

COVID-19 and student achievement in Aotearoa New Zealand

Progressive Achievement Test
evidence on mathematics and
reading comprehension

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He ihirangi | Contents

He mihi Acknowledgements	v
Executive summary	1
Key results	1
What this means	1
Technical note	1
1. Introduction	2
Global context	2
Aotearoa New Zealand	4
<i>Nationwide school closures in 2020</i>	4
<i>Regional closures in late 2020 and early 2021</i>	5
<i>Auckland closures in 2021</i>	5
<i>Omicron and the end of widespread school closures</i>	5
<i>Impact on attendance</i>	6
Progressive Achievement Tests	6
Scale score	7
2. Methodology	8
Data cleaning	8
<i>PAT Pāngarau PAT Mathematics</i>	8
<i>PAT Pānui PAT Reading Comprehension</i>	9
Analysis populations	9
<i>Stable schools</i>	9
Statistical methods	11
<i>General methods</i>	11
<i>Technical details</i>	12
<i>Analyses explored but not retained</i>	12
<i>Limitations</i>	13
3. Results	14
PAT Pāngarau PAT Mathematics	14
<i>Stable schools</i>	14
<i>EQI groups</i>	15
<i>Ethnicity</i>	19
<i>Gender</i>	25
<i>Mathematics summary</i>	27
PAT Pānui PAT Reading Comprehension	27
<i>Stable schools</i>	27
<i>EQI groups</i>	29
<i>Ethnicity</i>	33
<i>Gender</i>	39
<i>Reading comprehension summary</i>	41
4. Conclusions	42
References	43

Tables

Table 1: Analysis populations, mathematics	10
Table 2: Analysis populations, reading comprehension	11
Table 3: Stable school population, mathematics	15
Table 4: EQI group 'Fewer', mathematics	16
Table 5: EQI group 'Moderate', mathematics	17
Table 6: EQI group 'More', mathematics	19
Table 7: Māori students, mathematics	20
Table 8: North Asian students, mathematics	21
Table 9: South and Southeast Asian students, mathematics	22
Table 10: Pasifika students, mathematics	23
Table 11: NZ European students, mathematics	24
Table 12: Girls, mathematics	26
Table 13: Boys, mathematics	27
Table 14: Stable school population, reading comprehension	29
Table 15: EQI group 'Fewer', reading comprehension	30
Table 16: EQI group 'Moderate', reading comprehension	31
Table 17: EQI group 'More', reading comprehension	33
Table 18: Māori students, reading comprehension	34
Table 19: North Asian students, reading comprehension	35
Table 20: South and Southeast Asian students, reading comprehension	36
Table 21: Pasifika students, reading comprehension	37
Table 22: NZ European students, reading comprehension	38
Table 23: Girls, reading comprehension	40
Table 24: Boys, reading comprehension	41

Figures

Figure 1: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics)	14
Figure 2: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, EQI group 'Fewer')	16
Figure 3: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, EQI group 'Moderate')	17
Figure 4: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, EQI group 'More')	18
Figure 5: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, Māori)	20
Figure 6: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, North Asian)	21
Figure 7: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, South and Southeast Asian)	22
Figure 8: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, Pasifika)	23
Figure 9: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, NZ European)	24
Figure 10: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, girls)	25
Figure 11: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, boys)	26
Figure 12: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Reading Comprehension)	28
Figure 13: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, EQI group 'Fewer')	30
Figure 14: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, EQI group 'Moderate')	31
Figure 15: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, EQI group 'More')	32
Figure 16: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, Māori)	34
Figure 17: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, North Asian)	35
Figure 18: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, South and Southeast Asian)	36
Figure 19: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, Pasifika)	37
Figure 20: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, NZ European)	38
Figure 21: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, girls)	39
Figure 22: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, boys)	40

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Executive summary

This report was commissioned by the COVID-19 Lessons Learned Royal Commission | Te Tira Ārai Urutā to provide an evidence-based view of how COVID-19–related school disruptions may have affected student learning in Aotearoa New Zealand. It estimates the effect of COVID-19–era school closures on achievement using Term 1 Progressive Achievement Tests (PAT) in Mathematics (Pāngarau) and Reading Comprehension (Pānui). Auckland is compared with the rest of New Zealand using a difference-in-differences design in linear mixed-effects models, adjusting for year level, gender, ethnicity, and school socioeconomic context (Equity Index).

Note: *The pre-publication version of this report provided to COVID-19 Lessons Learned Royal Commission | Te Tira Ārai Urutā did not include any discussion or analysis of gender. All gender content was added later to the publication version by NZCER and was not available to Te Tira Ārai Urutā. The material in the Limitations section was verbally discussed with Te Tira Ārai Urutā but not included in the original written draft provided to the Royal Commission. Some other text has been lightly edited for readability in ways that do not affect interpretation.*

Key results

Mathematics: National scores dipped in 2020 and again in 2021, then broadly returned toward baseline by 2022. Auckland shows an additional 2021 decline consistent with its longer closures; most of that Auckland gap closes by 2022 in the aggregate, though higher-barrier (higher EQI) Auckland schools and Māori and Pasifika learners carried more persistent effects. Girls and boys both show an Auckland-specific dip in comparison to baseline in 2021 that does not persist into 2022.

Reading: There was a slight multi-year decline in reading comprehension. Declines are evident by 2020 (reflecting pre-pandemic learning) and continue thereafter; Auckland’s COVID-specific movement is small and temporary (a relative dip in 2021 that normalises subsequently). Patterns vary somewhat by group: NZ European and Māori track the mild national decline; North Asian learners improve; South and Southeast Asian and Pasifika remain near baseline. The national decline is slightly more pronounced for girls, while boys show a clearer Auckland-specific effect in 2021.

What this means

New Zealand’s learning impacts from COVID-19 were real but comparatively modest by international standards and concentrated where disruption was greatest—Auckland in 2021—and where socioeconomic barriers are higher. While the primary benefit of this report is as a historical record, possible policy implications at this stage are two-fold: there may still be a need for continued mathematics catch-up for high-barrier Auckland schools and for some Māori and Pasifika learners as well as longer-horizon work on reading in the context of pre-COVID trends not attributable to school closures alone.

Technical note

This is intended as a technical report for an audience that is comfortable interpreting standardised test scores, graphs and tables, and brief summaries of statistical models (for example, adjusted averages and confidence intervals).

1. Introduction

This report was commissioned by the COVID-19 Lessons Learned Royal Commission | Te Tira Ārai Urutā to provide an evidence-based view of how COVID-19–related school disruptions may have affected student learning in Aotearoa New Zealand. Using large-scale data from NZCER’s Progressive Achievement Tests (PATs), it focuses specifically on whether there is evidence of learning loss in mathematics (PAT: Pāngarau | PAT: Mathematics) and reading comprehension (PAT: Pānui | PAT: Reading Comprehension) associated with the pandemic period. The central questions are whether PAT results show systematic changes over time for Aotearoa New Zealand as a whole, whether any such changes differ for any regions—especially Auckland, which experienced longer school closures than most of the rest of the country—and whether certain groups of learners may have been more affected than others.

The structure of the report reflects these aims. Following this introduction, we first set out the international and national context of COVID-19 and school closures, before describing in more detail the timeline of nationwide, regional, and Auckland-specific disruptions. We then outline the PAT assessments and their role in New Zealand schools, followed by a technical methodology section describing how the PAT data were prepared, which schools and students were included, and how exposure to COVID-era schooling conditions was defined. The Results section presents findings separately for PAT: Pāngarau and PAT: Pānui, moving from overall national patterns to analyses that distinguish Auckland from the rest of Aotearoa New Zealand and then to key subgroups defined by Equity Index bands and major ethnic groupings. The report concludes by situating these findings within the wider international literature on learning loss and drawing out implications for equity, system resilience, and future policy.

Although the analyses employ linear mixed-effects regression and a difference-in-differences design, the report has been written so that readers without specialist statistical training can follow the main story. A basic familiarity with graphs, confidence intervals, and p-values will help in interpreting the detailed tables and figures, but the text explains the key concepts in plain language and patterns in addition to providing technical detail. Readers with a general background in education policy, assessment, or data-informed decision making should therefore be able to generally engage with the findings.

Global context

The COVID-19 pandemic triggered a global disruption in education as schools around the world closed for extended periods to curb the virus’s spread. On average, schools worldwide were fully shut down for about 3.5 months in 2020, and when partial closures are included this rises to approximately 5.5 months. By the end of the pandemic’s first year, over 800 million students had experienced disruptions. It quickly became apparent that this lost instructional time would likely come at a cost to student learning outcomes, sparking early concern among educators and policymakers (UNESCO, 2021).

Researchers around the world have since gathered evidence of pandemic-related declines in academic achievement, often termed “learning loss”. For example, in the Netherlands, which had a relatively short nationwide school closure of 8 weeks and high rates of technology access, primary

school students in 2020 made only about 80% of the learning progress that would be expected in a normal year, suggesting that despite concerted efforts at online instruction, students “made little or no progress while learning from home” (Engzell et al., 2021, p. 1). This study was an early indicator that even relatively well-resourced education systems could suffer measurable learning deficits from relatively brief pandemic disruptions.

Other countries with longer school shutdowns or fewer educational resources have recorded greater impacts. In the United States, for instance, national assessment data revealed large reversals in progress. The National Assessment of Educational Progress (NAEP), sometimes called the Nation’s Report Card, showed that between 2019 (pre-pandemic) and 2022, average mathematics scores for eighth graders fell by 8 points (on NAEP’s 500-point scale), representing the largest drop in math performance in decades (NCES, 2022). This decline effectively erased about 20 years of gradual improvement in math achievement, reverting average performance to levels last seen in the early 2000s. Score declines in the US were distributed across student ages and affected both mathematics and reading (NCES, 2022; Pinto, 2023).

Similar patterns have emerged from other countries. A 2023 systematic review and meta-analysis of 42 studies across 15 countries estimated that students worldwide suffered an average learning deficit of several months during the pandemic (Betthäuser et al., 2023). The meta-analysis found that these learning losses emerged early in the pandemic (during the initial 2020 school closures) and have persisted over time, with little evidence of rapid “catch-up” learning once schools reopened (Betthäuser et al., 2023). The achievement gap caused by COVID disruptions has generally been a sustained problem for the cohort of students who experienced it.

COVID-19 school closures exacerbated pre-existing educational inequalities, with learning losses disproportionately affecting certain groups of students. Learners from low socio-economic backgrounds experienced larger declines than their more advantaged peers, reflecting disparities in access to digital devices, internet connectivity, and other learning resources that became especially critical during periods of remote instruction (Betthäuser et al., 2023). Age-related differences were also evident: younger students—particularly those in the early primary years, who rely more heavily on structured in-person teaching and have fewer independent learning skills—often lost more ground than older learners in several international studies (Jakubowski et al., 2025; Pinto, 2023).

In addition to these intergroup disparities, learning losses were uneven across academic domains. Research consistently finds that mathematics achievement was hit harder than reading in many countries, with students showing more substantial setbacks in mathematical skills than in literacy during remote learning periods (Betthäuser et al., 2023; Pinto, 2023). This pattern likely reflects the cumulative and conceptually sequenced nature of mathematics learning, which may be more sensitive to disruptions in instructional time and to the reduced opportunities for guided practice that accompanied school closures.

There is also evidence that, in general, the duration of school closures mattered. In general, the longer students remained out of the classroom, the larger their cumulative learning loss. One global analysis of secondary-school outcomes found that countries with relatively longer school closures saw correspondingly larger declines in standardised test scores, whereas countries that kept closures shorter or more intermittent saw smaller learning declines on average (Jakubowski et al., 2025).

Evidence from Australia provides a useful point of comparison for Aotearoa New Zealand, given broadly similar schooling systems and relatively short periods of full school closure. Early modelling and policy commentary highlighted risks of substantial learning loss and widening achievement

gaps, especially for students in disadvantaged communities, which influenced calls for large-scale targeted tutoring (Sonnemann & Goss, 2020). Empirical analyses of Progressive Achievement Tests in New South Wales primary schools, however, found no evidence of systematic declines in reading and mathematics progress in 2020 compared with pre-pandemic cohorts (Gore et al., 2021). More recent quasi-experimental work using NAPLAN data suggests only modest average test-score impacts, around a tenth of a standard deviation for approximately 100 days of disrupted schooling, which is much smaller than reported in many other systems, even though NAPLAN reporting has continued to identify a notable minority of students who need additional support to meet national benchmarks (ACARA, 2023; Gillitzer & Prasad, 2024). These Australian findings suggest that in a schooling context broadly comparable to Aotearoa New Zealand, which was also characterised by relatively short though uneven periods of school closure, it is plausible that any COVID-related impacts on standardised measures such as PAT may be modest, while still warranting attention to equity patterns and the experiences of students at greater risk.

Aotearoa New Zealand

New Zealand's experience during the pandemic reflected many of the global challenges, though on a different scale. Like many other countries, the New Zealand Government implemented swift public health measures to control the spread of the virus, including nationwide lockdowns and regional restrictions, which involved closing schools for in-person learning for extended periods. The summary that follows outlines the timeline of COVID-19-related school closures in New Zealand, focusing on key Government decisions and their impact on primary and secondary schools.

Nationwide school closures in 2020

New Zealand confirmed its first COVID-19 case on 28 February 2020. In response to rising case numbers and signs of community transmission, the Government introduced a four-tier COVID-19 Alert Level system on 21 March 2020 (Education Review Office, 2023). On 23 March 2020, Prime Minister Jacinda Ardern announced an immediate escalation to Alert Level 3, followed by a move to Alert Level 4 (the highest level) within 48 hours (Radio New Zealand [RNZ], 2021). All schools, early childhood centres, and tertiary institutions were ordered to close for in-person instruction from 24 March 2020 (RNZ, 2021). By midnight on 25 March, New Zealand entered a full nationwide lockdown, requiring everyone to stay home and effectively shutting schools and non-essential businesses (Ministry for Culture and Heritage, 2025).

During the Alert Level 4 lockdown (late March to late April 2020), schools transitioned to remote learning. The Ministry of Education supported this effort by launching online learning platforms and distributing devices and learning packs to students (RNZ, 2020). New Zealand remained in Alert Level 4 for about 5 weeks, then shifted to Alert Level 3 in late April when daily case numbers had fallen (Royal Commission of Inquiry, 2023). Under Level 3, in-person schooling was still highly limited, as schools were only open to children up to Year 10 who could not be supervised at home (Royal Commission of Inquiry, 2023). For most students, learning continued remotely.

As community transmission was contained, the first national lockdown formally ended on 13 May 2020, when the country moved down to Alert Level 2. By 18 May 2020, all schools were allowed to reopen for on-site learning under Level 2 conditions (ERO, 2023; Roy, 2020). By June 2020 the virus was considered eliminated in the community throughout New Zealand, allowing schools to operate normally for several months (ERO, 2023). International comparisons indicate that New Zealand's students missed relatively few days of school in 2020 compared to other OECD countries (Royal Commission of Inquiry, 2023).

Regional closures in late 2020 and early 2021

On 11 August 2020, four cases of COVID-19 were detected in Auckland, ending a 102-day streak without local transmission (RNZ, 2021). In response, the Government reimposed restrictions in the Auckland region: from 12 August, Auckland moved to Alert Level 3 (a local lockdown), while the rest of New Zealand was raised to Level 2 as a precaution (RNZ, 2021). All Auckland schools closed their campuses on 12 August 2020, switching back to distance learning, while schools in other regions remained open with social distancing and limits on gatherings. This Auckland-specific lockdown lasted about 2.5 weeks. By the first week of September 2020, the Auckland outbreak was contained. Consequently, Auckland schools reopened for in-person learning in early September, after roughly 2 weeks of closure (Royal Commission of Inquiry, 2023).

In early 2021, New Zealand faced additional, targeted lockdowns due to small clusters in Auckland. In February 2021, a community cluster in South Auckland prompted a short Level 3 lockdown in the Auckland region (with the rest of the country at Level 2). Auckland schools closed for 1 week in February 2021 and again for several days in March 2021 during a second brief lockdown, each time moving to online instruction (ERO, 2023). Outside of Auckland, most schools experienced continuous in-person classes for the majority of 2020–2021, with the initial lockdown and a few precautionary closures being the main interruptions (Royal Commission of Inquiry, 2023).

Auckland closures in 2021

New Zealand's most significant school disruptions occurred during the Delta outbreak in the second half of 2021. On 17 August 2021, a single community case of the Delta strain was identified in Auckland. Given Delta's high transmissibility, the Government responded with an immediate nationwide lockdown. All schools nationwide were shut down and reverted to remote learning from 18 August 2021 as the country entered Alert Level 4. This was New Zealand's first nationwide lockdown since the initial wave, and it came with little warning due to the urgency of containing Delta (ERO, 2023). By early September 2021, areas beyond Auckland were able to move down to Level 2, allowing schools in those regions to reopen in-person after about 3 weeks of closure (Royal Commission of Inquiry, 2023).

However, Auckland, and to a lesser extent parts of Northland and Waikato, faced a much more prolonged lockdown due to sustained community transmission. The city remained under heavy restrictions for several months. Auckland schools did not fully reopen at Level 2 until mid-November 2021. In total, Auckland primary and secondary schools were closed for an additional 15 weeks in the latter half of 2021 (Royal Commission of Inquiry, 2023). During this time, teaching and learning continued remotely. Some limited in-person learning was gradually reintroduced as the situation improved: for example, senior secondary students (Years 11–13) in Auckland were allowed to return to school on a limited basis from 26 October 2021 to prepare for NCEA examinations, with strict mask use and distancing (Gerritsen, 2021). By 17 November 2021, all year levels in Auckland and affected parts of Waikato were permitted to resume on-campus classes, marking the end of the long Delta lockdown for schools (Franks, 2021). This reopening came ahead of the country's shift to a new COVID-19 management system in December 2021.

