NSW Department of Education

Evaluation of the compressed curriculum delivery model

Technical report

Centre for Education Statistics and Evaluation

April 2022

NSW GOVERNMENT

Centre for Education Statistics and Evaluation

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We acknowledge the homelands of all Aboriginal people and pay our respect to Country.

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Background

The NSW Department of Education's evaluation of the compressed curriculum delivery model ('the compressed curriculum model') presents information on:

- which schools are delivering a compressed curriculum
- reasons schools chose to deliver a compressed curriculum
- how schools are implementing a compressed curriculum model
- the effect of a compressed curriculum model on student outcomes
- staff perceptions of a compressed curriculum model.

The evaluation report[1] presents the findings of the evaluation to school principals and school communities so that they may make informed decisions about whether to use the compressed curriculum model to deliver Stage 6 courses. This technical report is intended to supplement the evaluation report and provides additional details about the methods used in the evaluation.

These include:

- how we cleaned and structured records for analysis
- how we identified course enrolments that used a compressed curriculum model
- how we identified suitable records for inclusion in the student outcomes analysis
- additional results to support the findings presented in the evaluation report
- additional information about the qualitative data sources.

1 https://education.nsw.gov.au/about-us/educational-data/cese/publications/cese-evaluations/compressed-curriculum

How did we identify course enrolments that used the compressed curriculum model?

We used Stage 6 enrolment records provided by the NSW Education Standards Authority (NESA) to identify course enrolments that used the compressed curriculum model. The data included information for all Stage 6 enrolments in NSW public schools from 2009 to 2019.

Initial data cleaning

In the enrolment data, each record included:

- a course name
- a unique course code
- a school year identifier
- the number of credit units for the course
- the calendar year of the enrolment
- a NSW Department of Education student identifier (DoE ID)
- NESA student identifier (NESA ID).

In this report, we refer to groups of records that were associated with the same student and the same course name (for example, ancient history) as 'course enrolments'.

Before cleaning, the data included 573 unique course names and 1,314 unique course codes. Typically, course names represent the broader area of study (for example, ancient history), while course codes represent different components within the broader course (for example, preliminary and HSC components).[2] However, many course enrolments were represented by complex patterns involving multiple course codes.[3] Our aim was to reduce the data so that each case represented a unique course enrolment.

Of the 5,781,732 Stage 6 enrolment records, we started by removing:

- 216 records with missing course names and/or missing credit units
- 79,153 records with missing DoE IDs
- 53,323 records with conflicting DoE and NESA IDs
- 125,785 records for optional examinations
- 8,733 records for minimum standard attempts
- 266,824 records for life skills courses.

2 Refer to Table 1 for an example of a course name with 2 course codes representing preliminary and HSC components.

3 Refer to Table 5 for an example of a course name with multiple course codes representing different hours of coursework.

Records with missing course names, missing credit units and/or missing DoE IDs were removed because they could not be attached to courses or students. Records with conflicting DoE and NESA IDs (multiple NESA IDs within a single DoE ID and/or multiple DoE IDs within a single NESA ID) were removed because they could not be attached to specific students. Records for optional exams and minimum standard attempts were removed because they do not reflect actual course enrolments.

According to NESA, life skills courses have been developed for the small percentage of students with disability who cannot access the regular course outcomes, particularly those with an intellectual disability. Some preliminary investigations showed that students who enrol in life skills courses tend to have different programs of study that cannot easily be classified as using either a traditional or compressed curriculum model. We therefore removed these courses from the data.

In addition to the exclusions noted above, we also found 68 students who had records for credit transfers. As we did not have complete information for these students (credit transfers indicate that the student completed part of their senior studies in a different system), we removed the 590 records attached to these students.

We also found 39,640 students who only had records for Year 12 courses. Of these students, 36,267 (91.5%) had all their records in 2009. Since our data capture did not include 2008, any student who was in their second year of senior study in 2009 had no preliminary records. We removed the 203,024 records associated with these students because, without their corresponding preliminary records, these course enrolments would be falsely classified as starting in the wrong calendar year (we later use the first record for each course enrolment to identify start years). This false classification would obscure the ways schools use the compressed curriculum model to deliver senior programs of study.

We also removed records for courses that were not considered to form part of a student's core senior program of study. This included 6,494 records for specialisation courses and 44,214 records for HSC extension courses that did not have preliminary prerequisites. We removed these records as we wanted to structure the data in a way so that a student/school that took/operated a fully compressed curriculum would have all their courses identified as compressed. Had these records been included, a student who started an extension course that only had an HSC component would always be seen as starting at least one course using the traditional delivery model. Likewise, a school that had a student who started an extension course that only included an HSC component would always be seen as delivering at least one course that year using the traditional delivery model.

We also identified 36,726 enrolments in non-vocational education and training (VET) Board Developed courses where the student did not have an enrolment in the required prerequisite. When we examined these records more closely, we found that 14,989 (40.8%) were identified based on their enrolment in HSC senior science and 13,645 (37.2%) were identified based on their enrolment in HSC English studies. These patterns indicate that these students changed their preliminary science/English course (for example, biology, English standard) to HSC senior science/English studies their second year. To ensure we accurately captured these mid-course changes, we created linking codes to match the HSC components to their preliminary counterparts.

After exclusions, our data included 4,959,794 results records for 3,016,595 course enrolments from 500,288 students. There were 412 unique course names and 924 unique course codes.

Bottom-up coding of the course enrolment data

To determine the delivery mode of each course enrolment, we first identified the earliest calendar year of each enrolment and then calculated the total number of credit units for the course that year. We then looked across the relevant enrolments to determine the different ways each course could be started (that is, the number of credit units a student could take the first year). For example, ancient history could be represented in the data as:

Table 1

Example data representation for ancient history

DoE ID	Course name	Course code	Course units	Calendar year	Year
1	Ancient history	11020	2	2016	11
2	Ancient history	11020	2	2016	11
2	Ancient history	15020	2	2017	12
3	Ancient history	11020	2	2016	11
3	Ancient history	15020	2	2016	12

which we reduced to:

Table 2

Example reduced data representation for ancient history

DoE ID	Course name	First calendar year	First-year units	Possible first-year units	Compressed
1	Ancient history	2016	2	2 or 4	No
2	Ancient history	2016	2	2 or 4	No
3	Ancient history	2016	4	2 or 4	Yes

Table 2 shows that ancient history can be taken in 3 different ways:

- Students can enrol in the preliminary component of the course their first year and not enrol in the HSC component of the course their second year.
- Students can enrol in the preliminary component of the course their first year and the HSC component of the course their second year.
- Students can enrol in both the preliminary and HSC components of the course their first year.

The first 2 course enrolments have the same number of first-year credit units and represent the traditional delivery model, whereas the third course enrolment has twice the number of first-year credit units and represents the compressed curriculum model. Across the 3,016,595 course enrolments, 2,626,836 (87.1%) were associated with courses that had the pattern we identified in Table 2 (2 or 4 credit units the first year).

Similar to the representations in Table 1 and Table 2, 127,957 (4.2%) of the course enrolments were associated with courses that could be started with 1 or 2 credit units the first year. For example, mathematics extension could be represented in the data as:

Table 3

Example data representation for mathematics extension

DoE ID	Course name	Course code	Course units	Calendar year	Year
1	Mathematics extension	11250	1	2016	11
2	Mathematics extension	11250	1	2016	11
2	Mathematics extension	15250	1	2016	12
3	Mathematics extension	11250	1	2016	11
3	Mathematics extension	15250	1	2017	12

which we reduced to:

Table 4

Example reduced data representation for mathematics extension

DoE ID	Course name	First calendar year	First-year units	Possible first-year units	Compressed
1	Mathematics extension	2016	1	1 or 2	No
2	Mathematics extension	2016	2	1 or 2	Yes

Like those courses that could be started with 2 or 4 credit units the first year, courses that could be started with 1 or 2 credit units the first year represented the traditional and compressed curriculum model, respectively.

