3 sets out why we would decline socio-economic inputs regardless.

WHY THIS MATTERS TO YOU

It means the data your school *already holds* is the data that matters. You do not need to collect background information about families, run additional testing, or buy a separate instrument to get a defensible projection. Your markbook is the asset.

It also means a competitor who adds socio-economic data is not buying much accuracy with it. As Section 3 sets out, they are also taking on a liability to get it.

02

Subject level, not whole school

Look at the table above and the school effect appears trivial — around 3%. That number is an **aggregation artefact**, and the point shaped our architecture more than any other.

A student sits five to seven courses with five to seven different teachers. Averaged into a single aggregate, strong and weak teaching cancel out. Disaggregate to a single subject and the school-level effect is far larger: DeCourcy's corresponding figure for one 2004 HSC course (Drama) is roughly **a fifth of the variance** rather than a thirtieth.^[2] That figure is read from a chart rather than a printed table, so we treat it as indicative of the direction, not as a precise quantity.

The underlying phenomenon is well established internationally as **differential school effectiveness**: schools are not uniformly effective across departments, and a single school-level number conceals that variation.^[4]

Whole-school comparison systematically understates what a faculty does. The thing a Head of Department can actually change is the thing the aggregate hides.

This is why Avantus calibrates per **subject and syllabus version**, never as a single school-wide curve. When NESA resets a syllabus, results under the old and new versions stay in separate buckets rather than being blended into a misleading average.

WHY THIS MATTERS TO YOU

The comparison your school already receives — against statistically similar schools — is a whole-school, backward-looking measure. It can tell you where you sat last year. It cannot tell a Head of Mathematics what is happening in their own course while there is still time to act.

Subject-level calibration is what makes a projection actionable rather than merely interesting.

Why we refuse socio-economic adjustment

Section 1 establishes that socio-economic data adds little. This section explains why we would decline it even if it added more, because the reasoning is what a school should hold us to.

A measure of intake is not a measure of teaching

The socio-economic instruments available in Australian schooling, ICSEA and the Commonwealth SES score used in funding, are built to describe **who a school enrolls**. Within that purpose they are reasonable instruments, and ACARA moved ICSEA onto parent-reported student-level data precisely to improve it.

Our objection is not that they are poorly built. It is that a description of intake answers a different question from the one a faculty is asking.

A similar-schools comparison tells you how your results sit against schools whose *students* look like yours. That is a statement about enrolment. It is not a statement about what your teaching did, and it cannot identify which student in your Year 12 Chemistry class is within reach of a better result while there is still time to act.

The same reasoning applies to the individual. A school-level or area-level index describes a population; a projection carries one child's name. The Australian Bureau of Statistics draws that line explicitly for its own area-based indexes:

"SEIFA says nothing about the socio-economic status of a particular person or household. ... It is not correct to use SEIFA to say any particular person is relatively disadvantaged."

Brian Pink, Australian Statistician, 2006^[7]

Where an area-based method has been used to characterise school communities, the Australian Government's review of school funding identified the same flaw, of the Commonwealth SES score rather than of ICSEA: students attending a given school are not necessarily representative of the socioeconomic averages of the areas they live in.^[6]

Avantus therefore uses no socio-economic measure of any kind, at any level, as an input to a student's projection. Given the evidence in Section 1, the accuracy cost is small; the interpretive cost of the alternative is not.

Adjusting for prior marks does not make a model neutral

We state this plainly because it is a claim our competitors make and we will not. Prior attainment is itself measured imperfectly. When a predictor carries measurement error, its regression coefficient is **attenuated**, so any adjustment built on it systematically under-corrects. Kane's analysis of value-added models shows the resulting bias favours **teachers and schools serving students with high prior scores**, and penalises those serving students with low prior scores.^[5]

Because prior attainment is clustered by advantage, a residual that tracks prior attainment also tracks advantage. The claim "we adjust for prior marks, therefore the result is neutral" does not hold — for us or for anyone else making it.