Omicron and the end of widespread school closures

In early 2022, New Zealand, like the rest of the world, confronted the Omicron variant. Omicron led to a large surge in cases nationwide, but the policy settings and public health response differed from earlier phases. Due to widespread vaccination and the introduction of the traffic light system, the Government did not impose any more general school shutdowns in 2022. Primary and secondary

schools largely remained open for in-person learning throughout the Omicron wave, except for temporary, localised disruptions. However, many schools still experienced significant challenges: high numbers of students and teachers were absent due to illness or isolation requirements, and some schools had to briefly transition certain classes to online learning because of staff shortages (ERO, 2023). However, these were individual school decisions rather than systemic, Government-mandated closures.

Impact on attendance

New Zealand's decisive early actions in 2020 and 2021 minimised the total number of days schools were closed compared to many other countries, especially during the first year of the pandemic (Royal Commission of Inquiry, 2023). Nonetheless, the closures that did occur, particularly the longer Auckland lockdown in 2021, had a clear effect on student attendance patterns. Even after schools reopened, many students did not return to attending regularly. Nationwide data show that overall "regular attendance" (defined as attending more than 90% of school days) hit a record low of about 40% of students in Term 2 of 2022 (Education Review Office, 2023). By the end of 2022, regular attendance had only partially recovered to around 51%, indicating a longer-term challenge in re-engaging students with school (Education Review Office, 2023).

Progressive Achievement Tests

To assess student learning outcomes over time, many New Zealand schools use the Progressive Achievement Tests (PATs), a series of standardised, multiple-choice assessments developed by the New Zealand Council for Educational Research (NZCER) and normed for New Zealand students. PATs can be administered to students in Year 4 through Year 10 (roughly ages 8–15). There are PAT assessments for Mathematics (Pāngarau), Reading Comprehension (Pānui), Reading Vocabulary, Listening Comprehension, Punctuation and Grammar, and more recently Tuhituhi | Writing. Each test assesses proficiency in its domain. For example, the PAT: Mathematics measures skills in number knowledge, algebra, geometry, and statistics, while the PAT: Reading Comprehension assesses how well students understand and interpret written texts. Schools typically administer these tests once or twice a year to gauge student achievement in core skill areas, with the heaviest use being in Term 1.

Importantly, PATs are low-stakes, formative assessments. Teachers use PAT results to identify students' strengths and weaknesses, determine what kind of teaching support or materials might be needed, and track progress over time. Because the tests are standardised and nationally norm-referenced, a student's performance can be compared against a national sample to see how they are achieving relative to peers. More importantly for this study, PATs allow measurement of student progress year-to-year. As each PAT subject test is scored on a continuous scale, teachers (and researchers) can observe how a student's scale score grows as they advance from one year level to the next. In this way, PAT data can help quantify whether students are making expected gains in learning. Large-scale patterns in PAT scores over multiple years and across many students can also provide an indicator of overall learning trends in New Zealand.

The PAT assessments have a long history in New Zealand education. The first PAT test was developed by NZCER in the late 1960s and they have been periodically updated to remain aligned with curriculum changes and shifting testing standards. For more than 50 years, PATs have been among the most widely used assessment tools in New Zealand schools (New Zealand Council for Educational Research, 2023).

PAT data offer a robust basis for examining trends in New Zealand student achievement over time as the tests are administered to large numbers of students nationwide each year, producing large datasets of achievement across all regions of the country that can be aggregated to observe system-wide changes. By analysing anonymised PAT scores over time, we can attempt to detect whether there was a reduction in PAT performance corresponding to the COVID-19 disruption years.

In the past few years, NZCER has been refreshing the PAT assessments to ensure they reflect the needs of New Zealand learners. The PAT Mathematics (now called PAT: Pāngarau | PAT: Mathematics) and Reading Comprehension (PAT: Pānui | PAT: Reading Comprehension) assessments were updated in 2024 and 2025, respectively, so that the language, culture, and identity of all learners are reflected in the assessments. This recent updating of the PAT assessments is an important consideration for this analysis as they represent an interruption to continuous measurement.

The following sections will delve into that analysis, presenting findings on how New Zealand students' PAT results changed following the pandemic and discussing what these reveal about learning loss (or recovery) in the wake of COVID-19.

Scale score

In PAT, a scale score is the number we use to place a student on a common measurement scale for a learning area, such as mathematics or reading. A student's raw score (how many questions they got right on a particular test form) is converted to this scale using a psychometric Rasch model. Because all questions within a subject sit on the same underlying scale, a scale score tells us how difficult the questions were that the student could reliably answer. Importantly, scale scores are designed to behave like an interval scale: a difference of (say) 5 points means roughly the same amount of progress anywhere on the scale. PAT: Mathematics and PAT: Reading Comprehension each have their own scale and measurement unit, so scores are comparable over time within, but not necessarily between, these subjects.

For PAT Pāngarau | PAT Mathematics, recent national norms show that the average Term 1 scale score rises from about 25 units in Year 3 to about 33 in Year 4, 40 in Year 5, and 46 in Year 6, with typical year-to-year gains of around 6–7 units in the upper primary years and about 3–5 units in later years. This means that, for the purposes of this report, a change in scale score of roughly 5–7 units can be thought of as corresponding to 1 year's average progress in mathematics.

For PAT Pānui | PAT Reading Comprehension, Term 1 norms indicate average scale scores of about 29 units in Year 4, 37 in Year 5, 46 in Year 6, and 55 in Year 7, with typical annual gains between year levels of around 8–9 units at most stages. In this context we treat a difference of roughly 7–9 units as approximately 1 year of learning in reading comprehension.

Occasionally scale score points are converted in this report into approximate weeks of learning. This is done assuming that six scale score points represents 38 weeks of learning in mathematics and that eight scale score points represents 38 weeks of learning in reading comprehension.

2. Methodology

This section describes how the PAT datasets were prepared, how analysis populations were defined, and the statistical models that were used to estimate COVID-19 impact on student achievement.

Data cleaning

PAT Pāngarau | PAT Mathematics

The refreshed PAT: Mathematics assessment was introduced to a limited number of schools in 2023 and then used universally in 2024. PAT: Reading Comprehension followed the same pattern but started 1 year later, with limited use of the refreshed assessment in 2024 and full adoption only in 2025. Because data for the new assessment versions has been collected at scale for only a few years (1 year for reading and 2 years for mathematics), data from refreshed assessments was excluded from this analysis.

To allow for the inclusion of school-level demographic information in our models, the NZCER student PAT database was merged with the Ministry of Education school directory for all analyses.

While some schools use PAT assessments across the school year, historically they have been disproportionately administered in Term 1. For this reason, we restricted our analysis to Term 1 tests only. This gave us a single, clean measure of achievement for each student in our dataset for each year they were present, which primarily reflected their achievement for the school year before the assessment (e.g., Term 1 2020 data primarily tell us about student achievement in 2019).

The pool of schools that uses PAT assessments has always shifted across time and has been growing sharply in recent years. For this reason, to better control for school-specific factors that are not in the database, the analysis was restricted to those schools that used the PAT: Mathematics assessment for at least 10 students each year in the 2020–2023 date range.

The database was restricted to English-medium, state and state-integrated schools to ensure alignment between the assessments used and the curriculum they are designed to represent. PATs are developed in the context of the *New Zealand Curriculum (NZC)*, and they have historically been used primarily in these schools. The tests are available only in English and are used infrequently in non-English-medium settings. In addition, the Equity Index (EQI) is defined and published only for state and state-integrated schools and kura (Ministry of Education, 2025). Private schools fall outside the EQI framework, and many do not follow the NZC in full, making them less comparable to state and state-integrated schools.

The PAT Pāngarau | PAT Mathematics assessment has an online, adaptive and a static test version. Adaptive tests have historically been used less than static tests and were excluded from all analyses. In addition, alternative test versions are available for schools for a variety of purposes (e.g., testing Year 3 students toward the end of the school year, providing additional assessments for retesting students, etc.). As these tests provide only a small amount of the total data available and are not used as consistently as the primary test sequence, alternative tests were excluded.

Occasionally, tests are administered to students outside the intended age range for the test. These tests were excluded.

Ethnicity in the PAT database is encoded into the following categories—NZ European; detailed European subgroups (e.g., Australian or Dutch); Māori; Pacific subgroups (e.g., Tongan); Southeast Asian subgroups (e.g., Sri Lankan); Chinese; Indian; other Asian subgroups (e.g., Japanese); Middle Eastern; Latin American; African; Other Ethnicity; and Not Stated. Due to the large amount of data available and the large amount of variation predicted by these fine ethnicity categories, detailed ethnicity variables were retained in the modelling. Coefficients for these are generally not presented, to retain focus on group changes relative to baseline during the COVID-19 period.

Some variables were transformed to allow for easier interpretation and presentation. EQI was centred within the analysis population to form a mean-zero equity measure. Ethnicity measures were also centred for easier interpretability.

PAT Pānui | PAT Reading Comprehension

Preparation of the PAT Reading Comprehension dataset was analogous to that of PAT Mathematics. However, as PAT Reading Comprehension was trialled in 2024 and replaced the legacy exam only in 2025 (1 year later than for Mathematics), the analysis window for PAT Reading Comprehension was extended to 5 years, covering 2020–2024 (giving us information primary about 2019 through 2023), allowing for an additional year of post-pandemic follow-up.

Analysis populations

Modelling was done using three complementary population frames. The first and primary frame was a stable-schools analysis population that included all schools that consistently used PAT assessment throughout the analysis period.

The second frame looked at each of the three Equity Index bands, to better explore outcomes for learners with different levels of privilege.

The third frame looked at ethnicity and gender-focused subsets (Māori, Pasifika, North Asian, European, Male, Female) and were drawn from the stable-schools base. Ethnicity groups were pooled based in part on cultural affinity but also on similar achievement coefficients in the models themselves. For this later reason, North Asian (Chinese, Korean, and Japanese) and South and Southeastern Asian populations (most other ethnicities typically considered to be Asian) were distinguished.

In the PAT database, it is possible for learners to identify with more than one ethnicity. The minority of students who did so were included in all relevant analysis subpopulations (e.g., Pasifika and North Asian).

Stable schools

This was the primary analysis dataset. All schools not excluded during data cleaning that consistently contributed Term 1 PAT results across the analysis window were included.

Stable schools—‘Fewer’ Equity Index Group

Same as the *Stable Schools* dataset but restricted to students in schools with EQI < 428.

Stable schools—‘Moderate’ Equity Index Group

Same as the *Stable Schools* dataset but restricted to EQI 428–494 inclusive.

Stable schools—‘More’ Equity Index Group

Same as the *Stable Schools* dataset but restricted to EQI >494 inclusive.

NZ European students

Students in the *Stable Schools* dataset who indicated that their ethnicities were NZ European or that they were from another European background (e.g., German, Dutch).

Māori students

Those students in the *Stable Schools* dataset who indicated that their ethnicity was Māori.

Pasifika students

Those students in the *Stable Schools* dataset who indicated that their ethnicity was Tongan, Samoan, Cook Islands Māori, Niuean, or Fijian. Other subgroups of Pacific peoples were not included either due to small absolute numbers in the database or dissimilar score profiles.

North Asian students

Those students in the *Stable Schools* dataset who indicated that their ethnicity was Chinese, Japanese, or Korean.

South and Southeast Asian students

Those students in the *Stable Schools* dataset who indicated that their ethnicity was Indian, Sri Lankan, Vietnamese, Filipino, Cambodian, or Other Asian.

Girls

Those students in the *Stable Schools* dataset who indicated that their gender was female.

Boys

Those students in the *Stable Schools* dataset who indicated that their gender was male.

TABLE 1: Analysis populations, mathematics

Analysis Population	Assessments	Unique Students	Unique Schools	Assessments from Auckland (%)
Stable schools	387134	200640	575	34.7
‘Fewer’ EQI band	186762	99357	238	47.6
‘Moderate’ EQI Group	172864	93146	265	20.4
‘More’ EQI Group	27508	15041	72	34.5
European	266079	134589	575	28.2
Māori	86483	45306	572	24.3
Pacific	30538	16089	523	61.4
North Asian	28717	15295	452	63.8
South and Southeast Asian	38083	20169	535	51.4
Girls	188049	97405	565	35.3
Boys	199014	103197	566	34.1

TABLE 2: Analysis populations, reading comprehension

Analysis Population	Assessments	Unique Students	Unique Schools	Assessments from Auckland (%)
Stable schools	481648	228393	494	40.4
'Fewer' EQI band	251457	118821	230	50.7
'Moderate' EQI Group	194347	100666	206	25.7
'More' EQI Group	35844	18852	58	47.7
European	321763	149033	494	32.6
Māori	94407	45668	494	28.4
Pacific	50067	24049	472	64.0
North Asian	43526	20386	419	71.9
South and Southeast Asian	51451	25089	472	54.6
Girls	236067	112071	480	40.1
Boys	245528	116297	483	40.8

Statistical methods

General methods

All analyses used linear mixed-effects regression fitted in R (version 4.5 or higher) with the lme4 and lmerTest packages, estimated by restricted maximum likelihood. Each model included random intercepts for students and for schools to accommodate repeated observations on the same learners and the clustering of learners within schools. Inference for fixed effects used Satterthwaite degrees of freedom as implemented in lmerTest, and we report model-based 95% confidence intervals and two-sided p-values.

Difference-in-differences

The causal contrast was defined through a difference-in-differences (DID) design comparing Auckland (as defined by the Region Council) with the rest of Aotearoa New Zealand across multiple school years. In plain terms, difference-in-differences asks how much Auckland changed from a pre-COVID baseline to a given later year, how much the rest of the country changed over the same period, and then subtracts the latter from the former. This subtraction removes changes that both groups would have experienced anyway—for example, national curriculum shifts or broad cohort effects—so what remains is the “extra” change associated with Auckland’s additional disruptions. If, for example, from baseline to 2021 Auckland’s adjusted mean rose by 1 scale score points while the rest of New Zealand increased by 3, the DID for 2021 would be $1 - 3 = -2$ scale points, indicating that Auckland’s relative position worsened by two points compared with the national trend. The key identifying assumption is that, without Auckland-specific disruptions, Auckland and the rest of New Zealand would have followed similar underlying movements (often called “parallel trends”). Our regression model adjustments and random-effects structure help make those movements as comparable as possible, but the DID interpretation relies on that assumption.

Exposure year

Statistically, we represented time with an “exposure year” factor that links each Term 1 test to the school year immediately preceding it, took the earliest pre-COVID exposure year as the baseline, and included a binary region indicator for Auckland versus the rest of New Zealand. The interaction between region and exposure year is the DID component: each interaction coefficient estimates how the Auckland–rest gap in that year differs from the corresponding gap in the baseline year, after adjustment. To improve comparability and reduce confounding, models further adjusted for student year level, gender, school socioeconomic context via the Ministry of Education’s Equity Index (treated as continuous), and broad ethnic-group indicators where sample sizes permitted stable estimation.

Technical details

Reference levels were set so that the intercept corresponds to the baseline exposure year in the rest-of-New Zealand group; region-by-year interaction coefficients can therefore be read directly as adjusted DID contrasts on the PAT scale-point metric.

Alongside models on raw scores, we fitted a complementary change-from-baseline specification that emphasises within-student change. For students with a pre-COVID observation, we subtracted each learner’s own baseline score from their later scores and modelled these change scores with the same fixed-effect structure and the same student and school-level random intercepts. In this formulation, the region-by-year interaction again yields DID contrasts, now interpreted as differences in average within-student change relative to the pre-COVID year.

We examined heterogeneity by re-estimating the DID models within key subgroups. Separate fits were produced within broad Equity-Index bands and for major ethnic groups, and we also analysed a more strictly longitudinal cohort of students observed across multiple years. In an extended specification, we allowed the COVID-era effects to vary along the Equity-Index continuum by including an Equity-Index-by-region-by-year interaction, with the index centred and scaled to aid interpretation.

Because many related contrasts are evaluated across years and subgroups, we controlled the expected proportion of false positives using Benjamini–Hochberg adjustments applied to families of p-values. As a robustness check, we recalculated key DID contrasts with standard errors clustered at the school level; results were consistent with the mixed-model inferences, supporting the stability of our conclusions under alternative variance assumptions.

Figures generally use a y-axis spanning -1.25 to $+1.25$ scale-score points (roughly $\pm 20\%$ of a year level of learning in maths and $\pm 15\%$ in reading comprehension). This range suited most plots, but a small number use different y-axis limits to better accommodate the data. Readers should therefore note that the y-axis range is not consistent across all figures when making direct comparisons.

Analyses explored but not retained

Extending the observation window earlier to allow for the inclusion of more pre-pandemic school years was explored, but this was not retained as it reduced the pool of schools that had stably used PAT assessments throughout the observation window.

PAT: Reading Vocabulary was analysed but not included in this report as there was little evidence of a COVID-19 learning loss in this data, suggesting that vocabulary acquisition is less sensitive to school closures than mathematics and reading comprehension.