While 91.3% of the course enrolments were easily classified, 131,166 (4.3%) could be taken in the first year as a 120-hour (2-unit), 240-hour (4-unit) or 360-hour (6-unit) course. For example, human services could be represented in the data as:

Table 5

Example data representation for human services

DoE ID	Course name	Course code	Course units	Calendar year	Year
1	Human services	27101	2	2016	11
2	Human services	27101	2	2016	11
2	Human services	27102	2	2017	12
3	Human services	27101	2	2016	11
3	Human services	27102	2	2016	12
4	Human services	27102	2	2016	11
5	Human services	27101	2	2016	11
5	Human services	27102	2	2017	12
5	Human services	27109	2	2017	12
6	Human services	27101	2	2016	11
6	Human services	27102	2	2016	12
6	Human services	27109	2	2017	12
7	Human services	27101	2	2016	11
7	Human services	27102	2	2016	12
7	Human services	27109	2	2016	12

which we reduced to:

Table 6

Example reduced data representation for human services

DoE ID	Course name	First calendar year	First-year units	Possible first-year units	Compressed
1	Human services	2016	2	2, 4 or 6	No
2	Human services	2016	2	2, 4 or 6	No
3	Human services	2016	4	2, 4 or 6	Yes
4	Human services	2016	2	2, 4 or 6	No
5	Human services	2016	2	2, 4 or 6	No
6	Human services	2016	4	2, 4 or 6	Yes
7	Human services	2016	6	2, 4 or 6	Yes

These types of courses are more complicated in that the number of indicative hours represents differences in course content, not just differences in first year delivery mode (the 240-hour course is not simply half the 360-hour course). However, courses that have either 2, 4 or 6 units their first year can still be aligned with those that have only 2 start patterns (for example, 2 or 4 units their first year). For these types of courses, a student who took 4 units their first year would always be studying the same content as the other students who took 4 units their first year due to the fact that the additional 2 units of HSC credit never occurs in the first year of study without the 4 units that comprise the 240-hour course. This means that we can treat those who take 4 units their first year the same as those who take 6 units their first year (both represent the compressed curriculum model).

87,200 (2.9%) course enrolments could be taken the first year as a 60-hour (1-unit), 120-hour (2-unit), 180-hour (3-unit) or 240-hour (4-unit) course. For example, photography, video and digital imaging (PVDI) could be represented in the data as:

Table 7

Example data representation for PVD

DoE ID	Course name	Course code	Course units	Calendar year	Year
1	PVDI	35225	1	2016	11
2	PVDI	35225	1	2016	11
2	PVDI	35227	1	2016	12
3	PVDI	35225	1	2016	11
3	PVDI	35227	1	2017	12
4	PVDI	35226	2	2016	11
5	PVDI	35226	2	2016	11
5	PVDI	35227	1	2016	12
6	PVDI	35225	1	2016	12
6	PVDI	35228	2	2016	11
7	PVDI	35226	2	2016	11
7	PVDI	35228	2	2017	12
8	PVDI	35226	2	2016	11
8	PVDI	35228	2	2016	12

which we reduced to:

Table 8

Example reduced data representation for PVID

DoE ID	Course name	First calendar year	First-year units	Possible first-year units	Compressed
1	PVDI	2016	1	1, 2, 3 or 4	No
2	PVDI	2016	2	1, 2, 3 or 4	No
3	PVDI	2016	1	1, 2, 3 or 4	No
4	PVDI	2016	2	1, 2, 3 or 4	No
5	PVDI	2016	3	1, 2, 3 or 4	No
6	PVDI	2016	3	1, 2, 3 or 4	No
7	PVDI	2016	2	1, 2, 3 or 4	No
8	PVDI	2016	4	1, 2, 3 or 4	Yes

While the processes outlined thus far covered the vast majority of courses, 43,423 (1.4%) enrolments had other patterns. For these enrolments, we used a simple heuristic to classify delivery modes: those with 4 or more credit units in their first year were classified as compressed while those with less than 4 credit units were classified as traditional.

The last step in the bottom-up coding procedure involved removing the 271,107 enrolments from 2009. We needed to remove these enrolments because the Year 12 students who were taking compressed course(s) in 2009 were still included in the data (they would have at least 1 record for Year 11), while the Year 12 students who were taking traditional courses were removed earlier in the data cleaning. If these students were included in our analysis, the rates of compression in 2009 would be overestimated.

Top-down coding of the course enrolment data

One limitation of the bottom-up coding procedure is that it may falsely classify certain compressed courses as being delivered using the traditional model. To complete the HSC, students must complete a Year 11 pattern of study comprising at least 12 units and a Year 12 pattern of study comprising at least 10 units. The fewer Year 12 units means that students often start more courses than they finish. Indeed, of the 2,745,452 course enrolments, 833,826 (30.4%) had data for only preliminary components. As the first-year units for compressed courses that were started but not finished are the same as those that were started using the traditional delivery model but also not finished, the above procedure does not differentiate between the 2 different types of enrolments and falsely classifies the compressed courses as traditional.

To investigate the impact of these false classifications, we linked the course enrolment records to school data. Of the 459,576 students, 437,540 (95.2%) were matched to a single school. We then grouped the records according to school-year-course cohorts (all the records for the Year 11 students who attended the same school the same year and took the same course belonged to the same school-year-course cohort). For each school-year-course cohort, we then calculated the proportion of compressed enrolments using only those courses that had both preliminary and HSC components. Courses were classified as compressed when more than 90% of the enrolments were compressed. For the school-year-course cohorts that were classified as compressed, we recoded the delivery model of the 4,460 courses with only preliminary records.

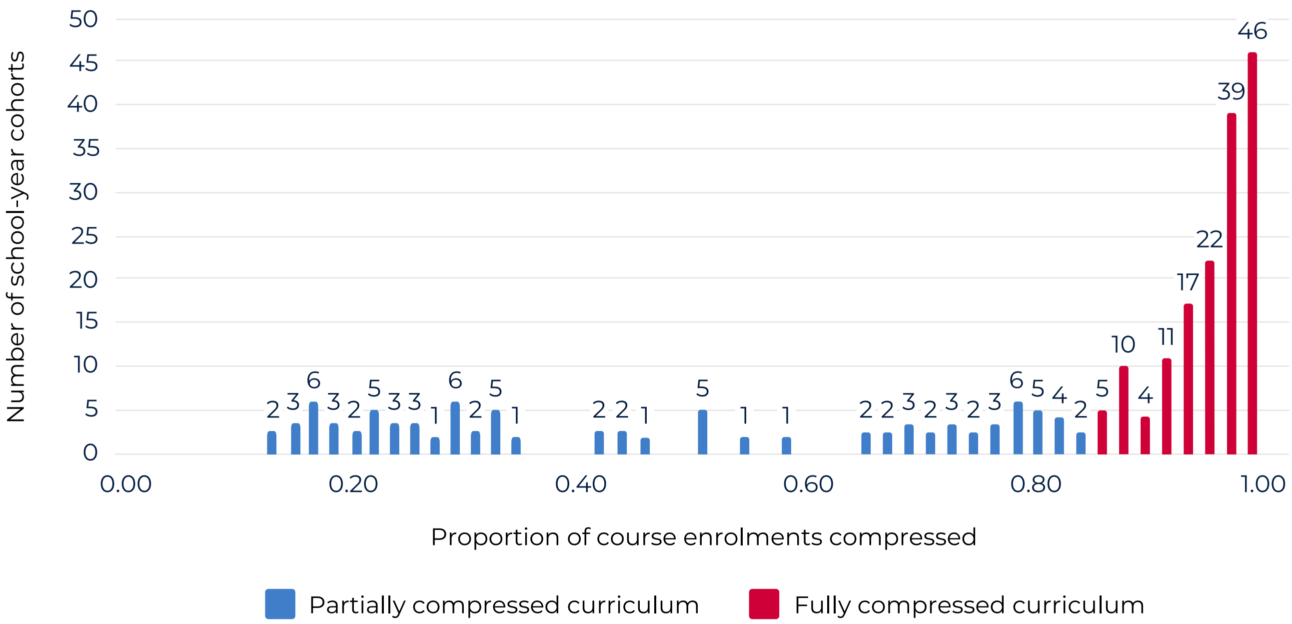
Of the 2,619,777 course enrolments, 293,018 (11.2%) could contribute to a student's HSC as either preliminary or HSC units. These courses were predominantly (96.3%) VET courses. Due to the flexibility that VET courses are meant to offer, it is possible that students at the same school in the same year can take the same course using different delivery models. Since we cannot rule out this possibility, we do not apply the top-down coding procedure to these courses.