WHAT WE DO INSTEAD

We do not claim neutrality we cannot demonstrate. Our backtest reports error broken down by rank decile, so bias at the top and bottom of a cohort is visible rather than averaged away. Where a school's own history cannot support a tuned projection, the interface says so instead of presenting a confident number.

04

The variable we refuse that others would use

DeCourcy used gender as a predictor, and on his evidence it was a large one — he reports it as related to **10–14%** of the variance in the Tertiary Entrance Score, several times the socio-economic contribution. In his 2004 analysis of NSW Catholic secondary schools, "31 subjects showed significant gender effects, with 30 of these favouring females", the effects ranging from **2.3% (Mathematics) to 16.7% (Food Technology)**.^[2]

Avantus does not use gender, and the difference between his position and ours is worth being precise about, because it is not a disagreement about the statistics.

His output was retrospective, system-level research, where adjusting for gender to isolate teaching effects is entirely legitimate. Our output is a forward projection with an individual child's name on it. The same variable is sound in his use and indefensible in ours.

Three further reasons, each sufficient on its own:

- **It is already in the marks.** Any real cohort effect shows up in students' actual school results, which the engine already uses. A gender term would count it twice.
- **The average misfires on the individual.** The gap is a difference in distributions, not a constant offset: boys are more widely dispersed, and are over-represented at both the top and the bottom, even though the average girl finishes ahead of the average boy.^[8] A flat adjustment derived from the average would therefore be most wrong for the students at the extremes — including those most likely to top the state.
- **It would treat a student differently because of their sex.** Issuing a lower projection to a boy than to an identically-performing girl, on the basis of sex alone, is not a position we would be willing to defend to a parent. Australian anti-discrimination law covering the provision of education, at both Commonwealth and NSW level, is not hospitable to it either. It also recreates the "ATAR as ceiling" harm the student view was designed to avoid.

WHY THIS MATTERS TO YOU

Where a co-educational school wants to see how groups are tracking, that belongs in an aggregate, staff-side diagnostic: a signal for directing support, never a modifier on a child's number. Two students with the same marks receive the same projection, whoever they are.

What we do with uncertainty

A projection that hides its own limits is worse than no projection. Three constraints shape how ours are presented.

Small cohorts

Leckie and Goldstein showed that once prediction uncertainty is properly carried, only **9 of 266 schools** could be distinguished from the national average on a forward-looking basis, and none at all after adjusting for intake, with intervals roughly 3.5 times wider than describing the past.^[6] Their cohorts averaged about 160 students. A single HSC course cohort is often 15 to 25.

The published mitigation is multi-year pooling, which is what our recency-weighted history does: the weight given to a school's own curve rises with the number of distinct years behind it, so a subject backed by one year is trusted less, and its band is wider, than one backed by six.

Who is not in the data

In building its Year 9 to Year 12 model, CESE reports that about **40% of the NSW government school cohort** it began with does not reach a Tertiary Entrance Score: students who leave before completing Year 12, who move to a non-government school, or who take a pattern of study that is not TES-eligible.^[1] That figure is not 40% of a given school's Year 12 class, and it counts students who simply moved schools. The principle survives the arithmetic: a model fitted on students who finished with a tertiary entrance rank inherits that selection. Ours included.

A projection is not a target

England abolished its contextual value-added measure in 2010, on the stated ground that it "entrenches low aspirations for children because of their background."^[9] The evidence for that specific claim is weak — it was later tested and the opposite pattern found^[10] — but the underlying concern was real, and it was about *use*, not method. The measure was built for evaluation and was used to set differential expectations for individual children.

A per-student projected mark is precisely the artefact that misuse requires. It is why every number in Avantus is framed as a signal about where attention is worth spending now. Not a ceiling, not a target, and not a statement about what a student is capable of.

