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Growing Up in Australia:
The Longitudinal Study of Australian Children (LSAC)

LSAC Technical Paper No. 8

Using National Assessment Program—Literacy and Numeracy (NAPLAN) data in the Longitudinal Study of Australian Children (LSAC)

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Growing Up in Australia: The Longitudinal Study of Australian Children, is conducted in partnership between the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs, the Australian Institute of Family Studies and the Australian Bureau of Statistics, with advice provided by a consortium of leading researchers.

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1. Introduction

1.1 The Longitudinal Study of Australian Children (LSAC)

Growing Up in Australia: The Longitudinal Study of Australian Children (LSAC) is a national study designed to provide an in-depth understanding of children's development in Australia's current social, economic and cultural environment, thereby contributing to the evidence base for future policy and practice development.

The study is conducted in partnership between the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA), the Australian Institute of Family Studies (AIFS) and the Australian Bureau of Statistics (ABS), with advice provided by a consortium of leading researchers from research institutions and universities throughout Australia.

The study commenced in 2004 with the recruitment of two cohorts: one cohort of 5,107 children aged 0–1 year old (the birth or "B cohort") and another of 4,983 children aged 4–5 years old (the kindergarten or "K cohort") and their families across all states and territories of Australia. Interviews comprising different instruments are conducted with families every two years.

1.2 National Assessment Program—Literacy and Numeracy (NAPLAN)

The National Assessment Program—Literacy and Numeracy (NAPLAN) is designed to assess all Australian students in Years 3, 5, 7 and 9 in reading, writing, language conventions (spelling, grammar and punctuation) and numeracy, using a national test that has been conducted annually since 2008, on the same days each year.

The NAPLAN assessment process is performed using a national common reporting format by the test administration authorities. The reporting scales are constructed so that given scale scores can be compared across school year levels and over time. For example, a score of 500 in Reading for Year 3 in 2008 means the same as a score of 500 for Year 5 in 2008 and will also mean the same in future testing years. For more details on the NAPLAN assessment process, refer to the reports: *2009 National Assessment Program Literacy and Numeracy* (Ministerial Council for Education, Early Childhood Development and Youth Affairs [MCEECDYA], 2009) and *Reporting Guide: 2009 National Assessment Program Literacy and Numeracy* (Victorian Curriculum and Assessment Authority [VCAA], 2009).

LSAC does not have an instrument that directly measures children's academic performance after the study child starts school; instead, a class teacher and a parent each rate the children's academic performance. The parent's assessment is based on a relative comparison with the child's classmates, and therefore cannot be considered as an objective measure of the child's academic performance. Academic standards employed by teachers might also vary across teachers and schools. More issues arise as children enter high school. First of all, at that level, parents might be less aware of their children's academic achievements and, secondly, high school students have a number of different teachers and, therefore, any one teacher cannot properly assess a child's entire academic performance.

The NAPLAN score is a standardised measure that allows researchers to compare children's and schools' performances over time; therefore, it is extremely useful to link NAPLAN data to the LSAC database. The national and longitudinal nature of the NAPLAN tests enhances the value of LSAC to policy-makers and academic researchers, so during the LSAC Wave 3 and Wave 4 data collections, parents were asked to give consent to link a study child's NAPLAN data to the LSAC database.

This paper aims to provide guidance to a researcher on the NAPLAN data and how to use these data in LSAC. The paper describes the process of matching and linking NAPLAN data to the LSAC database and the resulting data structure of NAPLAN for LSAC data users. It draws attention to the extent and nature of bias introduced by missing NAPLAN data, benchmarks LSAC NAPLAN scores to national NAPLAN scores, and reports on the degree to which NAPLAN scores are associated with other cognitive and learning outcomes in the LSAC. The paper uses only K cohort data. These

data are used only as an example. The same approach and analysis may also be directly applied to B cohort data; however, given that at the time of writing only 20% of B cohort children had sat NAPLAN tests and nearly all K cohort children had sat at least one NAPLAN test, the latter cohort of children was chosen for ease of explanation.

Section 2 presents an overview of how consent was obtained, and the matching and linkage processes. It then examines to what degree the sample of children with linked NAPLAN data is representative of the LSAC Wave 1 sample. Section 3 describes how NAPLAN data are stored in the LSAC data file. Section 4 discusses the correspondence between year level cohort and birth cohort and how to use NAPLAN data in LSAC. Section 5 examines the representativeness of the NAPLAN results in LSAC at the national level and across different socio-demographic groups. The fifth section also explores the extent to which NAPLAN data are correlated with the main cognitive and learning measures used in LSAC. A discussion concludes the paper.

2. Linkage

2.1 Obtaining consent

At the LSAC Wave 3 data collection, parents of the K cohort children were asked to fill in a consent form for allowing access to their study child's NAPLAN data (see Appendix A). Parents who did not provide consent at Wave 3 for any reason or who did not participate at Wave 3 were asked again at Wave 4 using an updated consent form (see Appendix B).[1] If a family did not participate at either of these waves, parents did not have an opportunity to provide or refuse the consent to link the NAPLAN; therefore, these families were considered not available. For consent to be obtained, one of the parents or guardians had to tick all relevant boxes in the form and sign the form in the presence of a witness. If at least one box or one signature was missing, the form was incomplete (also referred to here as being filled in incorrectly) and, in these cases, it was considered that consent was not given. Consent was also not obtained if parents refused to sign the form or the ABS office did not receive the consent form from parents. Table 1 reports the consent rate for the total sample (Wave 1 sample) and the available sample (participants of Waves 3 or 4).