How did we identify schools that used the compressed curriculum model?

To investigate the ways in which schools used the compressed curriculum model to deliver HSC programs, we grouped the course records according to school-year cohorts (all the records for the Year 11 students who attended the same school the same year belonged to the same school cohort). For each school-year cohort, we calculated the proportion of courses that were delivered using the compressed curriculum model. Of the 4,561 school-year cohorts, 242 (5.3%) had more than 10% of their courses delivered using the compressed curriculum model. We present the rates of compression for these 242 school-year cohorts in Figure 1.

Figure 1

Number of school-year cohorts by proportion of compressed enrolments



As shown in Figure 1, 46 school-year cohorts had almost 100% of their courses delivered using the compressed curriculum model. While these results show that schools rarely compress all their courses in a given year, 114 additional school-year cohorts still had very high rates of compression (80% or greater). For the purpose of investigating the types of schools that offer a fully compressed curriculum, and the potential impacts of this offering, we considered the 37 schools that had 80% or more of their courses compressed in any year as 'fully' compressing schools. Schools were defined as 'partially compressing' if in any year they compressed over 10% but less than 80% of their courses. We identified 22 schools as partially compressing.

What is the impact of offering a fully compressed pattern of senior study on HSC outcomes?

To estimate the impacts of offering a fully compressed pattern of senior study, we attempted to estimate what the outcomes for students who were offered a fully compressed pattern of study (treated students) would have been had they been offered a traditional delivery mode. As these (counterfactual) outcomes are impossible to observe, we used the outcomes for students from schools that would go on to offer a fully compressed curriculum in later years as a useful starting point (untreated students from eventually treated schools). We then adjusted these initial estimates using the changes in outcomes for students from similar schools who were offered a traditional mode of study (control students). We provide more detailed information in this section.

Identification strategy

Our analytical approach aims to estimate individual average treatment effects for each treated school (ATT) each treated year. The method extends the simple 2 group, 2 time period difference-in-differences strategy to cases that involve multiple groups and multiple time periods. The method also allows us to easily incorporate variation in treatment timing, which was a feature of our study. While we provide some exposition in the following paragraphs, interested readers are directed to Callaway and Sant'Anna (2019).

Let g index schools where $g = 1, \ldots, G$ and t index calendar years where $t = 2010, \ldots, 2016$. Also, let l_g represent the last calendar year where school g offered a compressed curriculum mode, f_g represent the first calendar year where school g offered a compressed curriculum mode (the transition year), and b_g represent the last calendar year where school g offered a traditional delivery mode (the base year). As students typically take 2 years to complete their senior studies, base years were restricted to those that occurred at least 2 years before the transition year (that is, where $b_g \leq f_g - 2$). Finally, let the binary variable C_g equal 1 if school g was included in the control group and 0 if school g was included in the treatment group (we describe how we select control schools in more detail in the following paragraphs).

The average treatment effect for treated school g at treated time t was given by:

$$ATT_{gt} = [\bar{Y}_t | C_g = 0] - \Phi\{\Phi^{-1}(\bar{Y}_{bg} | C_g = 0) + [\Phi^{-1}(\bar{Y}_t | C_g = 1) - \Phi^{-1}(\bar{Y}_{bg} | C_g = 1)]\} \quad (1)$$

where $\bar{Y}_t$ represents the proportion of students in year t who achieved the outcome of interest and Φ represents the cumulative standard normal distribution function (refer to Puhani 2012).[4] Note that the effects in (1) are only identified where the base year for a treated school was at least 2 years before the treated year of interest (that is, where $b_g + 2 \leq t$).

To estimate the amount of uncertainty in the parameters, we used a 2-stage bootstrap procedure (Davison and Hinkley 1997). In the first stage, we randomly selected schools with replacement. In the second stage, we randomly selected students with replacement from each school cohort associated with the schools selected in the first stage.

4 As $\Phi(x)$ is only solvable when $0 < x < 1$, we needed to regularise some school cohort means by replacing 0s and 1s with .005s and .995s, respectively.

In each bootstrap replication, we calculated the individual school cohort effects as well as other summary parameters of interest (described in more detail later in this report). Across the bootstrap replications (n =1,000), we calculated nonparametric confidence intervals by using the 2.5 and 97.5 percentiles of the ordered distributions.

How did we identify treated cohorts?

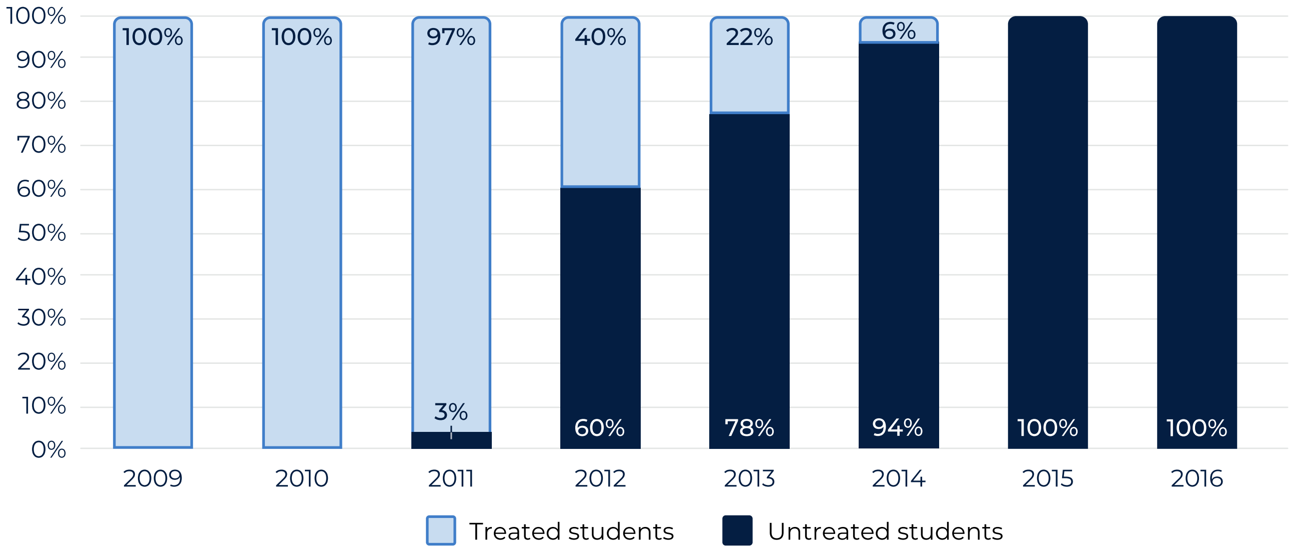
To estimate the impact that offering a fully compressed curriculum may have on HSC outcomes, we first needed to define the population of students that might be affected by that decision. For each school that was identified as delivering a fully compressed curriculum to a particular Year 11 cohort (described earlier in this report), we defined the population of treated students as those enrolled in Year 10 at that school the calendar year before. For example, for a school that delivered a fully compressed curriculum to their Year 11 students in 2015, the treated cohort included all the Year 10 students enrolled at the school in 2014. We focused on Year 10 cohorts because we wanted to estimate effects for all students who were offered a fully compressed curriculum, not just those who actually started Stage 6.