To check that the main findings were not driven by specific modelling choices, more complex specifications were fitted that added multiple higher-order interaction terms among the retained predictors. These elaborations offered little additional explanatory value and did not materially alter the pattern of results, so the simpler, more interpretable formulations are presented. Models incorporating refreshed data from additional follow-up years were also explored, but uncertainty about linking these data to earlier records with sufficient precision meant they were not carried forward into the main reporting.

More detailed regional groupings were considered as an alternative to the simple Auckland versus rest-of-New-Zealand split. In practice, most regions had non-significant coefficients even before p-value adjustment, so the two-area structure was retained for the primary analyses. A “national-only” variant that omitted the Auckland term and focused solely on whether national achievement changed relative to baseline was also fitted and used as a corroborating check on the overall pattern of change.

Use of AIC and BIC for formal model selection was restricted to instances where this was computationally convenient; given the long runtimes and the high degree of consistency in patterns across different model specifications, a fully systematic information-criterion search was not pursued.

Limitations

This analysis draws on available Term 1 PAT data from English-medium state and state-integrated schools that administered PAT across the observation window. It therefore describes achievement change within a stable PAT-using school population rather than providing a census of all New Zealand schools or learners.

Moreover, PAT use is shaped by school practice and student attendance. The results cannot speak to students who dropped out of the testing population within schools—for example, learners who were chronically absent or otherwise not present on testing days and therefore did not sit a PAT. In that sense, the estimates primarily capture changes among students who continued to be assessed, and they may understate learning impacts if the least engaged learners were increasingly missing from testing after COVID-19.

The exposure to COVID-era disruption is also measured indirectly. The design uses Auckland versus the rest of Aotearoa New Zealand by year as a proxy for differential disruption, rather than directly capturing important factors such as access to devices and connectivity or school-level mitigation efforts.

Finally, interpretation of the Auckland difference-in-differences contrasts rests on the assumption that Auckland and non-Auckland would have followed similar underlying trends in the absence of Auckland’s additional disruption. Restricting analysis to Term 1 testing improves year-to-year comparability but makes each year a snapshot rather than a more detailed learning trajectory. In addition, refreshed PAT versions were excluded, which allowed for a consistent measurement scale throughout the observation window, but limited the length of post-pandemic follow-up available.

3. Results

This section presents the estimated impacts of COVID-19–related school closures on student achievement in PAT: Pāngarau (Mathematics) and PAT: Pānui (Reading Comprehension), based on the linear mixed-effects models described in the previous section.

All graphs have points (one for each plotted group) at the same exposure year horizontally offset. This is for readability only and has no other significance.

PAT Pāngarau | PAT Mathematics

Stable schools

At the whole-system level (Figure 1, Table 3), Auckland tracked closely, though slightly above, the rest of Aotearoa in 2019 and 2020, and then falls below in 2021, which was the only year where we see a clear Auckland-specific shortfall in mathematics relative to the national trend. By 2022 the DID contrast returned to approximately zero, indicating that, in the population of schools that used PAT assessments across the 2020-2022 testing window, Auckland had climbed back to its pre-COVID relative position in 2022, with aggregate PAT: Mathematics scores roughly on par with what were seen in 2019. Because the mixed-effect statistical model controls for learner year level, gender, EQI, and ethnicity indicators, and includes random intercepts for individual students and schools, this change in 2022 reflects an Auckland dip in scale score over and above national shifts in any of these factors.

FIGURE 1: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics)

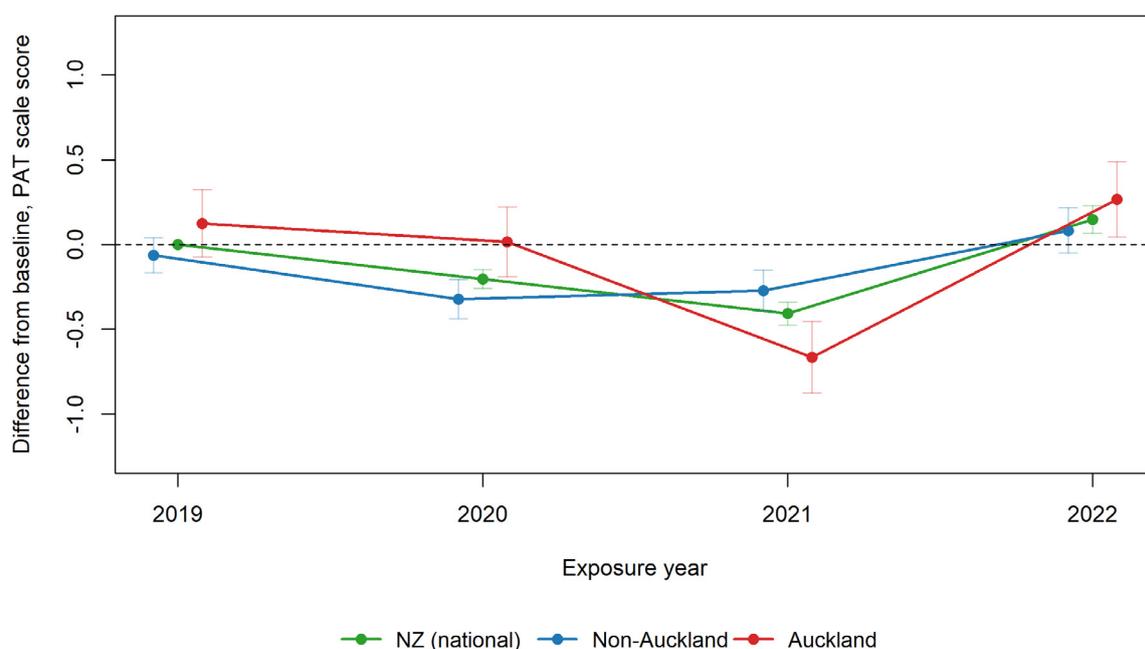


TABLE 3: Stable school population, mathematics

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	NA	NA	0.19 [-0.11, 0.49]	0.24	0.00	NA
2020	-0.20 [-0.26, -0.15]	< 0.001	0.34 [0.04, 0.64]	0.05	0.15 [0.04, 0.26]	0.01
2021	-0.41 [-0.47, -0.34]	< 0.001	-0.39 [-0.70, -0.09]	0.04	-0.58 [-0.71, -0.46]	< 0.001
2022	0.15 [0.07, 0.23]	< 0.001	0.18 [-0.13, 0.49]	0.24	-0.00 [-0.15, 0.14]	0.95

EQI groups

Overall, a 2021 dip in Auckland in comparison to the rest of New Zealand is visible across all EQI groups but the size of the dip and the degree of rebound in 2022 differed.

Schools with fewer barriers

For schools serving communities facing fewer socioeconomic barriers (lower EQI), PAT: Mathematics scores fell by about 0.2 scale points in 2020 and about 0.5 points in 2021 relative to the 2019 baseline, before returning to a level that is statistically indistinguishable from baseline in 2022 (estimate 0.10, 95% CI -0.02 to 0.22, $p = 0.12$). Auckland and non-Auckland schools look similar in 2019 and 2020, with Auckland sitting around 0.2 points above non-Auckland but with wide confidence intervals and no statistically clear gap.

In 2021, however, Auckland learners in these fewer barrier schools experienced a sharp decline. The Auckland vs. non-Auckland gap widened to -0.62 scale points (95% CI -1.07 to -0.18, $p = 0.02$), and the DID contrast for 2021 is -0.83 points (95% CI -1.01 to -0.65, $p < 0.001$), indicating an Auckland-specific decline over and above the national downturn corresponding to roughly 5 weeks of learning loss. However, after 2022, this was no longer statistically distinguishable from zero (-0.12 points, 95% CI -0.57 to 0.34, $p = 0.62$), but the DID estimate (-0.32 points, 95% CI -0.53 to -0.12, $p = 0.00$) suggests that more advantaged Auckland students have not fully regained the small relative advantage they held in fewer barrier schools elsewhere in New Zealand before the pandemic. See Figure 2 and Table 4 for more details.

FIGURE 2: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, EQI group ‘Fewer’)

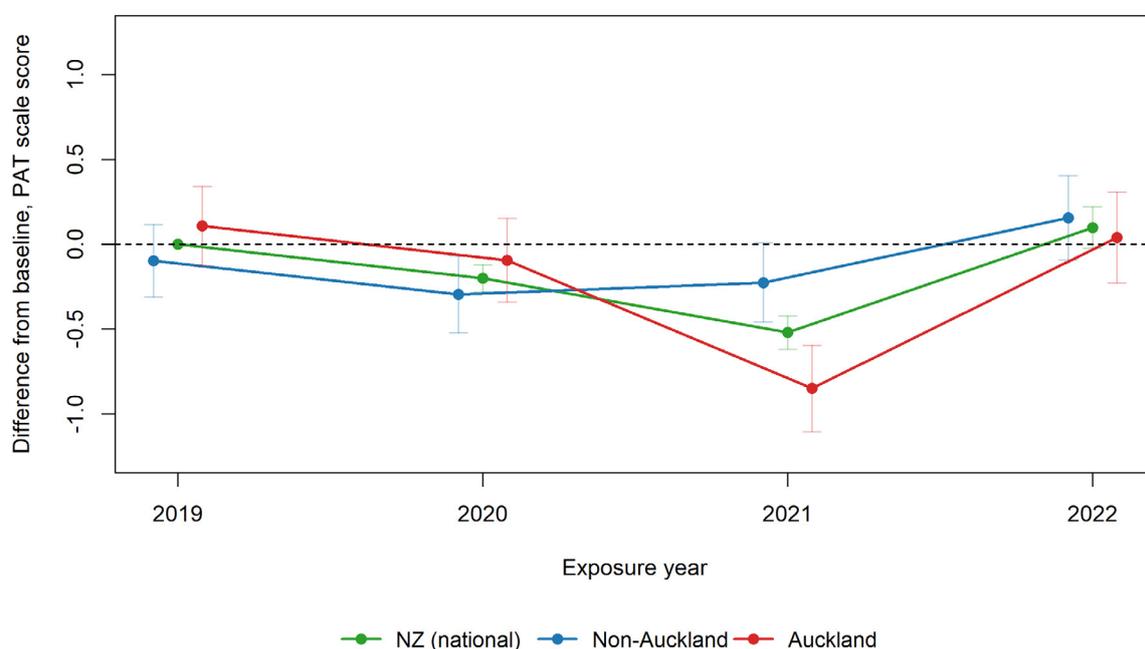


TABLE 4: EQI group ‘Fewer’, mathematics

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0.00	NA	0.21 [-0.24, 0.65]	0.5	0.00	NA
2020	-0.20 [-0.28, -0.12]	< 0.001	0.20 [-0.24, 0.65]	0.5	-0.00 [-0.16, 0.15]	0.96
2021	-0.52 [-0.62, -0.42]	< 0.001	-0.62 [-1.07, -0.18]	0.02	-0.83 [-1.01, -0.65]	< 0.001
2022	0.10 [-0.02, 0.22]	0.12	-0.12 [-0.57, 0.34]	0.62	-0.32 [-0.53, -0.12]	0

Schools with moderate barriers

Among schools in the moderate-barriers group (Figure 3, Table 5), national trends again show small COVID-era dips, with PAT: Mathematics scores dropping by about 0.25 points in 2020 and 0.37 points in 2021 relative to 2019 (both $p < 0.001$), followed by a near-complete recovery in 2022 (0.12 points above baseline, 95% CI -0.01 to 0.24, $p = 0.07$). The Auckland–non-Auckland contrast in this band is more muted and more variable than for the other two equity groups. Baseline differences between Auckland and the rest of New Zealand are small and not distinguishable from 0 statistically (-0.20 points, 95% CI -0.74 to 0.34, $p = 0.60$), and for each individual year 2020–2022 the point estimates for the gap are modest and statistically non-significant, though the point estimate in 2021 suggests a decline for that year.

The DID estimates indicate some movement in Auckland’s relative position: in 2020 and 2022 the gap shifted modestly in favour of Auckland (DIDs of +0.34 and +0.38 points respectively; both $p \leq 0.01$), while in 2021 there is a small but statistically significant swing against Auckland (-0.24 points, 95% CI -0.47 to -0.00, $p = 0.05$). Overall, for schools facing moderate socioeconomic barriers, the data is suggestive of a small amount of Auckland-specific learning loss in mathematics relative to the rest of New Zealand but is not conclusive in part due to the higher amount of variation in this group in Auckland, which is in part a consequence of the smaller share of students in this group whose data came from Auckland (see Table 1).

FIGURE 3: **Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, EQI group ‘Moderate’)**

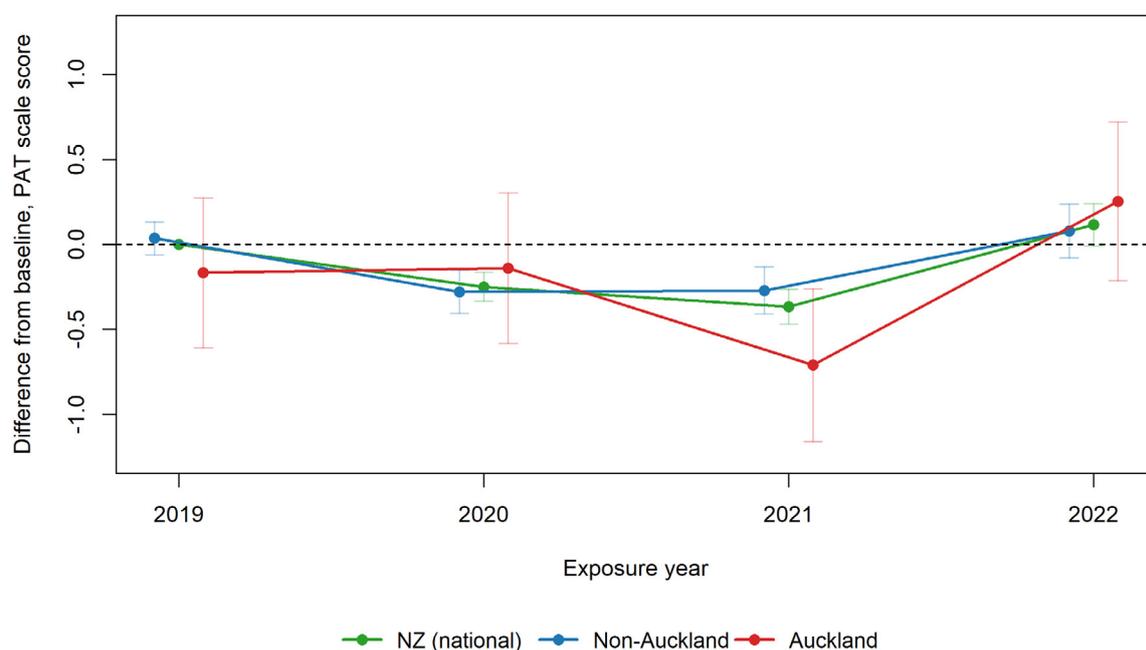


TABLE 5: **EQI group ‘Moderate’, mathematics**

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0.00	NA	-0.20 [-0.74, 0.34]	0.6	0.00	NA
2020	-0.25 [-0.33, -0.16]	< 0.001	0.14 [-0.39, 0.67]	0.6	0.34 [0.13, 0.55]	0
2021	-0.37 [-0.47, -0.26]	< 0.001	-0.44 [-0.98, 0.10]	0.43	-0.24 [-0.47, -0.00]	0.05
2022	0.12 [-0.01, 0.24]	0.07	0.17 [-0.38, 0.72]	0.6	0.38 [0.10, 0.66]	0.01

Schools with more barriers

The largest drop in 2021 was seen in the ‘More’ socioeconomic barriers group (Figure 4; Table 6). Point estimates suggest small drops of 0.12–0.25 scale points in 2019 and 2020, but the confidence intervals include 0, and the NZ-vs-baseline differences are not statistically significant. Against this relatively flat national backdrop, Auckland stands out. Even before COVID-19, Auckland students in higher-barrier schools were, on average, approximately half a scale point behind their peers in similar schools elsewhere (–0.55, 95% CI –1.50 to 0.40, $p = 0.30$). In 2021 this gap widened sharply to –1.54 points (95% CI –2.50 to –0.58, $p = 0.01$), and the DID estimate indicates an almost one-point worsening of the Auckland–non-Auckland difference relative to the 2019 baseline (–0.99 points, 95% CI –1.50 to –0.48, $p < 0.001$). By 2022 there was some recovery, but Auckland learners in higher-barrier schools are still estimated to be about one scale point, or approximately 6 weeks of learning, behind those in comparable schools elsewhere (–1.05, 95% CI –2.03 to –0.06, $p = 0.08$), and the DID contrast (–0.50, 95% CI –1.09 to 0.09, $p = 0.15$) suggests, though does not conclusively establish due to the lack of statistical significance, that this disadvantage has not fully closed or perhaps recovered to its pre-pandemic state.