Table 1: NAPLAN consent forms, K cohort

	Available sample [a]		Total sample [b]	
	n	%	*n*	%
Consent obtained	4,227	95.4	4,227	84.8
Consent not obtained	204	4.6	204	4.1
Not asked	–	–	552	11.1
Total	**4,431**	**100.0**	**4,983**	**100.0**

Notes: [a] Available sample refers to families who participated in Waves 3 or 4. [b] Total sample refers to Wave 1 sample.
Source: LSAC, K cohort

It can be seen from Table 1 that 95% of interviewed families provided their consent to NAPLAN data linkage and only 5% (204) did not actively consent. Of these 204 families, 48 families refused to provide consent, 117 did not tick all of the boxes or one or both of the signatures were missing, and 39 consent forms were not received by the office (see Table 2).

Table 2: Reasons for NAPLAN non-consents, K cohort

	N
Form filled in incorrectly	117
Consent refused	48
Form not returned	39
Total	**204**

Source: LSAC, K cohort

Out of the total sample (Wave 1), consent was not obtained from 15% of families, either because the family did not give consent due to the reasons specified in Table 2 or a family was not asked due to non-participation at Waves 3 or 4.

2.2 Linkage and matching process

The NAPLAN data identified as needing linkage are not held in one central location but rather are stored by the respective state/territory governments. To link NAPLAN data to the LSAC sample,

[1] The consent form was simplified, as most of the non-consents in Wave 3 (77% of non-consents) were due to the form being filled in incorrectly.

each state/territory government had to agree to match the data. Data matching was only done for children where consent to link the NAPLAN data to the LSAC sample was obtained.[2]

The procedure undertaken to link the LSAC and NAPLAN data was as follows:

1. The ABS sent each state/territory government a list of participants who had agreed to the linkage, with identifying variables—including school and child variables (see below)—and a dummy LSAC ID identifier. The LSAC ID was different from the HICID, which is the unique ID for a study child within LSAC.
2. Each state/territory government matched the LSAC child data on the list of variables provided with the NAPLAN data. They then sent AIFS a list that contained the scaled scores for each NAPLAN test against the LSAC ID identifier, without the school or child's data. The ABS was not sent LSAC NAPLAN data, so it did not have the ability to match the data back to names and addresses through the LSAC ID.
3. In order to link NAPLAN scaled scores to the LSAC data, AIFS used an ABS-generated concordance between the LSAC ID identifier and HICID.

This procedure ensured that each jurisdiction did not know the HICID and, therefore, could not match records in the AIFS output datasets, and at the same time AIFS did not know the school names, child information or postcodes.

The match between NAPLAN student results and LSAC children was based on the following variables:

- child's first name;
- child's surname;
- child's date of birth;
- school name; and
- school postcode.

Table 3 reports the overall matching rate results using 2008–11 NAPLAN results. For 2% of K cohort children, the NAPLAN data were not matched for Year 3, Year 5 and Year 7. For the remaining 98% of children, the NAPLAN data were matched for at least one year level (i.e., Year 3, Year 5 and/or Year 7). It is worth noting that a match rate within a particular year level might be lower than 98% because some children's NAPLAN data could be matched for one year level but not another (see section 2.4 for details). As NAPLAN data were linked to only 4,159 cases, we will refer to this sample as the LSAC NAPLAN sample from now on.

Table 3: Data matching rates, K cohort

	Eligible sample [a]		Total sample [b]	
	N	%	*N*	%
Matched cases	4,159	98.4	4,159	83.5
Unmatched cases	68	1.6	68	1.4
Not used in matching [c]	–	–	756	15.2
Total	4,227	100.0	4,983	100.0

Notes: [a] Eligible sample refers to families who gave consent to link NAPLAN data. [b] Total sample refers to Wave 1 sample. [c] Cases were not used in matching if consent was not obtained or families were not asked for their consent.
Source: LSAC, K cohort

While the matching rate for the eligible sample is very high (98%), the matching rate for the total sample (Wave 1 sample) is only 84% (4,159 out of 4,983). It is important to assess whether there are systematic differences in parental socio-demographic characteristics and the child's learning abilities between children with and without the linked NAPLAN data. Any observed significant differences

[2] While the original intention was to match records using an exact matching procedure, there were some problem cases that did not completely match the jurisdictions' databases. The most common reason for this was a slight discrepancy in names (for example, "Jenny" vs "Jennifer", or a hyphenated vs unhyphenated name). These cases were sorted through manually to match them to the NAPLAN database.

should be taken into account when interpreting LSAC NAPLAN scores or comparing them against NAPLAN national statistics. The following section presents the statistical analysis of this matter.