Our time series started at 2009 as this was the first year where control information was available for Year 10 students (that is, 2008 Year 9 National Assessment Program – Literacy and Numeracy (NAPLAN) scores). Our time series finished at 2016 as this was the last year with available outcome data (allowing 3 years after enrolment in Stage 6 for outcomes to be observed). Using the HSC results data, we identified 37 schools that offered a fully compressed curriculum to their Year 10 students at some time between 2009 and 2016 (treated schools). Of these, we excluded 11 schools because they did not have suitable data for untreated cohorts (where $b_g < 2010$ or where $b_g > f_g - 2$). Importantly, all cohorts that were offered a mixed pattern of senior study (that is, where some courses were offered using the compressed curriculum mode while others were offered using the traditional delivery mode) were removed from the analysis.

Of the 10,145 Year 10 students who attended the 26 treated schools in 2009 to 2016 (inclusive), 5,224 (51.5%) were offered a fully compressed curriculum. We present the proportion of treated and untreated students each year in Figure 2.
In total, we identified 72 separate treated cohorts.

Figure 2

Proportion of students treated and untreated each year for treated schools



How did we identify control groups?

Our identification strategy requires that, in the absence of treatment, the difference between the average outcomes for the untreated and treated cohorts would have been similar to the difference between the average outcomes for their specific controls. This is commonly known as the parallel trends assumption. Importantly, there may be certain school features (for example, school remoteness) that are related to the degree to which average student outcomes change over time. When these features are not balanced across the treated and control cohorts, effect estimates may be biased. To reduce the possibility of bias due to unobserved relationships between certain school features and change over time, we created unique control groups for each treated cohort.

Specifically, for each treated school g at treated time t, schools with similar properties to school g at time t were included in the control group for school g at time t, provided they had never offered a compressed curriculum before time t. Schools were considered to have similar properties where:

- their average Year 9 NAPLAN Reading and Numeracy scaled scores were within plus or minus 25 points
- their Index of Community Socio-Educational Advantage (ICSEA) score was within plus or minus 50 points
- the size of their Year 10 cohort was within 40 students
- they were the same type of school (central or secondary)
- they had the same selective school status
- they were in the same Australian Statistical Geography Standard (ASGS) remoteness category.

The binary variable C_g was equal to 1 when schools were included in the control group for school g at time t and was equal to 0 for school g. Treated schools were only included in control groups when their first treatment year occurred 2 or more years after the time period of interest ($b_g \geq t + 2$). This was done to ensure that there was no possible influence of later treatment (that is, offering a compressed curriculum) affecting the student cohort that would otherwise have been identified as not compressing. We present some additional evidence for the suitability of the control groups later in this report.

For each treated school g at treated time t, we calculated the differences between the means of the continuous variables for the treated and control groups (treated minus controls). We present the distributions of the differences in Figure 3 to Figure 6.

Figure 3

Difference in mean Year 9 NAPLAN Reading scores between treated and control schools

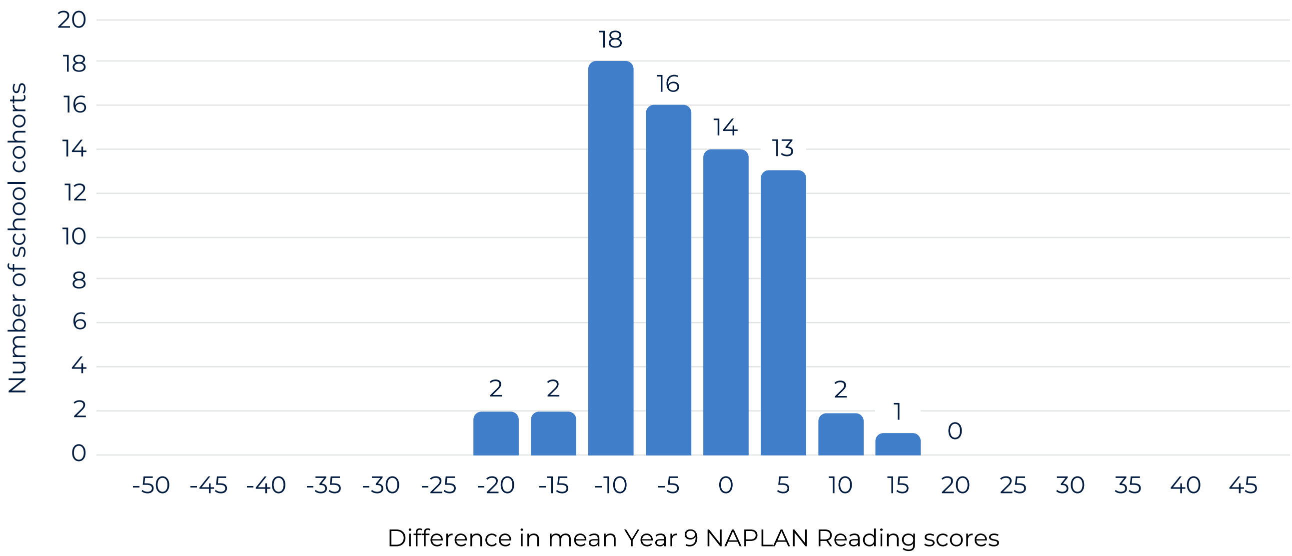


Figure 4

Difference in mean Year 9 NAPLAN Numeracy scores between treated and control schools