FIGURE 4: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, EQI group ‘More’)

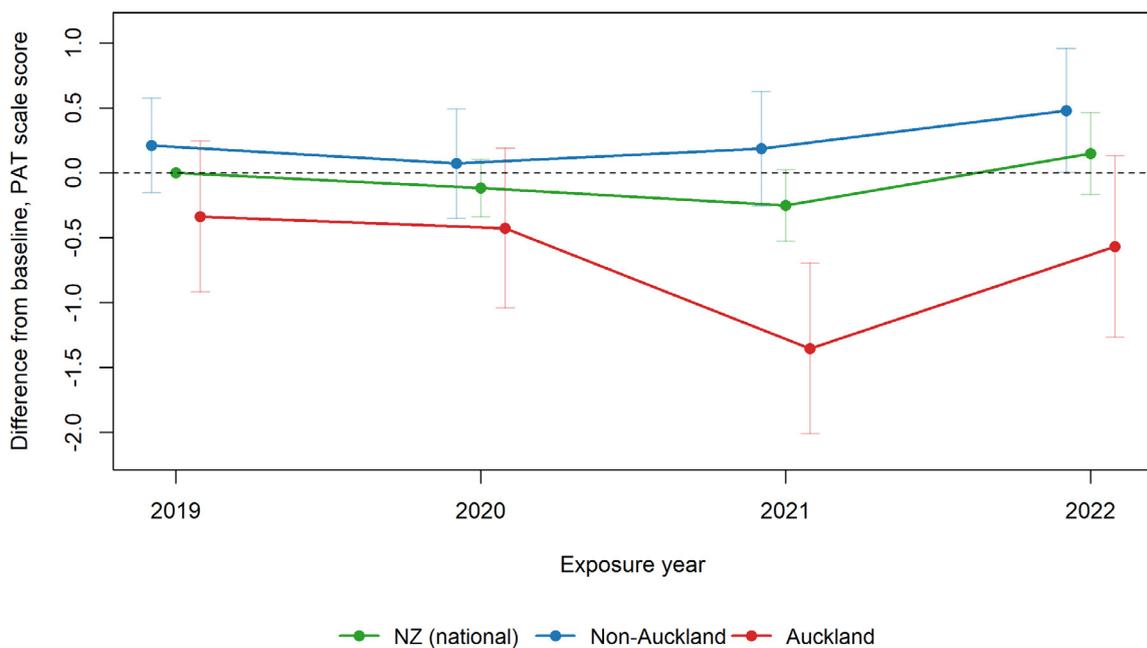


TABLE 6: EQI group 'More', mathematics

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0.00	NA	-0.55 [-1.50, 0.40]	0.3	0.00	NA
2020	-0.12 [-0.34, 0.10]	0.35	-0.50 [-1.43, 0.44]	0.3	0.05 [-0.39, 0.49]	0.82
2021	-0.25 [-0.53, 0.02]	0.22	-1.54 [-2.50, -0.58]	0.01	-0.99 [-1.50, -0.48]	< 0.001
2022	0.15 [-0.17, 0.46]	0.35	-1.05 [-2.03, -0.06]	0.08	-0.50 [-1.09, 0.09]	0.15

Taken together, these analyses highlight that the extended Auckland disruptions in 2021 had distinct equity impacts: Auckland's additional learning loss is clearest and most persistent in schools facing more barriers, where a sizeable pre-existing disadvantage deepened markedly in 2021 and remained in 2022. This was also evident—though less severe—in schools with fewer barriers. In contrast, for schools facing moderate levels of barriers, Auckland's trajectory tracks the national pattern more closely, with only modest and short-lived shifts in its relative position.

Ethnicity

Across ethnic groups in the stable schools mathematics analysis, the national pattern is broadly consistent with the overall results for the *Stable School* population. There were small declines in 2020, larger declines in 2021, and a return toward baseline by 2022. For Māori (Figure 5; Table 7), Pasifika (Figure 8; Table 10), and NZ European (Figure 9; Table 11) students the national (NZ vs baseline) changes follow this general arc (e.g., Māori: -0.33 in 2020 and -0.47 in 2021, then essentially back to baseline by 2022). For North Asian (Figure 6; Table 8) and South and Southeast Asian (Figure 7; Table 9) students, the national line sits above baseline by 2022 (+0.89 and +0.62 scale points, respectively).

The Auckland component shows a clear 2021 decline for most groups, with uneven recovery in 2022. Māori learners experienced an Auckland deficit in 2021 (DID -0.77, 95% CI -1.08 to -0.47), and although there was improvement in 2022, the DID remained below zero (-0.34, 95% CI -0.70 to 0.02). Pasifika learners similarly showed a 2021 decline (DID -0.96, 95% CI -1.35 to -0.58) and a shortfall in 2022 (-0.55, 95% CI -0.90 to -0.10), effectively erasing a modest pre-pandemic Auckland advantage. NZ European learners also showed a 2021 dip (-0.74, 95% CI -0.90 to -0.58), with a near return to baseline in 2022 (-0.17, 95% CI -0.36 to 0.02). For South and Southeast Asian learners, the pre-COVID Auckland advantage (+0.93 in 2019) compressed markedly in 2021 (DID -0.77, 95% CI -1.08 to -0.47) and only partly recovered in 2022 (-0.34, 95% CI -0.70 to 0.02). North Asian learners show a smaller, borderline 2021 decrease (-0.58, 95% CI -1.10 to -0.05) with no evident Auckland difference by 2022 (0.02, 95% CI -0.58 to 0.62). However, the national line for North Asian students rose strongly in 2022, and Auckland North Asian learners did not participate in that uplift to the same extent.

FIGURE 5: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, Māori)

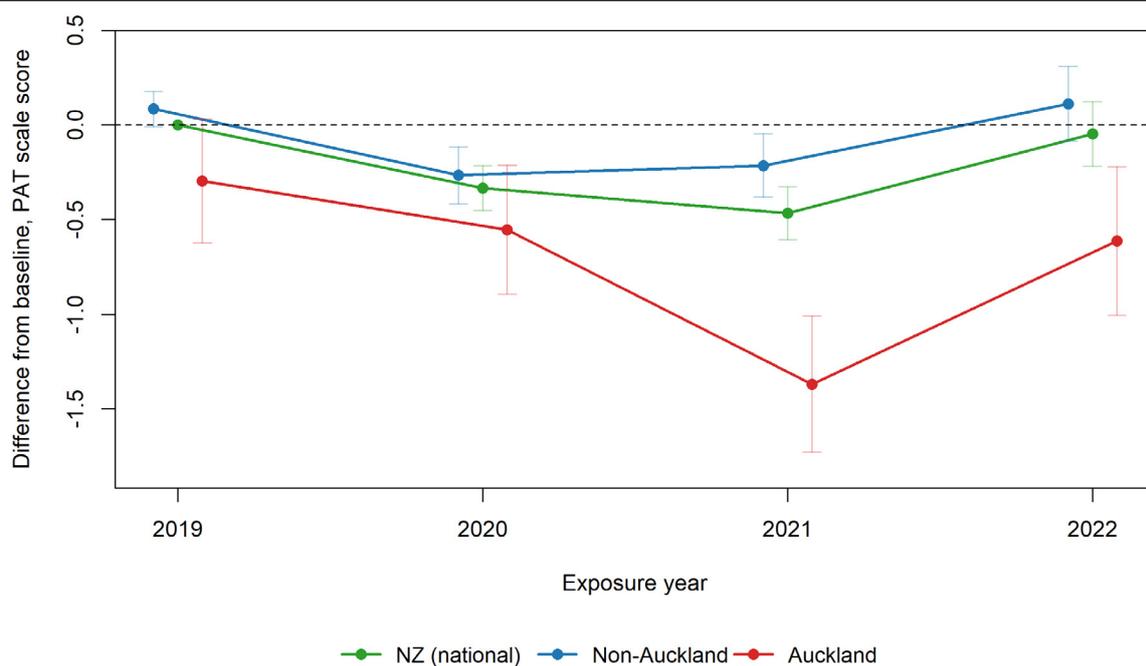


TABLE 7: Māori students, mathematics

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	-0.38 [-0.80, 0.04]	0.1	0	NA
2020	-0.33 [-0.45, -0.22]	< 0.001	-0.29 [-0.70, 0.12]	0.17	0.09 [-0.18, 0.37]	0.5
2021	-0.47 [-0.61, -0.33]	< 0.001	-1.16 [-1.58, -0.73]	< 0.001	-0.77 [-1.08, -0.47]	< 0.001
2022	-0.05 [-0.22, 0.12]	0.58	-0.73 [-1.18, -0.27]	0	-0.34 [-0.70, 0.02]	0.09

FIGURE 6: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, North Asian)

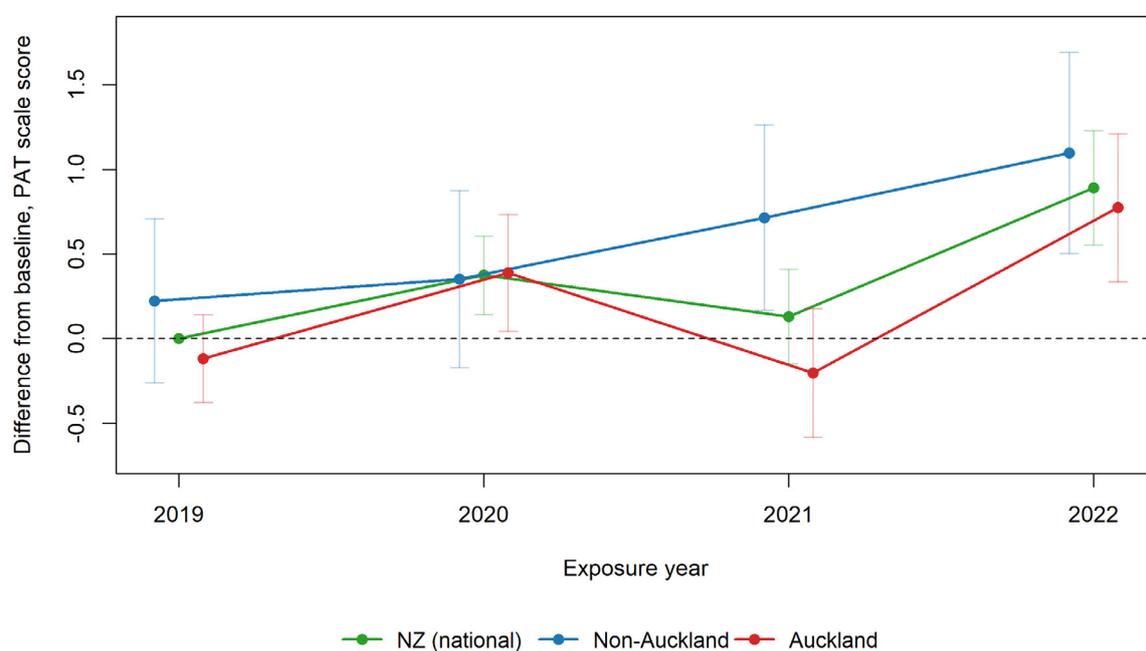


TABLE 8: North Asian students, mathematics

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	-0.34 [-1.09, 0.40]	0.54	0	NA
2020	0.37 [0.14, 0.61]	0	0.04 [-0.69, 0.76]	0.92	0.38 [-0.09, 0.84]	0.17
2021	0.13 [-0.15, 0.41]	0.36	-0.92 [-1.65, -0.19]	0.06	-0.58 [-1.10, -0.05]	0.09
2022	0.89 [0.55, 1.23]	< 0.001	-0.32 [-1.09, 0.44]	0.54	0.02 [-0.58, 0.62]	0.95

FIGURE 7: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, South and Southeast Asian)

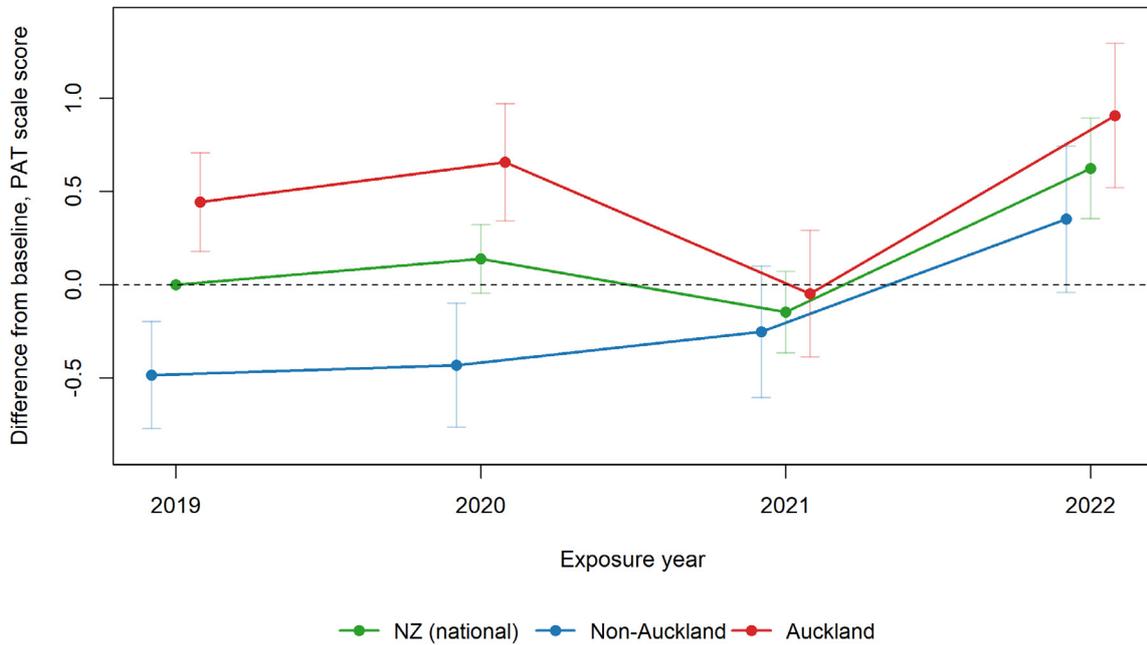


TABLE 9: South and Southeast Asian students, mathematics

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	0.93 [0.38, 1.48]	0	0	NA
2020	0.14 [-0.05, 0.32]	0.19	1.09 [0.56, 1.62]	< 0.001	0.16 [-0.20, 0.52]	0.38
2021	-0.15 [-0.37, 0.07]	0.19	0.20 [-0.33, 0.74]	0.45	-0.72 [-1.12, -0.33]	< 0.001
2022	0.62 [0.35, 0.89]	< 0.001	0.56 [-0.01, 1.12]	0.07	-0.37 [-0.83, 0.09]	0.17

FIGURE 8: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, Pasifika)

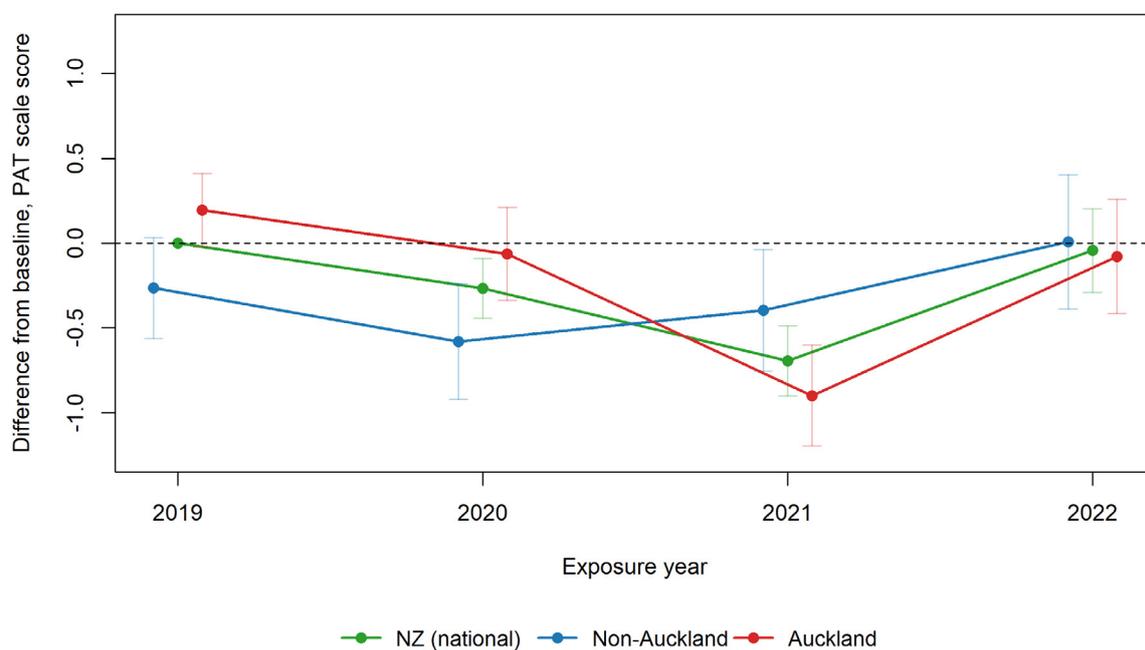


TABLE 10: Pasifika students, mathematics

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	0.46 [-0.05, 0.97]	0.11	0	NA
2020	-0.27 [-0.44, -0.09]	0	0.52 [0.01, 1.02]	0.1	0.06 [-0.29, 0.41]	0.75
2021	-0.70 [-0.90, -0.49]	< 0.001	-0.50 [-1.01, 0.01]	0.1	-0.96 [-1.35, -0.58]	< 0.001
2022	-0.04 [-0.29, 0.20]	0.73	-0.09 [-0.62, 0.45]	0.75	-0.55 [-0.99, -0.10]	0.02

FIGURE 9: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, NZ European)