2.3 Modelling non-NAPLAN data cases

NAPLAN data were linked for 84% of the total sample of K cohort children, while for 4% of children parents did not consent to the linkage for various reasons, 1% of children were not matched and, for 11% of children, parents were never asked to give a consent due to non-participation. It is important to assess whether the sample of children with linked NAPLAN data is representative of the Wave 1 sample and, if it is not, to ascertain the degree and nature of this selectivity. Therefore, this section aims to assess whether there are any differences between the NAPLAN sample and the LSAC Wave 1 sample on the main parental socio-demographic characteristics and children's learning abilities. The section starts with a description of the empirical model and statistical analysis, followed by the estimation results.

Statistical approach and empirical model

We examined the probability of not having NAPLAN scores linked using a logistic regression, a regression technique that is commonly used when a dependent variable is binary and consists of two mutually exclusive and exhaustive categories (Long, 1997). In a logistic regression to describe the relationship between the dependent variable and the independent variables, one category of the dependent variable is chosen as a reference category and the probability of being in the other category is compared with the probability of being in the reference category:

$$y_i = \begin{cases} 1, \text{ NAPLAN data absent} \\ 0, \text{ NAPLAN data present} \end{cases}$$

The explanatory variables include parental characteristics and children's characteristics. The explanatory variables are derived from LSAC Wave 1 data, as only at Wave 1 information is available for all respondents.

Summary statistics for the independent variables are presented in Appendix E.

Parental characteristics

Parental characteristics include educational attainment, mother's working hours, family composition and language background.

The level of *educational attainment* is measured as the highest educational qualification completed by either of the parents. In the logistic regression, level of educational attainment is treated as a set of dummy variables (bachelor degree or above; advanced diploma/diploma; certificate I–IV; Year 12 or equivalent; Year 11 or equivalent or below), where having a bachelor degree or above is considered as the reference category against which every other dummy variable is compared.

Mother's working hours is included as a set of dummy variables (employed 37 hours or more, employed fewer than 37 hours and employed zero hours), where being employed for 37 hours or more is considered as the reference category.[3] Parental occupation is not included as it is highly correlated with parental education and labour force status.

Family composition is categorised as a single-parent family if the study child has just one parent in the household in which he/she lives at the time of the study.

We also control for *language background* by whether the family is from a language background other than English (LBOTE). A family is classified as LBOTE if the study child or either of the parents speaks a language other than English at home.

[3] "Employed" includes employed full-time, employed part-time, and employed but on maternity leave.

Children's characteristics

Children's characteristics include the study child's gender and measures of cognitive and non-cognitive abilities, readiness for school, and levels of emotional and behavioural problems.

We measure differences in children's learning development, and cognitive and non-cognitive abilities using the Peabody Picture Vocabulary Test (PPVT-III 1997), Who Am I (WAI) and Strength and Difficulties Questionnaire (SDQ). The PPVT is used to measure receptive language and vocabulary, and knowledge of the meaning of spoken words. The WAI test is used to measure children's ability to perform pre-literacy/pre-numeracy tasks, such as reading, copying and writing letters, words, shapes and numbers. The SDQ assesses peer problems, conduct problems, hyperactivity, emotional problems and prosocial behaviours for children aged 3–12 years. All measures are standardised direct tests administered by interviewers.

Estimation results

The results of the logistic regression are reported in Table 4 in the form of odds ratios (ORs) and model fit indices. The odds ratio is a relative measure of risk, which indicates how much more likely it is that someone who has a particular characteristic will not have NAPLAN data linked, compared to someone who does not have this characteristics. An OR of greater than 1 suggests that the NAPLAN data is more likely to be absent for those with a particular characteristic compared to those without this characteristic. An OR of less than 1 suggests the NAPLAN data is less likely to be absent for those with a particular characteristic compared to those who without the characteristic. An odds ratio of 1 suggests that there is no difference in whether NAPLAN data is absent between two groups with or without the characteristic.

Table 4: Estimation results of logistic regression

	OR [a]	95% CI [b] of OR (Lower)	95% CI [b] of OR (Upper)	Change in odds for one SD [c] increase in IV [d]	SD of IV
Parental characteristics					
Educational attainment (ref. = Bachelor degree)					
Advanced diploma	1.00	0.73	1.39	1.00	.30
Certificate	1.34 **	1.08	1.66	1.14	.47
Year 12	1.05	0.76	1.46	1.01	.28
Year 11 or below	1.32	0.97	1.81	1.09	.30
Mother's working hours (ref. = 35 hours or more)					
Less than 35 hours	.89	0.69	1.15	.94	.48
No hours	1.38 **	1.09	1.76	1.17	.49
LBOTE	2.05 ***	1.63	2.59	1.38	.45
Single-parent family	.99	0.74	1.34	.99	.33
Children's characteristics					
Female	1.18	0.99	1.41	1.09	.50
PPVT	.96 ***	0.95	0.98	.80	6.13
Who Am I	.99	0.98	1.01	.96	7.86
SDQ	1.01	0.99	1.03	1.06	5.21
Constant	1.03	0.32	3.25	–	–
Test	χ^2		*df*		
Overall model fit: Likelihood ratio	190.89 ***		12		
Goodness-of-fit: Hosmer & Lemeshow	5.99		8		

Note: [a] Odds ratio. [b] Confidence interval of odds ratio. [c] Standard deviation. [d] Independent variable. All statistics reported herein use 2 decimal places in order to maintain statistical precision. Statistically significant differences are noted, *** $p < .001$; ** $p < .01$; * $p < .05$.