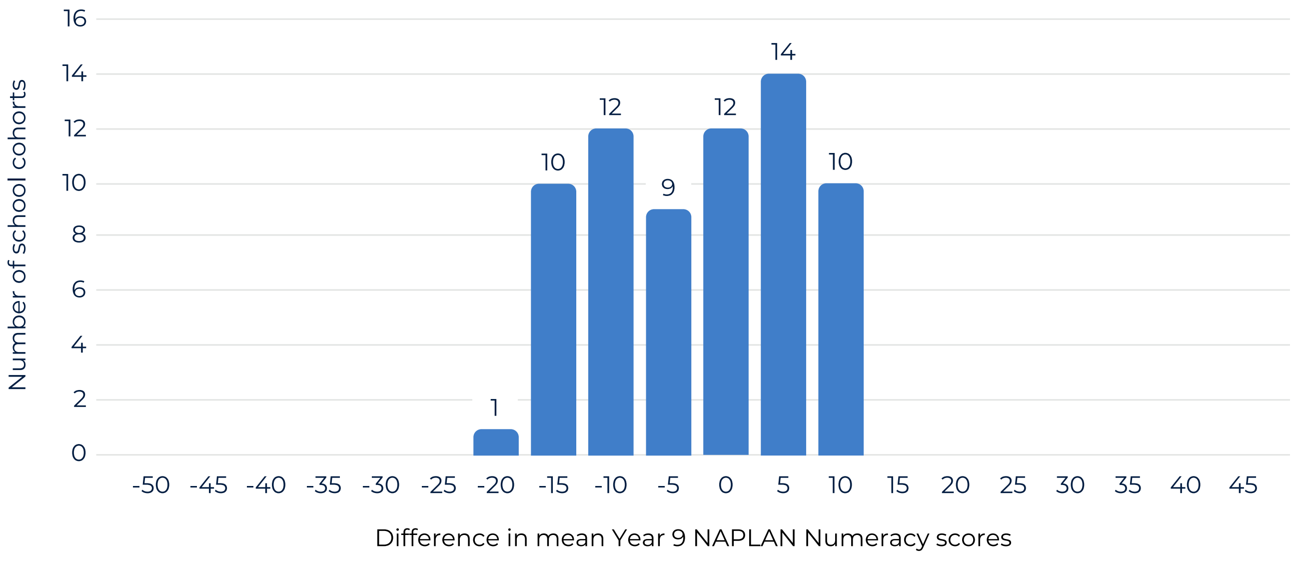


Figure 5

Difference in mean ICSEA values between treated and control schools

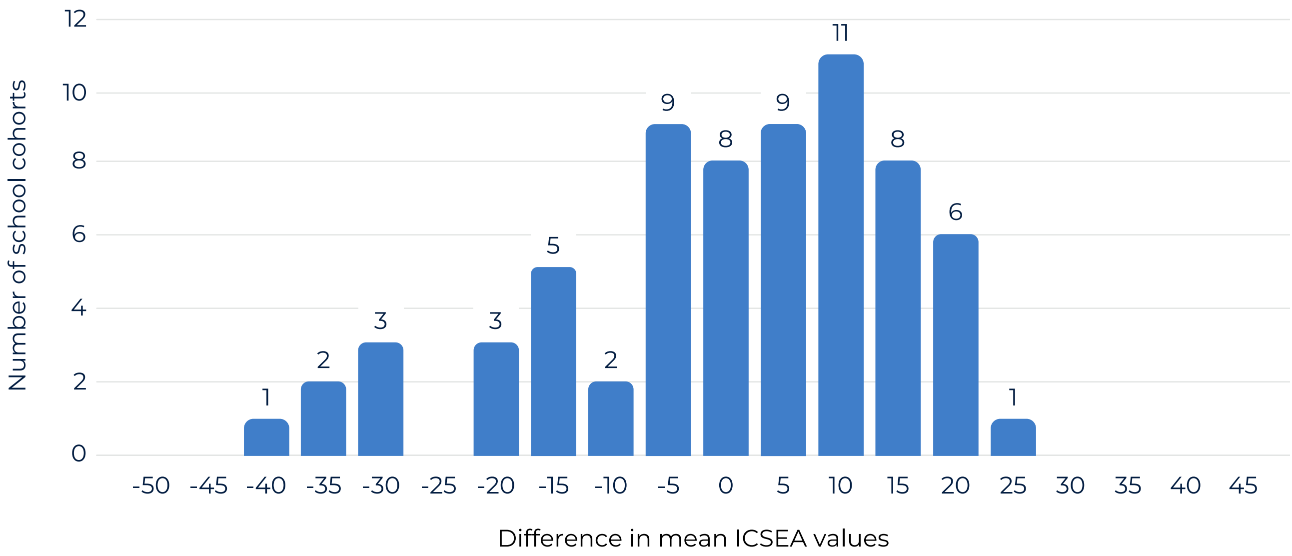
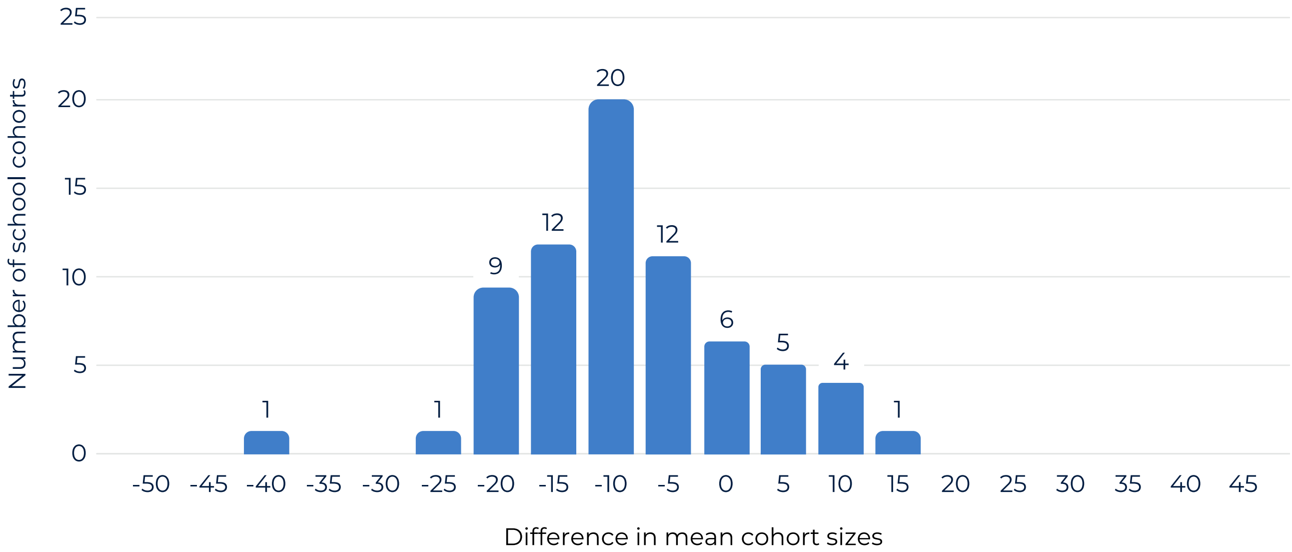


Figure 6

Difference in mean cohort sizes between treated and control schools



Outcome measures

In our analysis, we aimed to investigate the impact of offering a fully compressed curriculum on 4 HSC outcomes:

- HSC completion rates
- Australian Tertiary Admission Rank (ATAR) eligibility
- high performance rates
- low performance rates.

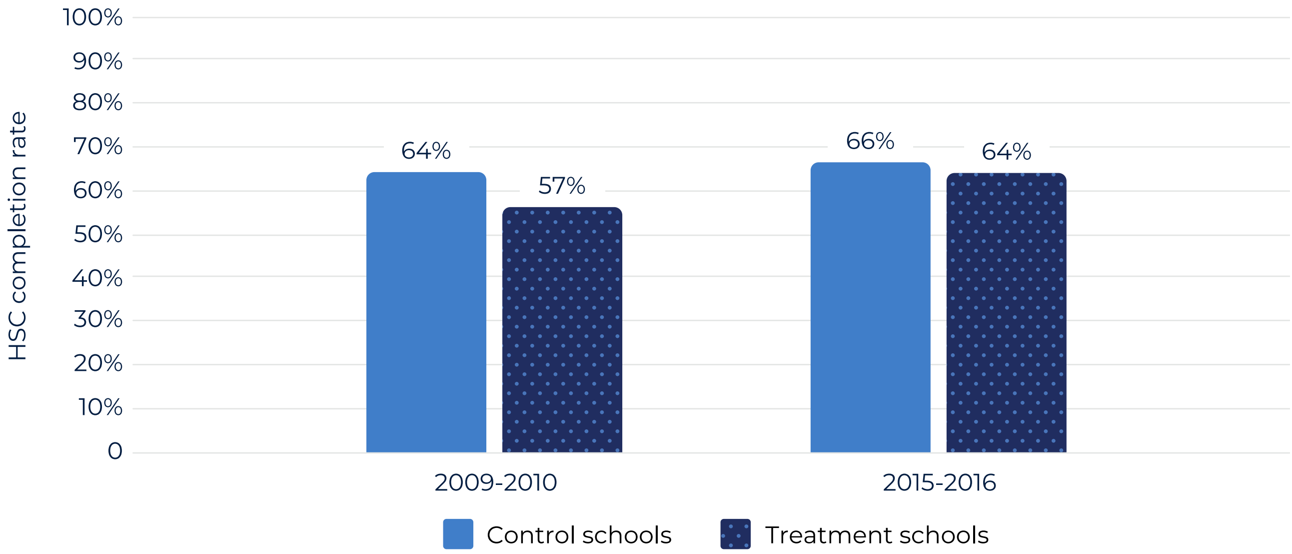
We provide more detailed information about these student outcomes in the following paragraphs.