"using data as an accountability mechanism, producing league tables which amplify tiny and statistically non-significant variations between schools into large differences in rank, is not effective in improving student performance."

DeCourcy, 2005, p. 99

What this adds up to

The method described here is not new, and we would be suspicious of anyone claiming it was. DeCourcy demonstrated its value on NSW HSC data two decades ago; the international school effectiveness literature established the subject-level point earlier still; and CESE applies value-added modelling to the NSW government estate today.

What none of that work does is run inside a single school, on the marks a faculty entered last week. DeCourcy's analysis required a statistician, a system-wide data collection and an annual cycle, and it produced a report after the results were already final. CESE's models describe schools, not the student sitting in front of a teacher on Tuesday.

That is the whole of it. The method is established and the evidence base is public. What Avantus changes is that it runs on your own data, at subject level, while the cohort is still in front of you — and tells you where it is uncertain.

07

References

- [1] Lu, L. & Rickard, K. (2014), *Value-added models for NSW government schools*, Centre for Education Statistics and Evaluation, NSW Department of Education. Table 7, p. 32: prior achievement 0.77, student SES 0.08, school SES 0.13 (standardised). Attrition figure at p. 33. [education.nsw.gov.au](https://education.nsw.gov.au/content/dam/main-education/about-us/educational-data/cese/2014-value-added-models-for-nsw-government-schools.pdf) (<https://education.nsw.gov.au/content/dam/main-education/about-us/educational-data/cese/2014-value-added-models-for-nsw-government-schools.pdf>)
- [2] DeCourcy, J. (2005), "Using HSC data to give principals leverage", *Research Conference 2005*, ACER, pp. 93–101. Variance shares read from Figures 1–2 (2004 TES; 2004 HSC Drama); stated SES figures and gender counts at p. 96; league tables at p. 98. 125 NSW Catholic secondary schools. [research.acer.edu.au](https://research.acer.edu.au/research_conference_2005/18/) (https://research.acer.edu.au/research_conference_2005/18/)
- [3] Marks, G. N. (2022), *School Effectiveness and School Improvement*, DOI 10.1080/09243453.2022.2102042; and Marks, G. N. (2020), *British Educational Research Journal*, DOI 10.1002/berj.3684.
- [4] Nuttall, D., Goldstein, H., Prosser, R. & Rasbash, J. (1989), "Differential school effectiveness", *International Journal of Educational Research*, 13(7), pp. 769–776; Thomas, S. et al. (1997), *School Effectiveness and School Improvement*, 8(2), pp. 169–197.
- [5] Kane, M. T. (2017), *Measurement Error and Bias in Value-Added Models*, ETS Research Report RR-17-25. DOI 10.1002/ets2.12153.
- [6] Australian Government (2011), *Review of Funding for Schooling — Final Report* (the Gonski Review), p. 177. The passage quoted concerns the Commonwealth SES score, a different instrument from ACARA's ICSEA, which since 2013 has been built from parent-reported data at student level rather than area averages.
- [7] Australian Bureau of Statistics (2008), *An Introduction to Socio-Economic Indexes for Areas (SEIFA), 2006*, Information Paper, cat. no. 2039.0, p. 15.
- [8] Universities Admissions Centre, *Report on the Scaling of the NSW Higher School Certificate* (annual series).
- [9] Department for Education (2010), *The Importance of Teaching: The Schools White Paper 2010*, Cm 7980, §6.13.
- [10] Treadaway, M. (2019), "Should we bring back contextual value added?", FFT Education Datalab, 15 November 2019.

A NOTE ON SOURCING

Every quotation in this paper was checked against the full text of the source document. Two figures in this paper are read from charts rather than printed tables: the variance shares in Section 1 and the subject-level figure in Section 2. Both are presented as approximate, and flagged as such where they appear. DeCourcy's system-level reports for the Catholic Education Commission are not publicly available; the ACER conference paper is.