To assess the model fit, a logistic model is compared against the intercept-only model (also called the null model, as it has no predictors). Consequently, according to this model, every observation would have the same probability of occurring. An improvement over this baseline model is examined by using the likelihood ratio. It can be seen that according to the likelihood ratio there is a significant improvement over the intercept-model. To assess the validity of the model, we assess the fit of a logistic model against actual outcomes using the Hosmer–Lemeshow (H–L) inferential goodness-of-fit test. The H-L test yielded a $\chi^2(8)$ of 6.0 and was not significant ($p < .05$), suggesting that the model fit the data well. In other words, the null hypothesis of a good model fit to data was tenable.

For ease of interpretation, we focus on the ORs. It can be seen from Table 8 that there is no statistically significant relationship between NAPLAN data being linked and family type, child's readiness to school (WAI) or child's level of emotional and behavioural problems.

The highest parental education appears to be a significant predictor of having NAPLAN data. Families with a certificate as the highest educational attainment were 1.34 times more likely not to have NAPLAN data linked compared with families who have a university degree, holding all other variables constant. There were no differences between families with other educational attainments.

Mother's working hours were also estimated to be a significant predictor of NAPLAN data not being linked. Children with mother's who were not working any hours at Wave 1 were 1.38 times more likely than mother's who were working 35 hours or more at Wave 1 not to have NAPLAN data linked, holding all other variables constant. There were no differences for children whose mother's were working less than 35 hours at Wave 1.

There is also a statistically significant relationship between LBOTE and whether NAPLAN data were linked. For children from non–English speaking backgrounds, the odds of not having NAPLAN data linked were 2.05 times greater than for children from English-speaking background families, holding all other variables constant.

While there were no statistically significant relationships between NAPLAN data being linked and most of the children's characteristics, children's level of receptive language and vocabulary was significantly associated with not having NAPLAN data linked. For one standard deviation increase in the PPVT score, the odds of not having NAPLAN data linked are 0.8 times smaller, holding all other variables constant. Figure 1 shows the predicted probabilities for not having NAPLAN data linked by the PPVT score. As the PPVT score increases, the predicted probability of NAPLAN data not being linked decreases. Even though the confidence interval is quite wide when PPVT scores are small, large differences in the children's PPVT scores lead to non-trivial differences in the probabilities of not having the NAPLAN data to be linked.

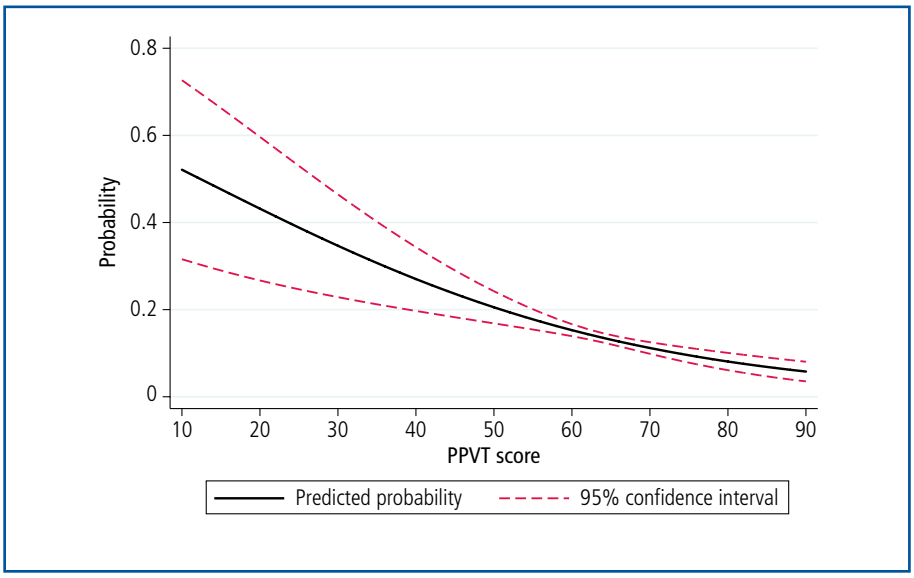


Figure 1: Predicted probability of NAPLAN data not to be linked, by PPVT score

Therefore, based on the logistic regression, it has been found that those children who have lower PPVT scores, are from non–English speaking background, have parents with a certificate as the highest educational attainment at Wave 1, and have mothers who did not work when the child was 4–5 years old are less likely to have their NAPLAN data linked.

3. LSAC NAPLAN data file

3.1 Data storage

LSAC NAPLAN data are stored in a separate data file, with 10,090 cases, where each case represents a study child recruited at Wave 1. The main reasons for storing the LSAC NAPLAN scores in a separate data file are as follows:

- A separate file simplifies the process of merging the between-waves NAPLAN data to any wave of LSAC; for example, children may have sat the NAPLAN test in 2009, while the LSAC data collection took place in 2008 (Wave 3) and 2010 (Wave 4). An analyst can merge 2009 NAPLAN scores to either the Wave 3 or Wave 4 data, depending on the research question.
- Children of the same cohort may sit the same NAPLAN test in different years; for example, children of the B cohort may sit Year 3 NAPLAN tests in 2011, 2012 and 2013, while LSAC data collection takes place in 2010, 2012 and 2014.
- A separate file simplifies the process of using and updating the LSAC NAPLAN data; for example, if parental consent to access NAPLAN data is obtained at later waves, only the LSAC NAPLAN file would require updating. In addition, having NAPLAN results across all year levels in one file for both cohorts makes it easier to perform cross-sectional and/or longitudinal analyses.