HSC completion

To qualify for the HSC, students must complete a Year 11 pattern of study comprising at least 12 units and a Year 12 pattern of study comprising at least 10 units.[5] While students can normally complete their HSC program over 5 years (starting in Year 11), we needed to restrict the window for completion to 3 years (starting in Year 10) so that we could observe the outcomes for the Year 10 students who were enrolled in 2016. Of the 391,731 students included in the outcome analysis, 256,596 (65.5%) completed their HSC within 3 years. We present the mean HSC completion rates for 2009 to 2010 and 2015 to 2016 by school type in Figure 7. We use these time periods throughout as they provide the clearest comparison of pre- and post-treatment.

Figure 7

HSC completion rates for 2009-2010 and 2015-2016 by school type



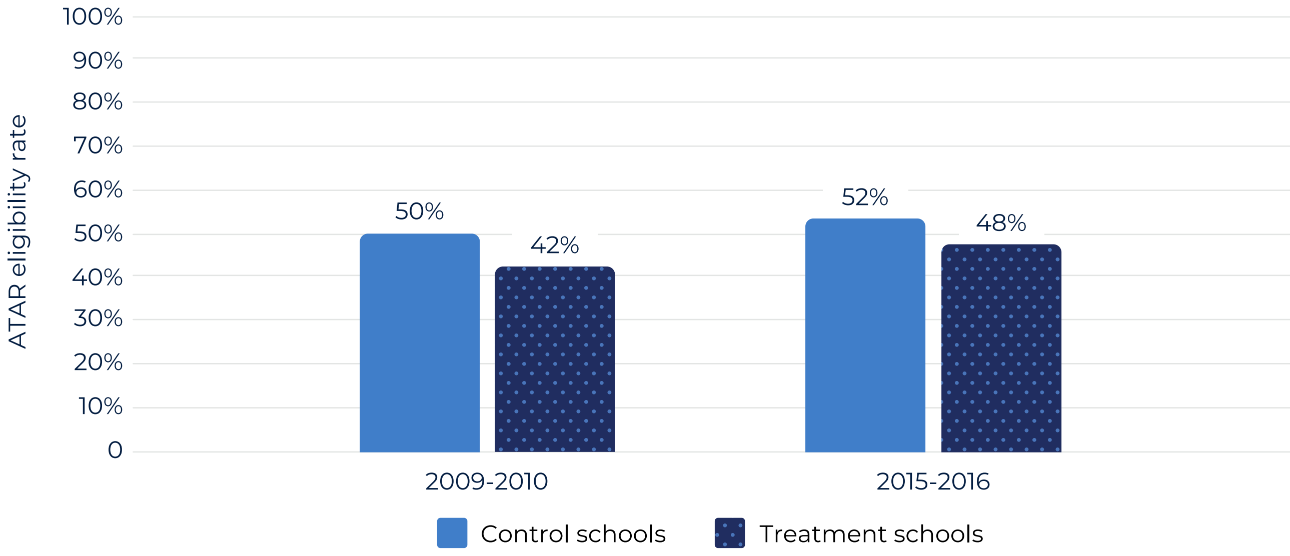
5 For more information refer to: https://ace.nesa.nsw.edu.au/ace-8005

ATAR eligibility

To be eligible for an ATAR, students must satisfactorily complete at least 10 units of certain Board Developed courses for which formal examinations are conducted by NESA. Of the 391,731 students included in the outcome analysis, 199,097 (50.8%) were eligible for an ATAR within 3 years. We present the mean ATAR eligibility rates for 2009 to 2010 and 2015 to 2016 by school type in Figure 8.

Figure 8

ATAR eligibility rates for 2009-2010 and 2015-2016 by school type



High and low performance in the HSC

For each HSC course that is externally examinable, a student will receive a band result. For 2-unit courses, there are 6 bands, ranging from band 1 (0-49 marks), then increasing by scores of 10 to band 6 (90-100 marks). For extension courses, there are 4 bands, ranging from E1 (0-24 marks), increasing by scores of 10 for the next 2 bands, to E4 (45-50 marks). Student performance in the HSC may be assessed by examining patterns of performance at the high and low ends of the achievement scales. In this analysis, we defined 'high performance' as achieving 2 or more results in the top 2 bands and 'low performance' as achieving 2 or more bottom band results.

As this analysis focuses on band results, it was necessary to restrict the analysis to students who completed a minimum of 4 ATAR eligible courses that provided band results. Of the 256,596 students who were included in the outcome analysis and who completed their HSC, 213,194 (83.1%) met our inclusion criteria. Of these students, 93,149 (43.6%) were classified as having high performance while 7,257 (3.4%) were classified as having low performance. Figure 9 shows the mean high performance rates and Figure 10 shows the mean low performance rates for 2009 to 2010 and 2015 to 2016 by school type.