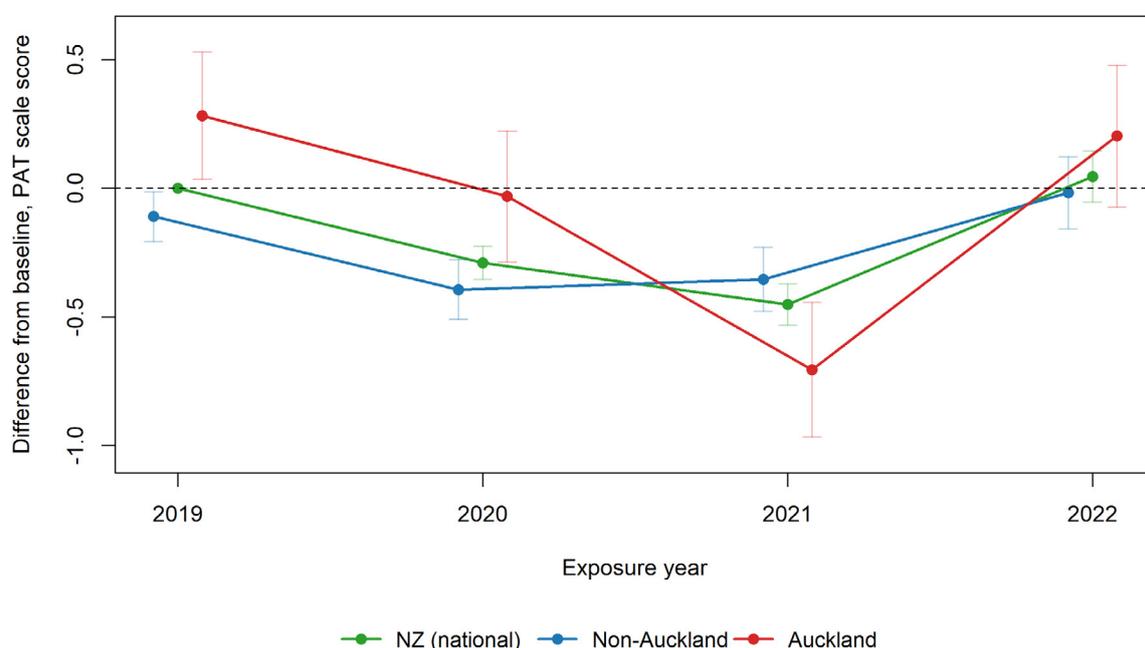


TABLE 11: NZ European students, mathematics

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	0.39 [0.05, 0.74]	0.06	0	NA
2020	-0.29 [-0.35, -0.23]	< 0.001	0.36 [0.02, 0.70]	0.06	-0.03 [-0.17, 0.11]	0.67
2021	-0.45 [-0.53, -0.37]	< 0.001	-0.35 [-0.70, -0.01]	0.06	-0.74 [-0.90, -0.58]	< 0.001
2022	0.05 [-0.05, 0.15]	0.36	0.22 [-0.13, 0.58]	0.22	-0.17 [-0.36, 0.02]	0.11

Overall, the extended 2021 Auckland closures shifted relative positions across ethnic groups by roughly half to one scale point (equivalent to roughly 3–6 weeks of learning) in their immediate aftermath, with Māori and Pasifika showing the most persistent Auckland-specific effect into 2022. For these learners, the 2021 deficit was large and the 2022 rebound incomplete: Māori still showed a clear negative Auckland vs. non-Auckland gap in 2022, and Auckland Pasifika had not returned to their pre-pandemic position relative to Pasifika in the remainder of New Zealand. In contrast, NZ European learners largely regained their pre-COVID relative position by 2022, and South and Southeast Asian learners recovered part—but not all—of their earlier Auckland advantage.

Gender

Across gender groups in the stable-schools mathematics analysis (Tables 12–13), the Auckland-specific disruption signal is evident for both girls and boys in 2021, but their national trajectories differ. In both groups, Auckland sits close to the rest of Aotearoa at baseline, shows a clear relative dip in 2021, and then returns toward its pre-COVID relative position by 2022.

For girls (Figure 10; Table 12), the national series shows a decline in 2020 (–0.29 scale points, 95% CI –0.37 to –0.22; $p < 0.001$) and a larger decline in 2021 (–0.58, 95% CI –0.67 to –0.49; $p < 0.001$), followed by only partial recovery in 2022. By 2022, girls remain modestly below baseline nationally (–0.13, 95% CI –0.25 to –0.02; $p = 0.02$). Auckland’s relative position for girls is slightly stronger in 2020 (DID +0.22, 95% CI 0.07 to 0.38; $p = 0.01$) but shifts sharply against Auckland in 2021 (–0.54, 95% CI –0.72 to –0.37; $p < 0.001$), equivalent to roughly 3–4 weeks of learning on the PAT: Mathematics scale. In 2022, the DID returns to approximately zero (–0.01, 95% CI –0.22 to 0.19; $p = 0.91$), indicating that the Auckland-specific shock for girls was concentrated in 2021 and did not persist into the following year.

FIGURE 10: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, girls)

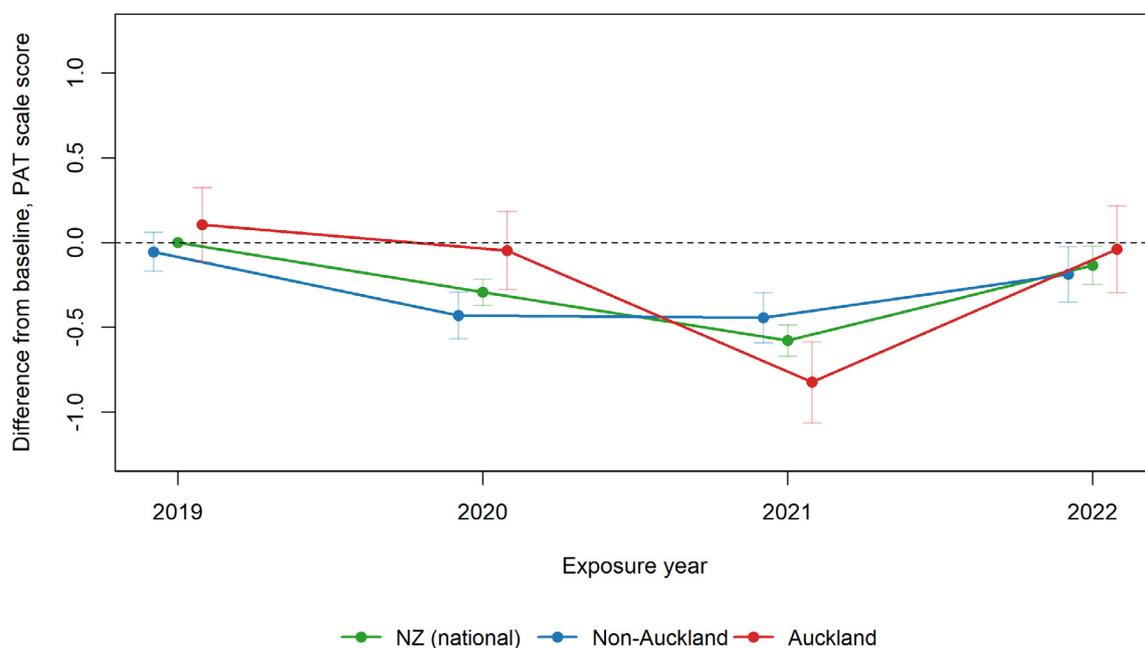


TABLE 12: **Girls, mathematics**

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	0.16 [-0.17, 0.49]	0.4	0	NA
2020	-0.29 [-0.37, -0.22]	< 0.001	0.38 [0.05, 0.72]	0.05	0.22 [0.07, 0.38]	0.01
2021	-0.58 [-0.67, -0.49]	< 0.001	-0.38 [-0.72, -0.04]	0.05	-0.54 [-0.72, -0.37]	< 0.001
2022	-0.13 [-0.25, -0.02]	0.02	0.15 [-0.20, 0.50]	0.4	-0.01 [-0.22, 0.19]	0.91

For boys (Figure 11; Table 13), national mathematics scores also dip in 2020 and 2021, but by less than for girls (2020: -0.12, 95% CI -0.19 to -0.04; 2021: -0.23, 95% CI -0.33 to -0.13; both $p < 0.001$). By 2022, boys' national scores sit clearly above baseline (+0.44, 95% CI 0.32 to 0.56; $p < 0.001$), suggesting a stronger overall rebound for boys in the stable-schools population. Auckland's additional 2021 shortfall is again evident (DID -0.60, 95% CI -0.78 to -0.42; $p < 0.001$), very similar in magnitude to the girls' estimate, and returns to near zero by 2022 (+0.04, 95% CI -0.18 to 0.25; $p = 0.73$).

FIGURE 11: **Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Mathematics, boys)**

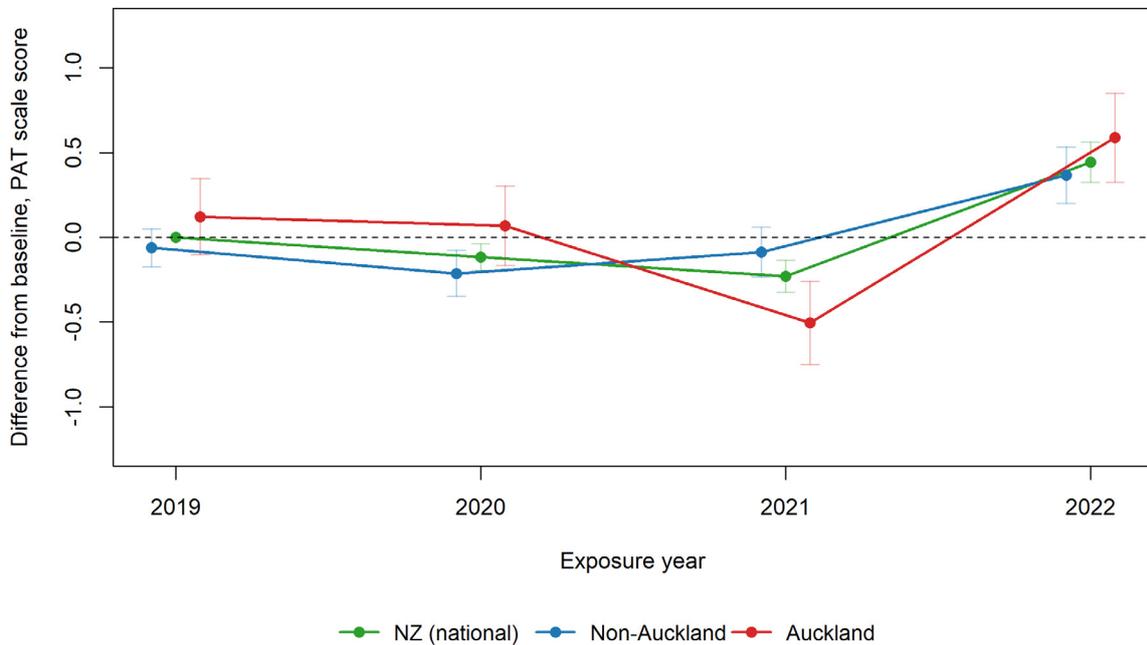


TABLE 13: Boys, mathematics

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	0.18 [-0.15, 0.52]	0.29	0	NA
2020	-0.12 [-0.19, -0.04]	0	0.28 [-0.05, 0.61]	0.2	0.10 [-0.06, 0.26]	0.35
2021	-0.23 [-0.33, -0.13]	< 0.001	-0.42 [-0.76, -0.08]	0.06	-0.60 [-0.78, -0.42]	< 0.001
2022	0.44 [0.32, 0.56]	< 0.001	0.22 [-0.13, 0.57]	0.29	0.04 [-0.18, 0.25]	0.73

Taken together, the gender analysis suggests that Auckland’s extended 2021 disruption produced a comparable Auckland-specific decline in mathematics for both girls and boys, with little evidence of an ongoing Auckland penalty by 2022. The more notable story was national, with the overall 2022 recovery in mathematics being slightly stronger for boys.

Mathematics summary

The most persistent Auckland shortfalls in mathematics appear in those ethnic groups for whom the 2021 disruption likely compounded existing barriers, echoing the EQI analysis in which the largest and most durable Auckland effects were observed in those schools whose communities face more socioeconomic barriers. In contrast, for groups with strong national gains by 2022, especially the North Asian group, Auckland’s recovery did not outpace the rest of the country, resulting in a missed share of a national upswing rather than an absolute decline. The gender patterns add further nuance. Auckland’s additional mathematics shortfall in 2021 was similar for girls and boys, equivalent to about 4–5 weeks of instruction, and it did not persist into 2022, although the national recovery was slightly less pronounced for girls than for boys. Together, these findings suggest that while 2022 saw broad recovery, Auckland’s 2021 shock left different groups on distinct post-pandemic trajectories, with some essentially back to baseline and others still carrying a measurable mathematics learning loss relative to their peers outside Auckland.

PAT Pānui | PAT Reading Comprehension

Stable schools

At the national level, PAT: Reading Comprehension did not evolve during the COVID-19 period in a system shock and recovery pattern as was generally seen with PAT: Mathematics (See Figure 12, Table 14). Instead, the “NZ vs baseline” series shows a small early decline in 2020 (–0.13 scale points, 95% CI –0.20 to –0.07; $p < 0.001$), a further step down in 2021 (–0.37, 95% CI –0.45 to –0.30; $p < 0.001$), and then no rebound during the 2 subsequent years: –0.49 in 2022 and –0.52 in 2023. In other words, by 2022–2023 the system remains roughly half a scale point (2.5 weeks) below its 2019 benchmark, even after accounting for changes in cohort composition and school mix via the mixedeffects controls.

While there was some additional movement for Auckland, it was modest. The Auckland change from baseline (2019) (Auckland by year interaction term) was slightly positive in 2020 (+0.15, 0.02 to 0.28; $p = 0.05$), turns negative in 2021 (-0.33, -0.48 to -0.19; $p < 0.001$), and then hovers near zero in 2022 (+0.03, -0.12 to 0.19; $p = 0.67$) with a borderline positive estimate in 2023 (+0.17, -0.00 to 0.34; $p = 0.07$). In other words, Auckland retained a small relative advantage in the first pandemic year, a clear relative shortfall during the prolonged 2021 disruption, and no statistically significant difference afterwards, though the point estimates suggest a return to a slightly advantaged position relative to the rest of New Zealand in the years after the pandemic.

Overall, the stable schools reading comprehension results indicate that the dominant reading comprehension story during the COVID-19 period was national and enduring, not regional and short-lived. Auckland's relative position moved adversely in the year of longest disruption and then normalised, but the larger finding is that neither Auckland nor the rest of Aotearoa returned to pre-pandemic reading levels within the 5-year window. This stands in contrast to the mathematics pattern reported earlier, where national scores had largely recovered by 2022; for reading comprehension, the systemwide decline in PAT scores continued into 2023 despite the fading out of Auckland effects.

FIGURE 12: Change in PAT scale scores relative to baseline by region, 2019–2022 (PAT: Reading Comprehension)

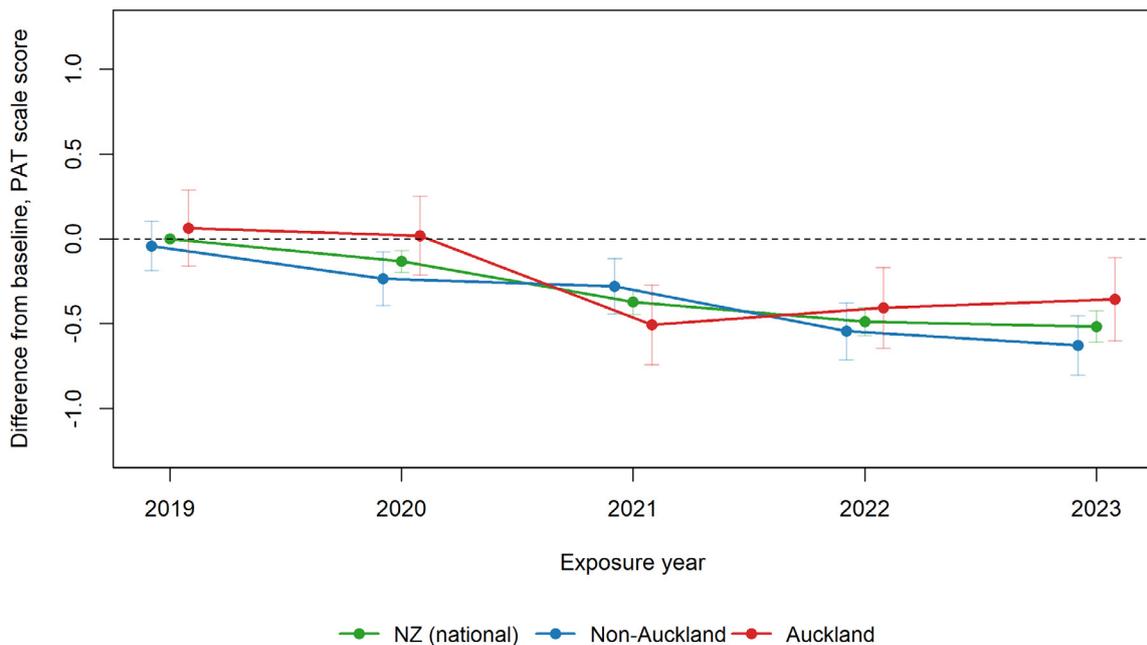


TABLE 14: **Stable school population, reading comprehension**

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	0.10 [-0.26, 0.47]	0.58	0	NA
2020	-0.13 [-0.20, -0.07]	< 0.001	0.25 [-0.11, 0.62]	0.38	0.15 [0.02, 0.28]	0.05
2021	-0.37 [-0.45, -0.30]	< 0.001	-0.23 [-0.59, 0.14]	0.38	-0.33 [-0.48, -0.19]	< 0.001
2022	-0.49 [-0.57, -0.41]	< 0.001	0.14 [-0.23, 0.51]	0.58	0.03 [-0.12, 0.19]	0.67
2023	-0.52 [-0.61, -0.42]	< 0.001	0.27 [-0.10, 0.65]	0.38	0.17 [-0.00, 0.34]	0.07

EQI groups

Across all EQI bands, reading comprehension showed a sustained national decline throughout the 2020–2024 period, with Auckland’s position shifting relative to the rest of Aotearoa in ways that were not completely consistent across EQI groups.