3.2 Key variables

Here we describe some key variables in the LSAC NAPLAN data file in more detail; a complete list of all variables can be found in Appendix C.

The variables *hicid* and *cohort* are the same as those used in all LSAC data files across all waves. These variables are used to provide one-to-one correspondence across all LSAC datasets.

The variable *consent* has five categories, reflecting whether consent was obtained (category 1), consent was refused (category 2), the form was filled in incorrectly (category 3), the form was not returned (category 4) or the form was never given to a parent (category –9).[4]

The variable *stream* was created to assist with structuring data for longitudinal analysis. There are six streams (see Table 5). Each stream corresponds to a subsample of the same children who are tested in each of Years 3, 5, 7 and 9 during the same calendar years. For example, all children tested in Year 3 in 2008, in Year 5 in 2010, in Year 7 in 2012, and in Year 9 in 2014 are assigned to the same stream (category 2). If a study child repeats a year level after NAPLAN testing commences—for example, repeats Year 3 or any other subsequent year level—the child is assigned to the "not applicable" category (–9). This is because the child will not sit the expected sequence of NAPLAN testing. It is important to emphasise that if a study child repeats a year level prior to Year 3, but does not repeat any year level subsequent to Year 3, he/she will still be assigned to one of the streams.

For different analyses, various streams can be selected and/or combined. For example, by selecting streams 1, 2 and 3, an analyst can perform analyses to examine whether there are any differences across time between children who start school at different ages within the K cohort. By merging streams 1, 2 and 3, an analyst can assess changes in academic performance across time for all children in the K cohort, with the exception of those who have repeated a year level since Year 3.

[4] It is worth mentioning that after Wave 4 some categories may become redundant; for example, category 3 may become irrelevant as the updated consent form has been simplified and the chance of filling the form in incorrectly will be very small. If a category becomes irrelevant at consequent waves, it will be removed and the list of categories will be updated. Ideally, it is expected that there will be a dummy variable with "1" corresponding to "consent obtained" and "0" corresponding to "consent refused".

Table 5: Streams for longitudinal analysis, LSAC NAPLAN Wave 3 data release

Cohort	Stream	Year 3	Year 5	Year 7	Year 9
		Calendar year of NAPLAN test			
K cohort	1	–	2009	2011	2013
	2	2008	2010	2012	2014
	3	2009	2011	2013	2015
B cohort	4	2011	2013	2015	2017
	5	2012	2014	2016	2018
	6	2013	2015	2017	2019
Both cohorts	–9	Stream not applicable			

The next ten dummy variables (*rprey* to *ry9*) correspond to all year levels, starting from pre-Year 1 and ending with Year 9, where 1 represents "year repeated".

The variable *repeated* refers to whether a study child repeated a year level at least once prior to NAPLAN (category 1 = pre-Year 1, Year 1 or Year 2), during NAPLAN testing (category 2 = Year 3, Year 4, Year 5, Year 6, Year 7, Year 8 or Year 9), or repeated in both periods (category 3). These categories are mutually exclusive—if category 1 is chosen, it means that a child repeated a year level (at least once) only prior to the NAPLAN tests commencing but has not repeated any year levels since Year 3, while category 3 suggests that a child repeated at least two year levels: one in the period prior to NAPLAN and one during NAPLAN. The variable can be of great use if an analyst is interested in selecting out all children who repeated a year level during NAPLAN, or in controlling for children who repeated a year level prior to NAPLAN.

The next eight variables, where # refers to a year level (Year 3, 5, 7 or 9), are recorded for each year level with respect to their corresponding NAPLAN tests.

The variables *y#read*, *y#write*, *y#spel*, *y#gram* and *y#num* refer to Reading, Writing, Spelling, Grammar and Punctuation, and Numeracy scaled scores, respectively. Scores are reported up to one decimal point unless state or territory authorities provided scores rounded to the whole number. Tasmania and Western Australia provided rounded NAPLAN scores for 2008 and 2009 tests. Scores range from 0 to 1,000. If a student was absent or was exempt from a test, his/her score is recorded as not applicable (–9). Students can be absent or exempt from one or all tests; for example, "students with a language background other than English, who arrived from overseas less than a year ago, and students with significant intellectual disabilities may be exempted from testing" (MCEECDYA 2009, p. 3). It is possible for parents to give their consent to access NAPLAN data, but that state/territory authorities are not able to identify (match) the study child in the national NAPLAN database; therefore, for these children scores are missing. Scores for children with no consent are also recorded as missing. If a study child repeats a year level and sits NAPLAN tests for a second time, the most recent NAPLAN scores are stored in the LSAC NAPLAN data file.

The variable *y#age* refers to the age of the child at the time of testing.

The next two variables in the LSAC NAPLAN data file are *y#test* and *y#state*. The former variable refers to the calendar year in which the test was undertaken by the study child. The latter refers to the state/territory of the school attended by the study child. There are instances where a study child resides in one state/territory but attends school in a different state/territory, which is explained by some children living on a state/territory border or moving their place of residence between data collection waves.