Figure 9

High performance rates for 2009-2010 and 2015-2016 by school type

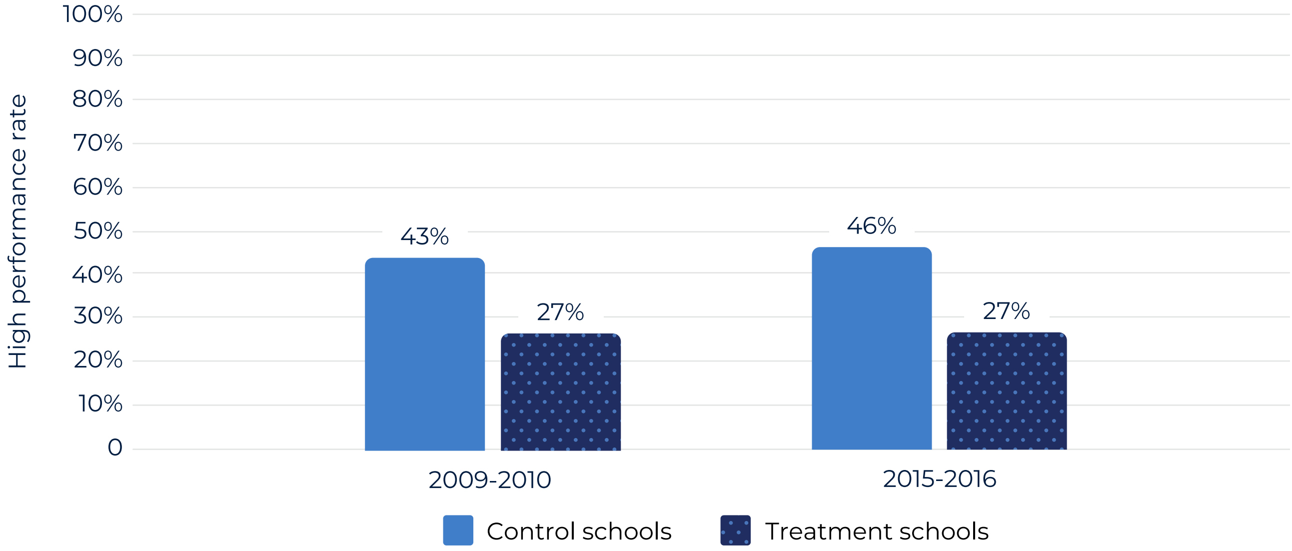
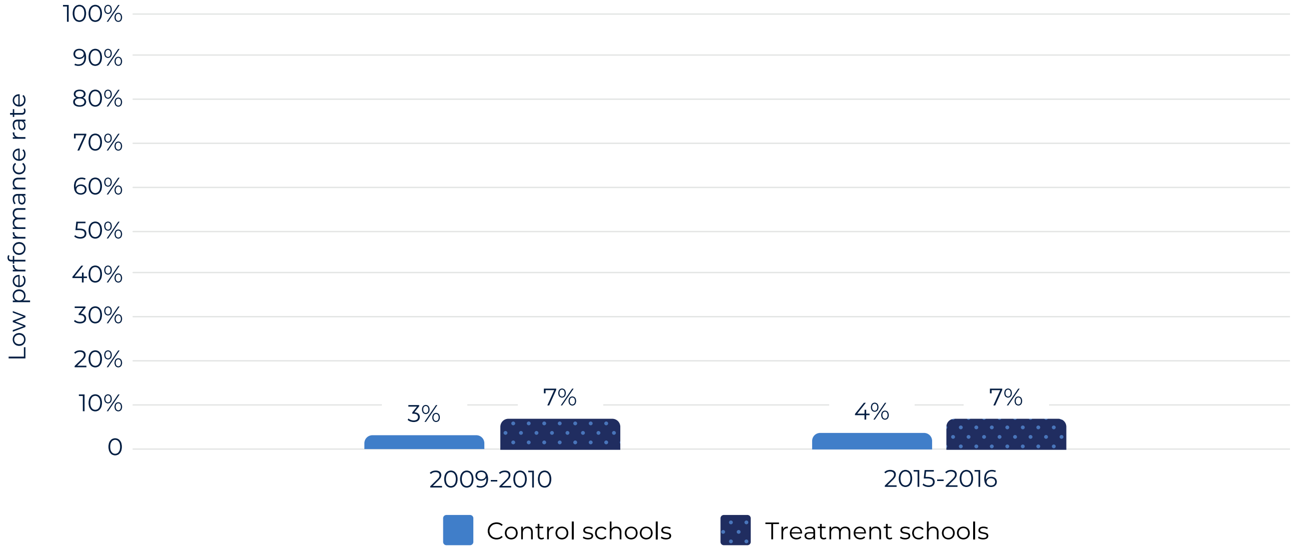


Figure 10

Low performance rates for 2009-2010 and 2015-2016 by school type



Main results

In applying our method to the treated cohorts, we attempted to estimate 72 individual average treatment effects. However, 2 school cohorts (33 students from 1 school) could not be matched to a suitable control group given our restrictions. For the 70 school cohorts that were matched (5,191 students from 25 schools), the mean number of matched control schools was 17.5 (SD = 12.6, min = 1, max = 48).

We used the following formula to combine the individual estimates for the treated cohorts:

$$\frac{1}{\sum_{g=1}^{G}\sum_{t=f_g}^{l_g} w_{gt}} \sum_{g=1}^{G} \sum_{t=f_g}^{l_g} ATT_{gt} w_{gt} \qquad (2)$$

where w_{gt} represents the number of students with observed outcomes in school g at time t. This represents the weighted average of the available school cohort average treatment effects. We present the summary parameters of interest for the treated cohorts along with their bootstrapped 95% confidence intervals in Table 9.

Table 9

Estimated effect of using a fully compressed curriculum for treated cohorts

	Weighted average ATT	Lower bound	Upper bound
HSC completion	-0.02	-0.06	0.05
ATAR	0.01	-0.03	0.08
High performance	-0.01	-0.09	0.07
Low performance	0.00	-0.07	0.03

These results suggest that it is unlikely that using a fully compressed curriculum has a substantial positive or negative effect on HSC outcomes. However, due to the uncertainty associated with our results, we cannot rule out the possibility that using a fully compressed curriculum has weak to strong positive or negative effects.

Another advantage of our method lies in the ability to consider how the effect of treatment varies across the different treated cohorts. We used the following formula to estimate the overall effect for the years in which treated schools first offered a fully compressed curriculum:

$$\frac{1}{\sum_{g=1}^{G} w_{gf_g}} \sum_{g=1}^{G} ATT_{gf_g} w_{gf_g} \qquad (3)$$

We present the summary parameters of interest for the treated cohorts along with their bootstrapped 95% confidence intervals in Table 10.

Table 10

Estimated overall effect of using a fully compressed curriculum for treated cohorts in transition years

	Weighted average ATT	Lower bound	Upper bound
HSC completion	-0.03	-0.1	0.04
ATAR	0.01	-0.05	0.08
High performance	-0.01	-0.09	0.08
Low performance	0.02	-0.05	0.08

These results suggest that the effect of using a fully compressed curriculum on HSC outcomes is probably similar in transition years as it is in other years. However, it is important to note that the results for the transition years are more uncertain than those for other years due to the decreased sample size.

Testing pre-treatment parallel trends

To provide some evidence for whether the parallel trends assumption was reasonable for the 72 cohorts who attended treated schools after they were treated (that is, where $f_g \leq t$), we attempted to calculate average treatment effects for the 52 cohorts who attended treated schools before they were treated (that is, where $f_g \geq t + 2$). However, 1 school cohort (13 students) could not be matched to a suitable control group given our restrictions. For the 51 school cohorts that were matched (3,095 students from 24 schools), the mean number of control schools was 9.7 (SD = 8.4, min = 1, max = 38).

To investigate pre-treatment parallel trends, the average treatment effects for untreated cohorts were calculated as:

$$ATT_{gt} = [\bar{Y}_t|C_g = 0] - \Phi\{\Phi^{-1}(\bar{Y}_{t-1}|C_g = 0) + [\Phi^{-1}(\bar{Y}_t|C_g = 1) - \Phi^{-1}(\bar{Y}_{t-1}|C_g = 1)]\} \quad (4)$$

We then used the following formula to combine the individual estimates:

$$\frac{1}{\sum_{g=1}^{G}\sum_{t=2010}^{b_g} w_{gt}} \sum_{g=1}^{G} \sum_{t=2010}^{b_g} ATT_{gt} w_{gt} \quad (5)$$

We present the summary parameters of interest for the untreated cohorts along with their bootstrapped 95% confidence intervals in Table 11.

Table 11

Estimated overall effect of a compressed curriculum model for untreated cohorts

	Weighted average ATT	Lower bound	Upper bound
HSC completion	0.02	-0.02	0.09
ATAR	0.00	-0.04	0.06
High performance	-0.01	-0.09	0.05
Low performance	-0.01	-0.08	0.02

These results show that the identified control groups tended to have similar changes over time compared to the treated schools when untreated. This provides some evidence that the parallel trends assumption may be reasonable for treated time periods.