Schools with fewer barriers

In the ‘Fewer’ barriers group (Figure 13, Table 15), the national trend descends steadily from 2021 onward with a modest dip in 2020 that is not statistically distinct from baseline (–0.03 scale points, 95% CI –0.13 to 0.06; $p = .48$), followed by clear national shortfalls of –0.34 in 2021, –0.44 in 2022, and –0.49 in 2023 (all $p < .001$). Against this national picture, Auckland’s DID moves only slightly in 2020 (–0.11; $p = .31$) but turns sharply negative in 2021 (–0.80, –1.00 to –0.60; $p < .001$), indicating an Auckland-specific reading shortfall in schools with fewer socioeconomic barriers over and above the general New Zealand decline. This extra decline receded in 2022 (–0.32; $p = .01$) and was no longer statistically distinguishable from zero for 2023 (–0.10; $p = .40$). The cross-sectional Auckland vs. non-Auckland differences are small and fail to achieve statistical significance, so the primary statistical signal for this EQI group comes from the comparisons with the 2020 baseline.

FIGURE 13: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, EQI group ‘Fewer’)

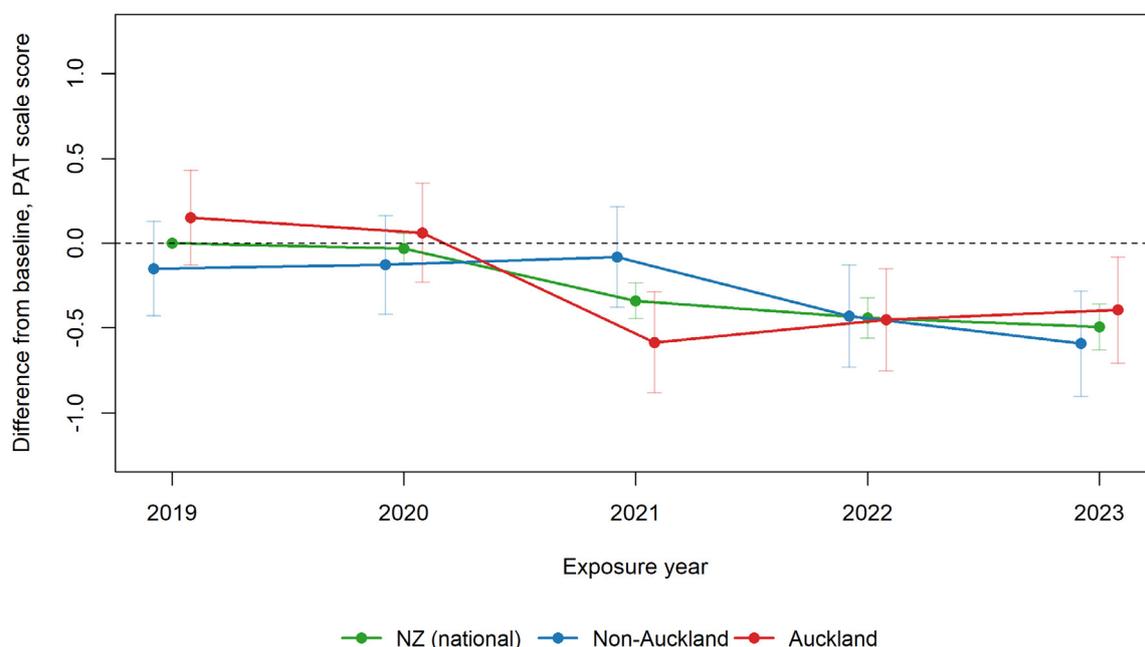


TABLE 15: EQI group ‘Fewer’, reading comprehension

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	0.30 [-0.26, 0.86]	0.63	0	NA
2020	-0.03 [-0.13, 0.06]	0.48	0.19 [-0.36, 0.74]	0.63	-0.11 [-0.29, 0.07]	0.31
2021	-0.34 [-0.44, -0.23]	< 0.001	-0.50 [-1.06, 0.05]	0.37	-0.80 [-1.00, -0.60]	< 0.001
2022	-0.44 [-0.56, -0.32]	< 0.001	-0.02 [-0.58, 0.54]	0.94	-0.32 [-0.54, -0.11]	0.01
2023	-0.49 [-0.63, -0.36]	< 0.001	0.20 [-0.36, 0.76]	0.63	-0.10 [-0.34, 0.14]	0.4

Schools with moderate barriers

The ‘Moderate’ barriers EQI group (Figure 14; Table 16) tells a different story. Here the national movement is both earlier and larger: Table 14 records -0.32 in 2020, deepening to -0.56 in 2021, -0.75 in 2022, and -0.81 in 2023 (all $p < .001$). However, during this downturn, Auckland was resilient relative to the rest of New Zealand. The difference between Auckland and the remainder of the country was positive in 2020 (+0.40, 0.16 to 0.64; $p < .001$), briefly dropped out of statistical significance after the long school closures in 2021 (+0.24; $p = .08$), and then returned to a statistical

3. Results

significance in both 2022 (+0.48; $p < .001$) and 2023 (+0.48; $p < .001$). The difference-in-difference analysis indicates that Auckland’s relative position in comparison to the rest of New Zealand was modestly stronger in 2023 than it was pre-COVID. In short, for schools facing moderate barriers, the COVID-era reading decline is systemwide and sustained, but Auckland’s additional movement is neutral-to-positive rather than negative.

FIGURE 14: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, EQI group ‘Moderate’)

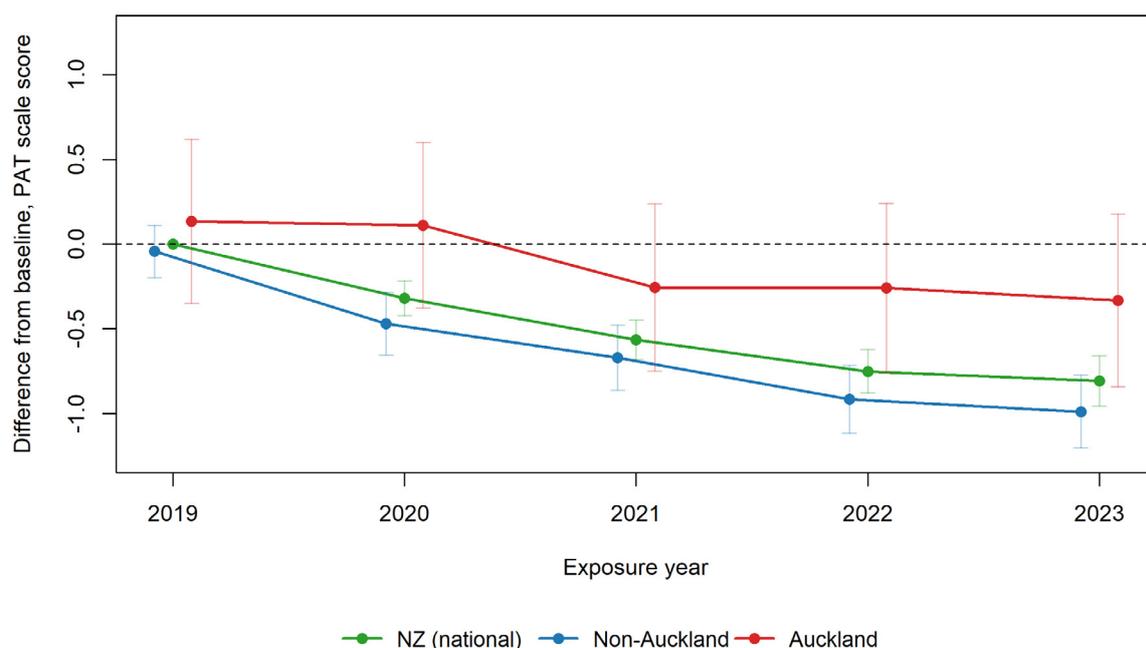


TABLE 16: EQI group ‘Moderate’, reading comprehension

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change in gap from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	0.18 [-0.46, 0.82]	0.58	0	NA
2020	-0.32 [-0.42, -0.22]	< 0.001	0.58 [-0.05, 1.21]	0.12	0.40 [0.16, 0.64]	< 0.001
2021	-0.56 [-0.68, -0.45]	< 0.001	0.42 [-0.22, 1.05]	0.25	0.24 [-0.03, 0.50]	0.08
2022	-0.75 [-0.88, -0.62]	< 0.001	0.66 [0.02, 1.29]	0.12	0.48 [0.20, 0.76]	< 0.001
2023	-0.81 [-0.96, -0.66]	< 0.001	0.66 [0.01, 1.30]	0.12	0.48 [0.17, 0.79]	< 0.001

Schools with more barriers

In the 'More' barriers EQI group (Figure 15; Table 17), the key feature is a pre-COVID Auckland disadvantage that narrows gradually after the COVID-19 school closings. Even at baseline the adjusted Auckland–non-Auckland gap was -1.59 scale score points (-2.64 to -0.54; $p = .01$; approximately 7 weeks of learning). Nationally, this band barely moved from baseline in 2020–2021 (e.g., -0.01 in 2020; -0.08 in 2021; not statistically significant), and modest declines in 2022–2023 (-0.32 and -0.18). Within that flat national backdrop, the Auckland vs. non-Auckland widened in 2021 (cross-sectional -1.86; $p < 0.01$), consistent with the separation visible in the figure below. Over time, the gap between Auckland and the remainder of New Zealand narrows, turning positive in 2022 (+0.43; $p = .22$) and strengthening in 2023 (+0.79, 0.21 to 1.36; $p = .03$), implying that Auckland closed a portion of the pre-existing gap with the rest of the country in reading comprehension by Term 1 2024. However, the 2023 cross-sectional difference remained negative (-0.81), which underscores that the band has not eliminated the historical disadvantage. Instead, the results are best read as showing that the extent of Auckland's relative disadvantage diminished between 2019 and 2023.

FIGURE 15: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, EQI group 'More')

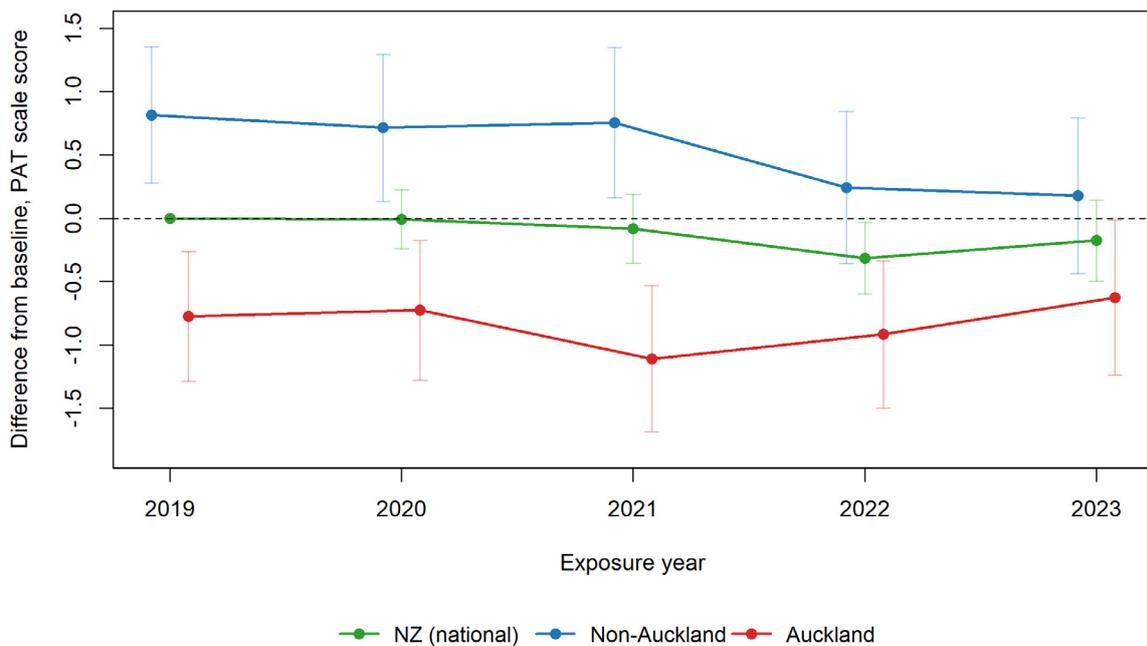


TABLE 17: EQI group 'More', reading comprehension

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change in gap from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	-1.59 [-2.64, -0.54]	0.01	0	NA
2020	-0.01 [-0.24, 0.23]	0.95	-1.44 [-2.48, -0.41]	0.01	0.15 [-0.31, 0.61]	0.52
2021	-0.08 [-0.36, 0.19]	0.74	-1.86 [-2.91, -0.82]	< 0.01	-0.27 [-0.79, 0.24]	0.40
2022	-0.32 [-0.60, -0.04]	0.11	-1.16 [-2.20, -0.12]	0.04	0.43 [-0.09, 0.96]	0.22
2023	-0.18 [-0.50, 0.14]	0.56	-0.81 [-1.86, 0.25]	0.13	0.79 [0.21, 1.36]	0.03

Taken together, the EQI group analyses of PAT: Reading Comprehension suggest that there has been a national downturn in reading comprehension in recent years that spans EQI groups. However, Auckland's additional movement in comparison to the rest of Aotearoa New Zealand depends somewhat on the barriers faced by the communities that schools serve. Lower-barrier schools saw a pronounced Auckland-specific shortfall concentrated in 2021 that weakened through 2022 and was no longer detectable by 2023, even as the national line in this band stays below baseline. Moderate-barrier schools experience the largest and most persistent national declines, yet Auckland's relative position within that decline is modestly better than its pre-COVID position. Higher-barrier schools carried a significant pre-existing Auckland disadvantage compared to the rest of New Zealand, which had modestly narrowed by 2023.

Ethnicity

Across ethnic groups, reading comprehension patterns reflect a mix of broad national shifts and group-specific trajectories, with some groups of learners experiencing sustained national declines, others holding steady, and a few showing gains over the same period. Auckland's position relative to the rest of Aotearoa also varies by ethnicity, as did the impact of the COVID-19 years. For some groups, the 2021 disruption amplifies an existing shortfall before it begins to narrow, for others it produces a sharp but short-lived dip, and for groups with a pre-COVID Auckland advantage the pandemic years largely preserved rather than transform that pattern.

For Māori learners (Figure 16; Table 18), the adjusted NZ-vs-baseline contrast goes from -0.30 in 2020 to -0.53 in 2021, and then to -0.83 in both 2022 and 2023, with each estimate clearly different from zero. On top of this slow national decrease, there is an Auckland vs non-Auckland gap that was already present before COVID and continues through most of the period. In 2019, Auckland Māori sit -0.65 scale points below Māori elsewhere (95% CI -1.12, -0.18; $p = .01$), and gaps of a similar size remain in 2020–2022 before narrowing to a smaller and statistically inconclusive -0.35 by 2023. The DID terms separate changes over time from these level differences: from 2020 to 2022, Auckland's change in gap relative to baseline is close to zero (0.04, -0.13, and -0.12), then turns positive in 2023 (+0.33 but doesn't achieve statistical significance).