The variable *y#status* has five categories. Category 1 refers to cases where a study child completes all tests; category 2 refers to cases where a study child is absent for some tests but completes at least one test; category 3 refers to cases where a study child is absent for all tests; category 4 refers to cases where a study child is exempt from all tests; and category 5 refers to cases where consent from parents has been obtained but state/territory authorities are unable to identify the study child within the national NAPLAN database. It is worth noting that if study children are not matched/identified to the NAPLAN data they are assigned to "no match" across all NAPLAN year

levels unless a match for any year level is found. If consent is not obtained, cases are considered "not applicable" (–9).

The above compendium is presented for NAPLAN testing in years from 2008 to 2011 only. Every two years, starting from 2013, the LSAC NAPLAN file will be updated by AIFS with new NAPLAN results and released along with the main wave release. The report below focuses only on Year 3 and Year 5 LSAC NAPLAN data, as data for these year levels are complete (i.e., all children from the eligible LSAC NAPLAN sample have already sat Year 3 and Year 5 NAPLAN tests).

4. Using NAPLAN data in LSAC

4.1 Data compendium

Table 6 provides a breakdown of NAPLAN data by year level (Years 3, 5 and 7). Year 3 NAPLAN data are available for 74% of the LSAC NAPLAN sample. The remaining 26% of children do not have Year 3 NAPLAN data, as the majority of them (approximately 23%) were enrolled in Year 3 in 2007, before NAPLAN testing was implemented. Year 5 NAPLAN data are available for 97% of the LSAC NAPLAN sample. For 3% of Year 5 children, the NAPLAN data are not matched by state/territory jurisdiction. Year 7 NAPLAN data are available for 23% only because the majority of K cohort children were scheduled to take Year 7 NAPLAN tests in 2012 and 2013.[5]

Table 6: NAPLAN data provided, by year level, LSAC NAPLAN, K cohort

	Year 3		Year 5		Year 7	
	N	%	*N*	%	*N*	%
Match	3,094	74.4	4,022	96.7	948	22.9
No match	1,065	25.6	137	3.3	3,211	77.2
Eligible sample	4,159	100.0	4,159	100.0	4,159	100.0

Source: LSAC NAPLAN, K cohort

4.2 Birth cohort vs year level cohort

The age regulations for children entering primary school vary across states and territories. The differences in entry age are also affected by parents' decisions about whether to delay their children. If a parent or a preschool teacher thinks that a child is not ready for school, parents may choose not to send their child to primary school in the year when the child is first eligible. This means that children born in the same year might be enrolled in one of three sequential year levels. At the same time, children enrolled in the same year level might be almost two years apart. This pattern is clearly reflected in the LSAC sample (Table 7).

Table 7: NAPLAN data provided, by year level and calendar year, LSAC NAPLAN, K cohort

	Year 3			Year 5			Year 7		
	N	%	Age (years)	*N*	%	Age (years)	*N*	%	Age (years)
2008	2,891	69.5	8.6	–	–		–	–	
2009	203	4.9	9.3	936	22.5	9.9	–	–	
2010	–			2,842	68.3	10.6	4	0.1	10.9
2011	–			244	5.9	11.4	944	22.8	11.9
No match	1,065	25.6		137	3.3		3,211	77.2	
Eligible sample	4,159	100.0		4,159	100.0		4,159	100.0	

Source: LSAC NAPLAN, K cohort

It can be seen that LSAC children born in the same year were enrolled in the same year level across different calendar years. For example, out of all Year 5 children, 23% were enrolled in 2009, 68% in 2010 and 6% in 2011. Also, children of the same age were enrolled in different year levels in the same calendar year. For example, in 2009, 5% of children were enrolled in Year 3, 72% were enrolled in Year 4 (not shown) and 23% were enrolled in Year 5. It is important to remember that children of the same birth cohort belong to different year level cohorts and children of the same year level cohort belong to different birth cohorts, due to LSAC data being collected for children of similar age and NAPLAN data being collected for children of the same year level.

[5] The 2012 NAPLAN results were not available at the time of writing.

To sum up:

- LSAC measures are collected for children of the same age but with different years of schooling; and
- NAPLAN data are collected for children with the same years of schooling but of different ages.

Therefore:

- if a researcher is interested in children's NAPLAN scores in the same year level, he/she should take into account of the age of the child at the time of NAPLAN testing; and
- if a researcher is interested in children's outcomes measured during LSAC data collection, he/she should take into account the year levels of schooling.

4.3 Representativeness of year level cohort in LSAC

As children born in the same year can enter school in different calendar years, the range of ages within a year level can be wide. This range may also tend to get wider the higher the year level as a result of the cumulative effects of skipping or repeating a year level. Overall, it is expected that the majority of children would be of relatively similar age, and smaller proportions of children would be either markedly younger or older relative to their classmates.

Figure 2 presents the age distribution of LSAC children in the K cohort who sat the Year 5 NAPLAN tests in 2009, 2010 and 2011 respectively. Red lines divide the Year 5 LSAC sample by the calendar year in which NAPLAN was taken.