Robustness checks

To test whether alternative approaches produced similar results to those from our primary method, we estimated 4 additional sets of models. The first set included a series of 2-way fixed effects linear regression models, written as:

$$Y_{gti} = \alpha_g + \delta_t + \gamma D_{gt} + \varepsilon_{igt} \quad (6)$$

where α_g represents the fixed effect of school g, δ_t represents the fixed effect of year t, D_{gt} represents a treatment indicator that was equal to 1 if school g was treated at time t and 0 otherwise, and ε_{igt} represents the residual error term.

The second set of models had the same specification as (6) but also included a set of student-level control covariates, written as:

$$Y_{gti} = \alpha_g + \delta_t + \gamma D_{gt} + \beta X_i + \varepsilon_{igt} \quad (7)$$

where X_i includes a vector of observed covariates, including: (a) Year 9 NAPLAN Reading and Numeracy scaled scores; (b) socio-educational advantage (SEA) quartile; and (c) Aboriginal and Torres Strait Islander status. For each linear model, γ was the parameter of interest.

The third and fourth set of models had the same specifications as (6) and (7) but were estimated with probit links. Using the estimated parameters, the treatment effect for student i from school g at time t was given by:

$$\rho_{gti} = [\Phi(\alpha_g + \delta_t + \gamma + \beta X_i)] - [\Phi(\alpha_g + \delta_t + \beta X_i)] \quad (8)$$

with the average treatment effect given by:

$$\frac{1}{\sum_{g=1}^{G} \sum_{t=f_g}^{l_g} \sum_{i=1}^{N_{gt}} 1} \sum_{g=1}^{G} \sum_{t=f_g}^{l_g} \sum_{i=1}^{N_{gt}} \rho_{gti} \quad (9)$$

The lower bound (LB) and upper bound (UB) of the estimates were calculated using the same 2-stage bootstrap procedure as detailed earlier in this report. We present the results from the robustness checks in Table 12 and Table 13.

Table 12

Results from 2-way fixed effects linear regressions

	Primary method			Linear regression			Linear regression with controls		
	Weighted average ATT	LB	UB	Point estimate	LB	UB	Point estimate	LB	UB
HSC completion	-0.02	-0.06	0.05	0.01	-0.02	0.04	-0.02	-0.09	0.05
ATAR	0.01	-0.03	0.08	0.01	-0.02	0.05	-0.02	-0.07	0.04
High performance	-0.01	-0.09	0.07	-0.03	-0.07	0.02	-0.02	-0.09	0.06
Low performance	0.00	-0.07	0.03	0.01	-0.02	0.04	-0.03	-0.11	0.03

Table 13

Results from 2-way fixed effects probit regressions

	Primary method			Probit regression			Probit regression with controls		
	Weighted average ATT	LB	UB	Point estimate	LB	UB	Point estimate	LB	UB
HSC completion	-0.02	-0.06	0.05	0.00	-0.02	0.04	0.00	-0.07	0.06
ATAR	0.01	-0.03	0.08	0.01	-0.01	0.04	-0.01	-0.07	0.08
High performance	-0.01	-0.09	0.07	-0.03	-0.08	0.02	-0.03	-0.11	0.1
Low performance	0.00	-0.07	0.03	0.00	-0.02	0.04	-0.02	-0.14	0.04

While the results had a modest degree of variability across the different methods, the results were mostly consistent with those produced by our primary method. That is, the results show that it is unlikely that a fully compressed curriculum has substantial positive or negative effects on HSC outcomes, but that we cannot rule out the possibility that a fully compressed curriculum has weak to strong positive or negative effects.

Limitations

While our method attempts to indirectly control for the effects of endogenous factors, it is possible that our results are still influenced by other policies and/or programs that affected the treated and control groups differently. To directly control for these possible influences, we require information about the programs each school operates and the different policies they were exposed to over the years, rather than the proxy information (for example, remoteness) used in our analysis. As this information was not available, there remains the possibility for omitted variable bias; however, we expect this bias to be small due to the type of methods used in our analysis and the robustness of our results.

In order to measure a student's performance in the HSC, a student must complete the HSC with a prescribed course undertaking (complete a minimum of 4 ATAR eligible courses that provide band results). This means that performance in the HSC is only observed for a subset of the Year 10 student sample, potentially limiting inferences regarding the effect of using a compressed curriculum model on performance in the HSC. This is problematic when a program influences the probability of observing outcomes for certain types of students. For example, if offering a fully compressed curriculum causes more students from lower socio-educational backgrounds to complete the HSC, with these students typically having poorer performance, the observed mean level of performance with treatment will be lower than what would have been observed without treatment (assuming a null treatment effect).

While our results suggest that it is unlikely that offering a fully compressed curriculum has a substantial positive or negative effect on HSC outcomes, the limited statistical power of our analysis means that we cannot rule out the possibility of weak to strong positive or negative effects. Future research could increase the precision of estimation if more schools started offering a fully compressed curriculum.

Finally, it is important to recognise that our results may not generalise to students and schools that substantially differ from those included in our analysis. While our analysis had limited scope to examine treatment effect heterogeneity (due to the small number of schools included in our analysis), if more data becomes available future research may be able to provide more specific estimates of effectiveness for certain students and schools.

Qualitative data sources

Cross-sectoral surveys of school principals and teachers

A survey of school principals was administered online to try to determine which NSW Government, independent and Catholic schools had implemented the compressed curriculum model, and if they had, why they had chosen to do so. All schools that offered Stage 6 courses (n = 889) were sent an email with a link to the survey. In total, 443 principals responded to the survey, resulting in a 50% response rate across all sectors. The survey data was intended to supplement the enrolment data analysis. The qualitative data from the survey was analysed thematically and aggregated with the interview data.

Schools that responded to the survey of principals formed the sampling frame for a new survey that was then sent to teachers. The aim of the survey of teachers was to determine the benefits, limitations and impacts of the compressed curriculum model on students, teachers and the whole school. This survey was sent to all teachers in government schools that had implemented the compressed curriculum model, as outlined in Table 14.

Table 14

Number of government school teachers receiving and completing the survey

Survey recipients	Respondents	Response rate
1,590	660	42%

The survey was also sent to teachers from non-government schools that opted to participate in the survey of school principals and identified as using the compressed curriculum model. As non-government schools opted into participating in the survey and were responsible for sending the survey to their teachers, we do not know how many non-government teachers were sent the survey and therefore we cannot calculate a response rate. Participation in the survey was voluntary, and as such, the results are not necessarily representative of all NSW schools that deliver or have delivered a compressed curriculum. The qualitative data from the survey was analysed thematically together with the interview data.

Cross-sectoral interviews with school staff

We conducted semi-structured interviews with staff within the 3 school sectors, as shown in Table 15. The purpose of these interviews was to gain a more in-depth understanding of schools' experiences with the compressed curriculum model, and to gather different perspectives about how schools have implemented the compressed curriculum model. Schools were selected to participate in interviews based on the following characteristics:

- school sector
- length of time compressing
- fully or partially compressing
- remoteness
- school size
- ICSEA value.

Table 15

Number of school staff who participated in interviews

School type (n)	Role	Number
Government (6)	Principal	5
	Deputy	6
	Head teacher/curriculum coordinator	6
	Teacher	9
	Careers advisor	1
	Total	**27**
Independent (6)	Principal	6
	Deputy	1
	Head teacher/curriculum coordinator	7
	Teacher	10
	Total	**24**
Catholic (2)	Principal	1
	Assistant principal	1
	Head teacher/curriculum coordinator	5
	Teacher	2
	Total	**9**
	Grand total	**60**

We recorded all interviews and discussions with the agreement of interview participants. We analysed interview transcriptions and notes across the key features of the compressed curriculum model together with the survey data.

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