FIGURE 16: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, Māori)

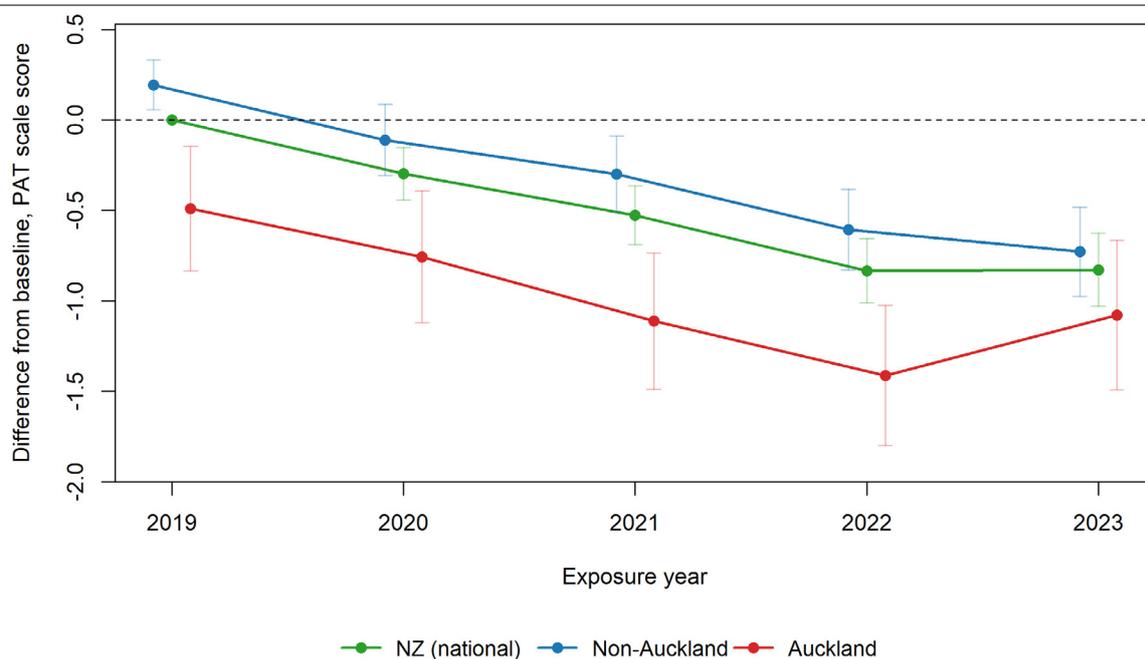


TABLE 18: Māori students, reading comprehension

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change in gap from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	-0.68 [-1.16, -0.20]	0.01	0	NA
2020	-0.30 [-0.44, -0.15]	< 0.001	-0.65 [-1.12, -0.18]	0.01	0.04 [-0.28, 0.35]	0.82
2021	-0.53 [-0.69, -0.36]	< 0.001	-0.81 [-1.29, -0.34]	0	-0.13 [-0.47, 0.22]	0.68
2022	-0.83 [-1.01, -0.66]	< 0.001	-0.81 [-1.29, -0.33]	0	-0.12 [-0.49, 0.24]	0.68
2023	-0.83 [-1.03, -0.63]	< 0.001	-0.35 [-0.85, 0.15]	0.17	0.33 [-0.07, 0.74]	0.43

Nationally, North Asian (Chinese, Japanese, and Korean) scores (see Figure 17; Table 19) rise above their baseline early and keep climbing, +0.51 in 2020, +0.29 in 2021, +0.58 in 2022, and +0.82 in 2023. This produces an upward-sloping national line in Figure 15. Within that national context, Auckland experienced a single-year dip relative to peers elsewhere as the 2021 cross-sectional gap widens against Auckland to -1.17 (95% CI -1.87, -0.46; $p = .01$). The DID for 2021 is negative (-0.57) but was not statistically significant, and by 2022–2023 both the cross-sectional gaps and the DID terms are again small and imprecise. Overall, the results indicate that this subgroup’s reading gains have been a national story, with a small, shortlived Auckland impact during the year of prolonged disruption that did not persist afterwards.

FIGURE 17: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, North Asian)

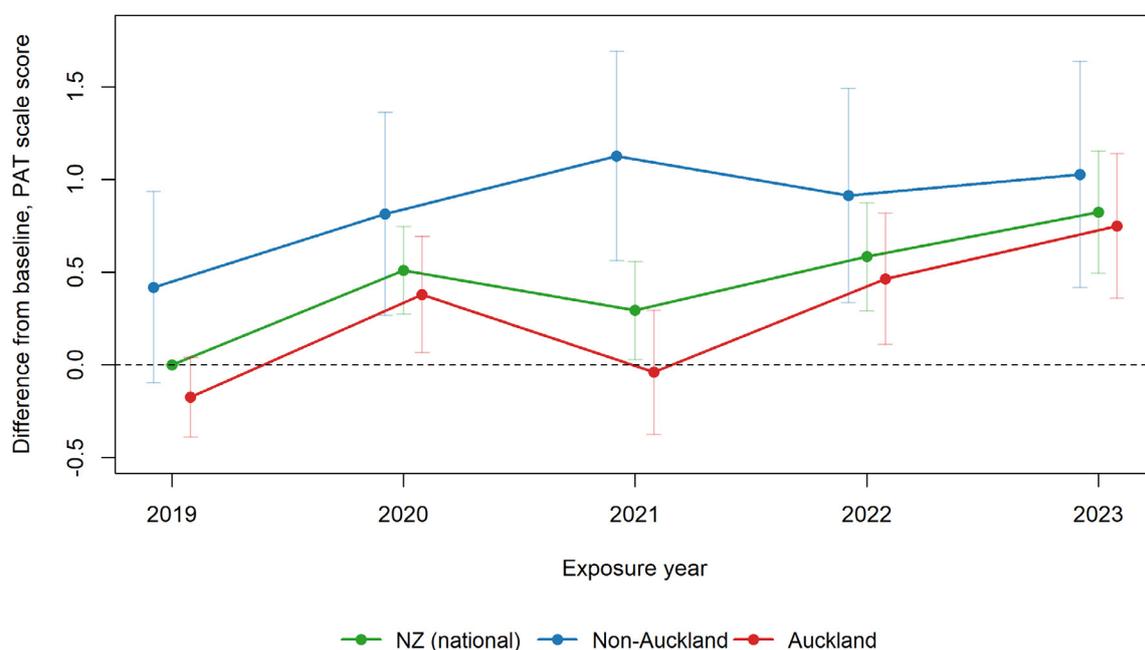


TABLE 19: North Asian students, reading comprehension

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change in gap from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	-0.59 [-1.33, 0.14]	0.28	0	NA
2020	0.51 [0.27, 0.74]	< 0.001	-0.44 [-1.13, 0.26]	0.28	0.16 [-0.35, 0.67]	0.63
2021	0.29 [0.03, 0.56]	0.03	-1.17 [-1.87, -0.46]	0.01	-0.57 [-1.13, -0.02]	0.17
2022	0.58 [0.29, 0.87]	< 0.001	-0.45 [-1.15, 0.25]	0.28	0.14 [-0.44, 0.73]	0.63
2023	0.82 [0.49, 1.15]	< 0.001	-0.28 [-1.00, 0.45]	0.45	0.32 [-0.32, 0.96]	0.63

For South and Southeast Asian learners (e.g., Indian, Sri Lankan, Vietnamese, Filipino, Cambodian—Figure 18; Table 20), the national line remains close to baseline throughout the observation window, with NZ-vs-baseline contrasts near zero in every year. Throughout, Auckland retains a pre-existing advantage relative to the rest of the country of 0.72 in 2019 (95% CI 0.12, 1.33; $p = .05$) that remains positive in 2020 (+0.91; $p = .01$) and is sustained, though borderline from a statistical significance perspective after p -value adjustment, in 2022–2023 (+0.62 to +0.60). The DID column is consistently small and statistically inconclusive, implying that Auckland’s advantage for this subgroup reflects durability of the pre-COVID relationship rather than new divergence created by the pandemic period.

FIGURE 18: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, South and Southeast Asian)

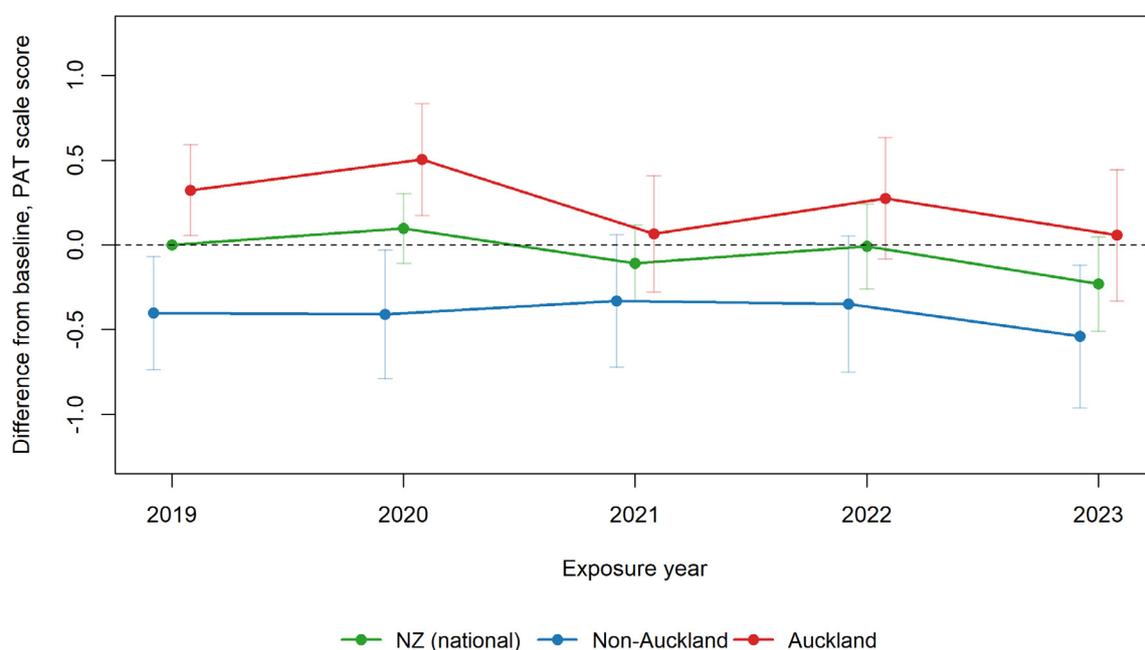


TABLE 20: South and Southeast Asian students, reading comprehension

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change in gap from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	0.72 [0.12, 1.33]	0.05	0	NA
2020	0.10 [-0.11, 0.30]	0.47	0.91 [0.34, 1.49]	0.01	0.19 [-0.22, 0.60]	0.67
2021	-0.11 [-0.34, 0.12]	0.47	0.40 [-0.18, 0.97]	0.18	-0.33 [-0.77, 0.11]	0.57
2022	-0.01 [-0.26, 0.24]	0.95	0.62 [0.05, 1.20]	0.05	-0.10 [-0.57, 0.36]	0.67
2023	-0.23 [-0.51, 0.05]	0.42	0.60 [0.01, 1.18]	0.06	-0.13 [-0.63, 0.38]	0.67

Nationally, Pasifika learners (Figure 19; Table 21) showed small declines in reading comprehension relative to 2019, with estimated movements of around a quarter to a third of a scale score point (roughly equivalent to 1.5 weeks of instruction) below baseline from 2021 onwards. Only in 2022 does this national change reach conventional statistical significance (-0.32 , $p = 0.02$), and the overall pattern is still one of a relatively flat national trajectory in Figure 17 rather than a sharp national movement. Cross-sectional Auckland–non-Auckland differences in any given year are small and

imprecisely estimated. The only hint of an Auckland-specific movement is a moderate negative DID in 2021 (-0.46), which falls short of statistical significance after the multiple-comparison adjustment; by 2022 and 2023, DIDs have returned to values close to zero. Taken together, the PAT: Reading Comprehension data do not support a sustained Auckland divergence from pre-existing patterns for Pasifika in reading, and whatever temporary softening may have occurred in 2021 relative to the rest of the country did not persist afterwards.

FIGURE 19: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, Pasifika)

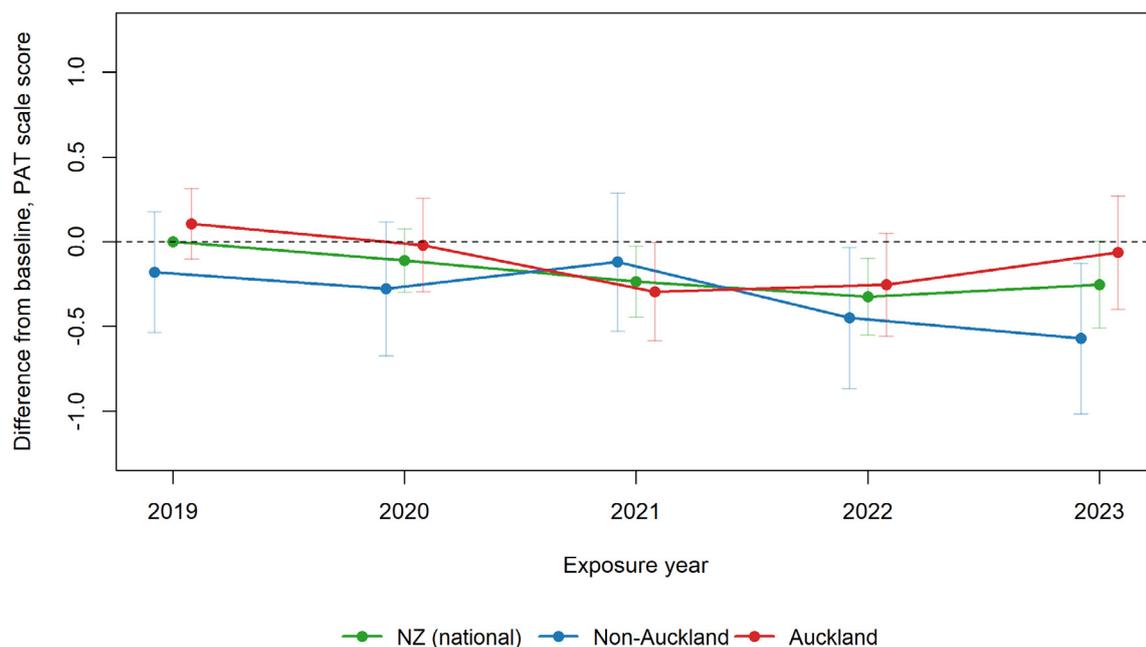


TABLE 21: Pasifika students, reading comprehension

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change in gap from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	0.28 [-0.28, 0.85]	0.53	0	NA
2020	-0.11 [-0.30, 0.08]	0.25	0.26 [-0.29, 0.81]	0.53	-0.03 [-0.41, 0.36]	0.89
2021	-0.23 [-0.44, -0.03]	0.06	-0.18 [-0.73, 0.38]	0.53	-0.46 [-0.88, -0.04]	0.12
2022	-0.32 [-0.55, -0.10]	0.02	0.20 [-0.36, 0.75]	0.53	-0.09 [-0.52, 0.35]	0.89
2023	-0.25 [-0.51, 0.00]	0.07	0.51 [-0.07, 1.08]	0.43	0.22 [-0.26, 0.70]	0.73

NZ European learners (Figure 20; Table 22) aligned most closely with the system-level reading picture. The national series declines from -0.23 in 2020 to -0.50 in 2021 and -0.67 to -0.69 in 2022–2023, each change clearly below baseline, yielding a consistently sub-zero national line in Figure 18. Within that decline, Auckland experiences a pronounced additional shortfall in 2021: the DID is -0.63 (95% CI -0.82, -0.45; $p < .001$), shrinking to -0.27 in 2022 ($p = .02$) and becoming small and statistically inconclusive in 2023 (-0.17; $p = .17$). Cross-sectional gaps between Auckland and the rest are never precisely estimated, which underscores the importance of the DID framing: the story is not a large static separation but a year-specific worsening of Auckland’s relative position that partially corrects thereafter.

FIGURE 20: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, NZ European)

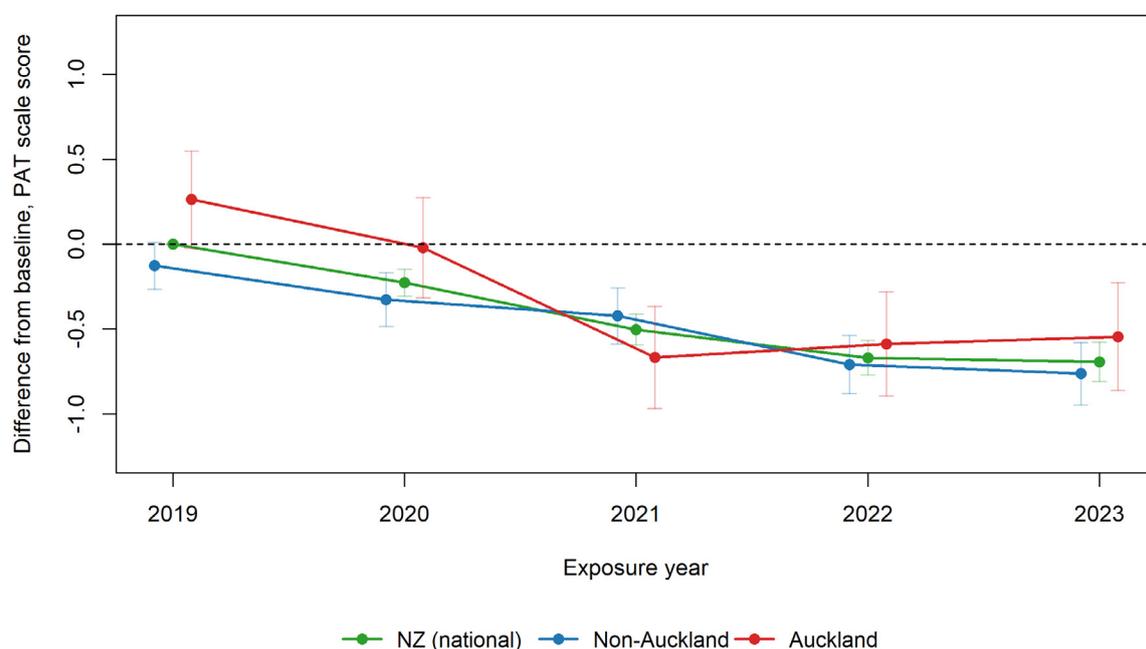


TABLE 22: NZ European students, reading comprehension

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change in gap from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	0.39 [-0.04, 0.82]	0.36	0	NA
2020	-0.23 [-0.31, -0.15]	< 0.001	0.31 [-0.12, 0.73]	0.39	-0.08 [-0.25, 0.08]	0.32
2021	-0.50 [-0.59, -0.41]	< 0.001	-0.24 [-0.67, 0.18]	0.41	-0.63 [-0.82, -0.45]	< 0.001
2022	-0.67 [-0.77, -0.57]	< 0.001	0.12 [-0.31, 0.55]	0.58	-0.27 [-0.47, -0.07]	0.02
2023	-0.69 [-0.81, -0.58]	< 0.001	0.22 [-0.22, 0.65]	0.41	-0.17 [-0.39, 0.05]	0.17

Gender

Reading comprehension shows a sustained national downturn for both girls and boys, but the magnitude and timing differ by gender (Tables 18–19). Girls show earlier and larger declines relative to baseline, while boys show a smaller decline that emerges later. Auckland’s additional movement is modest overall, but is more visible for boys in the year of Auckland’s prolonged disruption.