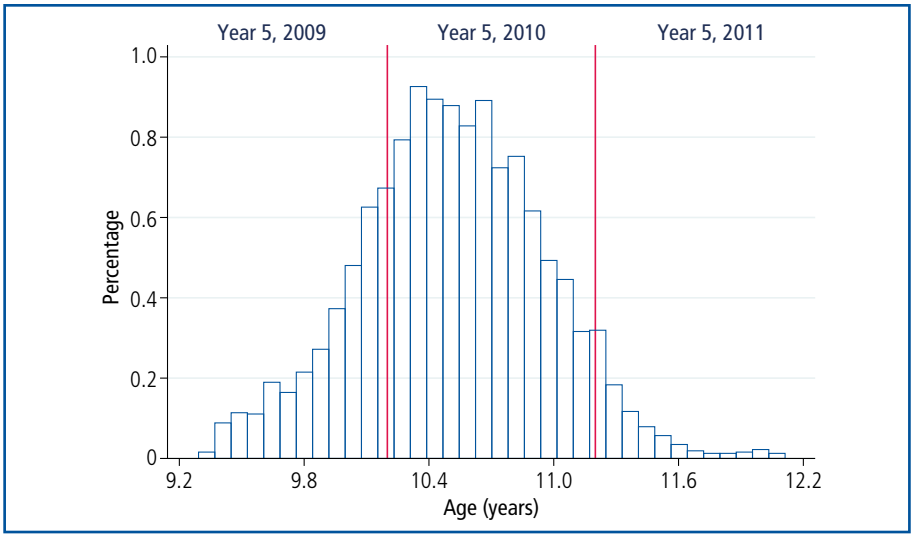


Figure 2: Age distribution of LSAC children who sat the NAPLAN test in Year 5, 2009–10

It can be seen that the LSAC data for each year level in a given calendar year represent a "censored" year level cohort, as not all ages are represented for the corresponding school year. For example, consider the LSAC sample of children who sat the Year 5 NAPLAN test in 2009. The age range for these children was from 9 years 2 months to 10 years 2 months (with the average age being 9 years 9 months), while the average age of all Australian children who sat Year 5 NAPLAN test in 2009 was 10 years 6 months. Thus, the Year 5, 2009 LSAC sample represents children who entered school relatively younger compared to their classmates. In contrast, the Year 5, 2011 LSAC sample represents children who were relatively older than their classmates, as their age varied from 11 years 2 months to 12 years 2 months (with the average age being 11 years 5 months), while the average age of all Australian children in Year 5, 2011 was also 10 years 6 months. LSAC children who were in Year 5 in 2009 were, on average, the same age as Year 5, 2010 children nationwide; however, the LSAC Year 5, 2010 sample was missing all children who were either relatively younger or relatively older compared to the majority of children enrolled in Year 5, 2010.

Assuming that there are no time-varying influences on the educational system across these consecutive years and no year-level cohort effect, we can assume that LSAC Year 5, 2009 children are representative of relatively younger Year 5, 2010 children and LSAC Year 5, 2011 children are representative of relatively older children in Year 5, 2010. As a result, LSAC Year 5 children could be considered as a representative sample of Year 5 children in the population, regardless of the calendar year (2009, 2010 or 2011). To assess whether this assumption is plausible or not, we examined whether the national NAPLAN scores, percentage of children at and above national minimum standard (NMS) and participation rates were significantly different across 2009–11. Table 8 shows that there were no significant differences in Year 5 NAPLAN results across 2009–11.

Table 8: Year 5 NAPLAN scores, Australia, 2009–11

		2009	2010	2011	Significance of difference in means	
					2009 and 2010	2010 and 2011
Reading	Score	493.9	487.4	488.1	*ns*	*ns*
	% at or above NMS	91.7	91.3	91.5	–	–
	Participation	96.8	96.2	96.2	*ns*	*ns*
Numeracy	Score	486.8	488.8	487.8	*ns*	*ns*
	% at or above NMS	94.2	93.7	94.4	–	–
	Participation	96.4	95.9	95.9	*ns*	*ns*
Spelling	Score	487.2	487.1	484.1	*ns*	*ns*
	% at or above NMS	92.4	92.0	91.3	–	–
	Participation	96.9	96.4	96.4	*ns*	*ns*
Grammar & Punctuation	Score	499.7	499.7	499.1	*ns*	*ns*
	% at or above NMS	92.0	92.2	92.0	–	–
	Participation	96.9	96.4	96.4	*ns*	*ns*
Writing	Score	484.7	485.2	482.6	*ns*	*ns*
	% at or above NMS	93.0	93.1	92.5	–	–
	Participation	96.8	96.2	96.2	*ns*	*ns*

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA), 2010 and 2011

To sum up:

- Due to the distribution of the school data in the LSAC NAPLAN sample, a school year level in a given calendar year cannot be considered representative of a corresponding year level in the population.
- Any analysis of NAPLAN data in LSAC by year level for a given calendar year should be avoided (e.g., Year 3, 2008).

4.4 Timing of NAPLAN testing in LSAC

LSAC interviews take place every two years and a family can be interviewed any day from March to December during the year of the interview. NAPLAN testing, however, takes place every year on the same days for all children. As a result, LSAC measures and NAPLAN scores are not necessarily collected contemporaneously.