For girls (Figure 21; Table 23), the national series is already below baseline in 2020 (–0.24, 95% CI –0.33 to –0.15; $p < 0.001$) and continues to step down over subsequent years (2021: –0.44; 2022–2023: –0.65; all $p < 0.001$). By 2022–2023, girls sit around two-thirds of a scale point below their 2019 benchmark, equivalent to roughly 3 weeks of learning on the PAT: Reading Comprehension scale. Auckland’s additional movement for girls is small: the DID is slightly positive in 2020 (+0.25, 95% CI 0.06 to 0.44; $p = 0.04$), and then close to zero thereafter (2021: –0.18; 2022–2023: +0.03; all $p \geq 0.19$). In other words, the girls’ pattern is dominated by the broader national decline rather than by an Auckland-specific effect.

FIGURE 21: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, girls)

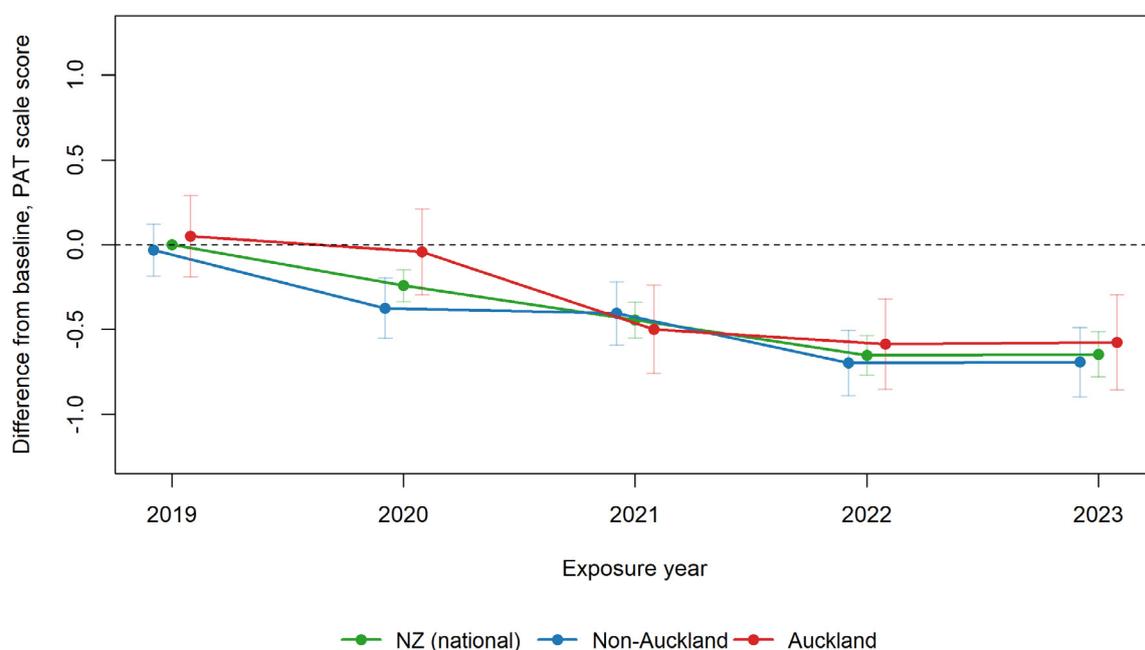


TABLE 23: Girls, reading comprehension

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change in gap from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	0.08 [-0.31, 0.48]	0.68	0	NA
2020	-0.24 [-0.33, -0.15]	< 0.001	0.33 [-0.06, 0.72]	0.47	0.25 [0.06, 0.44]	0.04
2021	-0.44 [-0.55, -0.34]	< 0.001	-0.09 [-0.48, 0.30]	0.68	-0.18 [-0.38, 0.03]	0.19
2022	-0.65 [-0.77, -0.54]	< 0.001	0.11 [-0.28, 0.51]	0.68	0.03 [-0.19, 0.25]	0.8
2023	-0.65 [-0.78, -0.51]	< 0.001	0.12 [-0.29, 0.52]	0.68	0.03 [-0.21, 0.28]	0.8

For boys (Figure 24, Table 26), national scores show little change in 2020 (-0.03, 95% CI -0.12 to 0.06; $p = 0.47$) but fall below baseline from 2021 onward (-0.32 in 2021, -0.35 in 2022, and -0.40 in 2023; all $p < 0.001$). Auckland’s position shifts more clearly for boys in the year of prolonged disruption: the DID for 2021 is -0.47 (95% CI -0.67 to -0.27; $p < 0.001$), indicating an Auckland-specific shortfall of roughly 2 weeks of learning over and above the national movement for boys. This Auckland effect is not evident in 2022 (DID +0.04; $p = 0.69$), and by 2023 the DID turns positive (+0.31, 95% CI 0.07 to 0.55; $p = 0.02$), suggesting Auckland boys gained some ground relative to their peers elsewhere in the post-pandemic period.

FIGURE 22: Change in PAT scale scores relative to baseline by region, 2019–2023 (PAT: Reading Comprehension, boys)

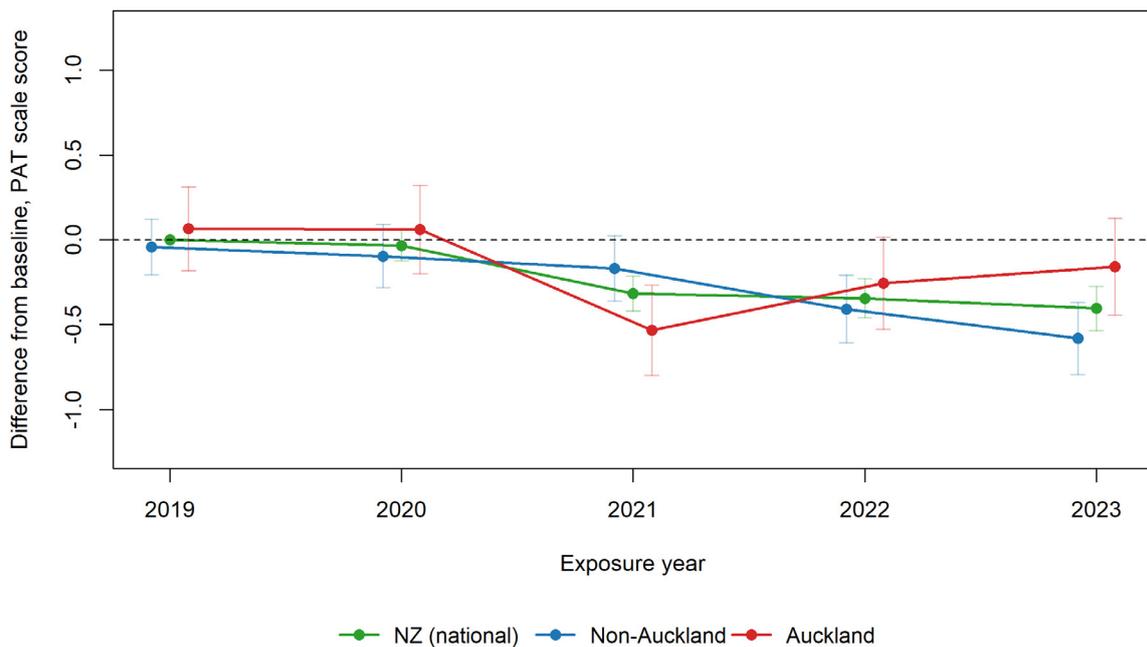


TABLE 24: Boys, reading comprehension

Exposure Year	NZ vs. Baseline (2019)		Difference: Auckland and non-Auckland		Auckland change in gap from Baseline (2019) (DID)	
	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value	Scale Score [95% CI]	p-value
2019	0	NA	0.11 [-0.30, 0.52]	0.61	0	NA
2020	-0.03 [-0.12, 0.06]	0.47	0.16 [-0.25, 0.56]	0.59	0.05 [-0.14, 0.23]	0.69
2021	-0.32 [-0.42, -0.21]	< 0.001	-0.36 [-0.77, 0.05]	0.2	-0.47 [-0.67, -0.27]	< 0.001
2022	-0.35 [-0.46, -0.23]	< 0.001	0.15 [-0.26, 0.56]	0.59	0.04 [-0.17, 0.26]	0.69
2023	-0.40 [-0.54, -0.27]	< 0.001	0.42 [0.00, 0.84]	0.2	0.31 [0.07, 0.55]	0.02

Overall, the gender results reinforce the earlier system-level conclusion that reading comprehension change during the COVID-era was primarily national and enduring. At the same time, they indicate that the sustained national decline is more pronounced for girls, while Auckland's 2021 disruption signal is clearer for boys.

Reading comprehension summary

Overall, the national downturn in reading comprehension during our observation window was primarily present for Māori and NZ European learners, where declines in comparison to baseline emerged by 2020 and persisted through 2023. During the same period, North Asian students showed relative gains, and South and Southeast Asian and Pasifika students remained near their baselines. By gender, girls show a larger and earlier national decline, while boys show a slightly smaller downturn that becomes clear from 2021.

The impact of the COVID-19 school closures was not universal across subgroups. It was pronounced but time-bound for NZ European learners in 2021, less visible for North Asian students in the same year, and had only minimal observable impact on Māori, Pasifika, and South and Southeast Asian students in comparison to pre-existing trends.

4. Conclusions

The effects described here for Aotearoa New Zealand are best thought of as real but comparatively modest. Many overseas school systems endured months of closures that left students with large and persistent learning deficits. That didn't happen here. Indeed, the global pattern—that the duration and intensity of closures matter—helps explain why our national learning loss was modest, with the clearest signal appearing in the data precisely where school closure was longest, in Auckland during 2021.

National mathematics achievement dipped in 2020 and more in 2021, then broadly returned toward baseline by 2022. Auckland experienced an additional, Auckland-specific 2021 decline associated with the year of its longer Delta lockdown, followed by a return to the national pattern in 2022. The aggregate recovery, however, masks some equity nuances. In higher barrier schools (EQI 'More'), Auckland's preexisting disadvantage widened sharply in 2021 and had not fully closed by 2022; Māori and Pasifika ākonga carried the clearest Auckland-specific mathematics learning loss into 2022, while NZ European and Asian students mostly regained or improved upon their pre-COVID positions relative to their own baselines in 2019. Both girls and boys showed an Auckland-specific dip in 2021, but national recovery differed slightly, with boys' mathematics scores rising above baseline by 2022, while girls remained slightly below their 2019 benchmark.

Reading followed a different, slower-moving national trajectory. Scores slipped below 2019 in 2020, stepped down again in 2021, and remained roughly half a scale point below baseline through 2022–2023, with only small and brief Auckland-specific movements. Across EQI bands, the downturn was broad; the largest sustained national declines appeared in the 'Moderate' barriers group. By ethnicity, NZ European and Māori learners closely tracked the slight overall national decline. North Asian learners recorded gains. South and Southeast Asian and Pasifika groups generally remained near their 2019 baselines. There was slightly more sustained national decline for girls than boys, and Auckland's clearest gender-specific movement was a short-lived 2021 dip for boys that was no longer detectable in PAT assessments by the end of 2022.

These patterns align with the international context. New Zealand lost relatively few instructional days in 2020 by OECD standards, whereas Auckland lost around 15 additional weeks in the second half of 2021. There were no further general school shutdowns in 2022, although Omicron produced high absence and staffing strain, and regular attendance fell to a record low of around 40% in Term 2 2022 before partially recovering to about 50% by the end of 2022. This sequence matches the results. We see a short and localised Auckland maths impact in 2021, alongside a broader reading softening that persisted into 2023 even after schools remained open. This persistence is consistent with post-reopening attendance and engagement pressures, and it may also reflect some mild longer-term system-level decline driven by factors outside the scope of this analysis.

In contrast, as discussed in the introduction, the average time OECD schools spent fully closed was around 3.5 months in 2020, rising to around 5.5 months when partial closures are included. Meta-analysis evidence across 15 countries shows learning deficits of several months that persisted after reopening, and multi-country work has linked longer closures to larger declines. Against that backdrop, New Zealand's temporary maths dips, with limited persistence in some subgroups, and a small system-level reading decline with an unclear relationship to school closures sit at the lower end of global impact estimates, aligning with Aotearoa New Zealand's shorter period of school closure.

References

- ACARA. (2023, August 23). *One in 10 students “need additional support” to meet higher NAPLAN expectations* [Media release]. Australian Curriculum, Assessment and Reporting Authority.
- Betthäuser, B. A., Bach-Mortensen, A. M., & Engzell, P. (2023). A systematic review and meta-analysis of the evidence on learning during the COVID-19 pandemic. *Nature Human Behaviour*, 7(3), 375–385. <https://doi.org/10.1038/s41562-022-01506-4>
- Education Review Office (ERO). (2023). *Long Covid: Ongoing impacts of Covid-19 on schools and learning*. Author. <https://www.evidence.ero.govt.nz/documents/long-covid-ongoing-impacts-of-covid-19-on-schools-and-learning>
- Engzell, P., Frey, A., & Verhagen, M. D. (2021). Learning loss due to school closures during the COVID-19 pandemic. *Proceedings of the National Academy of Sciences*, 118(17), e2022376118. <https://doi.org/10.1073/pnas.2022376118>
- Franks, J. (2021, November 10). Covid-19: All schools in locked-down areas to reopen from November 17. *Stuff* (via *NZ Herald*). <https://www.stuff.co.nz/national/education/126945566/covid19-all-schools-in-locked-down-areas-to-reopen-from-november-17>
- Gerritsen, J. (2021, November 12). *Some schools delaying return of junior high school students*. Radio New Zealand. <https://www.rnz.co.nz/news/national/455543/some-schools-delaying-return-of-junior-high-school-students>
- Gillitzer, C., & Prasad, N. (2024). The effect of school closures on standardized test scores: Evidence under zero-COVID policies. *Economics of Education Review*, 102, 102577. <https://doi.org/10.1016/j.econedurev.2024.102577>
- Gore, J., Fray, L., Miller, A., Harris, J., & Taggart, W. (2021). The impact of COVID-19 on student learning in New South Wales primary schools: An empirical study. *The Australian Educational Researcher*, 48, 605–637. <https://doi.org/10.1007/s13384-021-00436-w>
- Jakubowski, M., Gajderowicz, T. & Patrinos, H. A. (2025). COVID-19, school closures, and student learning outcomes. New global evidence from PISA. *npj Science of Learning*, 10(5), 5. <https://doi.org/10.1038/s41539-025-00297-3>
- Ministry for Culture and Heritage. (2025). *New Zealand enters nationwide lockdown in fight against COVID-19*. <https://nzhistory.govt.nz/new-zealand-enters-nationwide-lockdown-fight-against-covid-19>
- Ministry of Education. (2007). *The New Zealand Curriculum*. <https://newzealandcurriculum.tahurangi.education.govt.nz/>
- Ministry of Education. (2025, October 22). *Equity funding*. <https://www.education.govt.nz/education-professionals/schools-year-0-13/funding-and-financials/operational-funding/equity-funding>
- National Center for Education Statistics (NCES). (2022). *The Nation’s Report Card: 2022 NAEP mathematics and reading assessment results*. U.S. Department of Education, Institute of Education Sciences.
- New Zealand Council for Educational Research. (2023). *Understanding PATs: For parents, whānau, kaiako and community*. Author. <https://www.nzcer.org.nz/assessments/pats/understanding-pats>

- Pinto, S. (2023, August). *The pandemic's effects on children's education. Economic Brief (No. 23-29)*. Federal Reserve Bank of Richmond. https://www.richmondfed.org/publications/research/economic_brief/2023/eb_23-29
- Radio New Zealand (RNZ). (2020, March 24). *Coronavirus: What you need to know about school and uni closures*. RNZ News. <https://www.rnz.co.nz/news/national/412489/coronavirus-what-you-need-to-know-about-school-and-uni-closures>
- Radio New Zealand (RNZ). (2021, March 24). *Timeline: The year of Covid-19 in New Zealand*. RNZ News. <https://www.rnz.co.nz/news/national/437359/timeline-the-year-of-covid-19-in-new-zealand>
- Roy, E. A. (2020, May 11). Ardern thanks 'team of 5 million' as New Zealand reopens schools and offices. *The Guardian*. <https://www.theguardian.com/world/2020/may/11/ardern-announces-new-zealand-will-reopen-schools-offices-and-restaurants-this-week>
- Royal Commission of Inquiry. (2023). *Ko te pā harakeke: Report of the COVID-19 Lessons Learned Inquiry, Part Two*. COVID-19 Lessons Learned Royal Commission. <https://www.covid19lessons.royalcommission.nz/reports-lessons-learned>
- Sonnemann, J., & Goss, P. (2020). *COVID catch-up: Helping disadvantaged students close the equity gap*. Grattan Institute. <https://grattan.edu.au/report/covid-catch-up/>
- UNESCO. (2021, March 1). *UNESCO figures show two thirds of an academic year lost on average worldwide due to COVID-19 school closures*. [Press release] <https://www.unesco.org/en/articles/unesco-figures-show-two-thirds-academic-year-lost-average-worldwide-due-covid-19-school-closures>