Figure 3 illustrates the timelines of Year 5 NAPLAN and Wave 4 LSAC data collection. A histogram represents the distribution of Wave 4 interview dates and red lines represent the time points when Year 5 NAPLAN tests were taken. For 23% of children, the NAPLAN testing (Year 5, 2009) was a year before the LSAC Wave 4 data collection, for 6% of children the NAPLAN testing was in the year following the LSAC interview, and for the remaining 71% of children NAPLAN was in the same year as the Wave 4 data collection. However, even though for the majority of children NAPLAN testing and LSAC data collection were undertaken in the same year, this did not necessarily happen

concurrently. Out of these 71% of children, only 13% were interviewed in LSAC prior to NAPLAN testing, and the rest were interviewed after NAPLAN testing. As a result, for 80% of Year 5 children, NAPLAN testing took place before the LSAC Wave 4 data collection. The same pattern would be consistent across all year levels.

To sum up:

- Timing of NAPLAN testing in relation to the LSAC data collection is of crucial importance, as it determines to which wave of LSAC data the NAPLAN data should be linked.

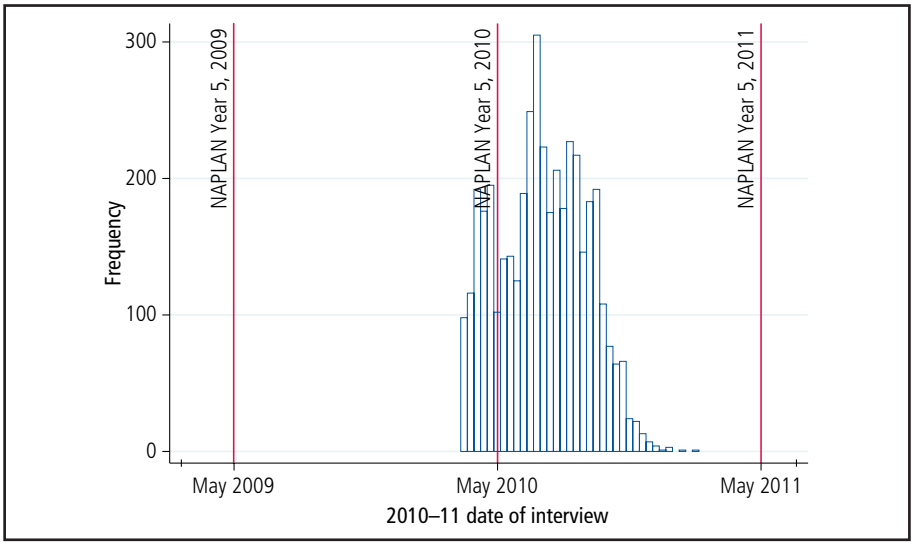


Figure 3: Distribution of Wave 4 interview dates

4.5 Correspondence between NAPLAN and LSAC data

To decide what NAPLAN and/or LSAC data to use, the following needs to be considered:

- whether analysis is longitudinal or cross-sectional;
- whether NAPLAN scores are considered as independent or dependent variables; and
- whether analysis is by year level or period.

Figure 4 schematically presents what should be considered when deciding what NAPLAN and LSAC data to use in the analysis.

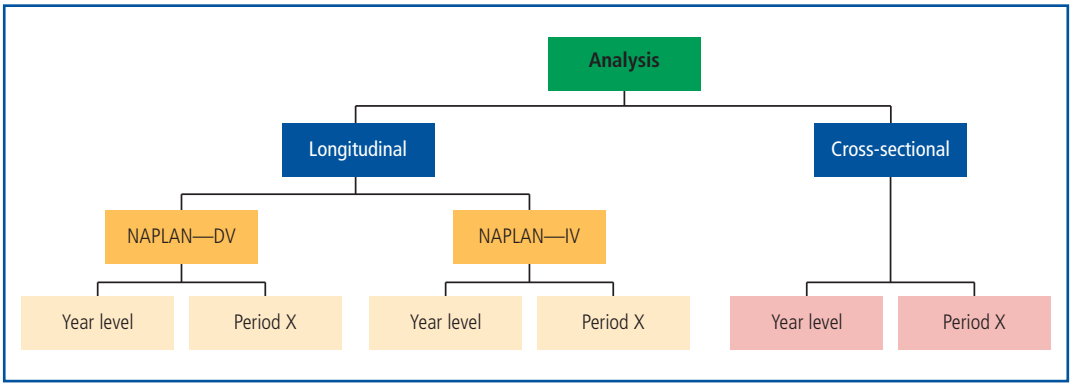


Figure 4: Step-by-step process of choosing the correct NAPLAN data and LSAC data

"Period X" refers to a period of two years—the year prior to the LSAC data collection and the year of LSAC data collection—with "X" referring to the wave. So, Period 1 covers 2003 and 2004, with Wave 1 data collection in 2004; Period 2 covers 2005 and 2006, with Wave 2 data collection in 2006;

Period 3 covers 2007 and 2008, with Wave 3 data collection in 2008; and so on. Figure 5 shows the collection of NAPLAN data by period. It can be seen that the same year level NAPLAN results are collected at different periods and NAPLAN results for different year levels are represented within the same period. Given that NAPLAN scores are measured on the same (common) scale and equated across different year levels, within a particular period an analyst can standardise NAPLAN scores for each year level separately and model NAPLAN scores regardless of year level.

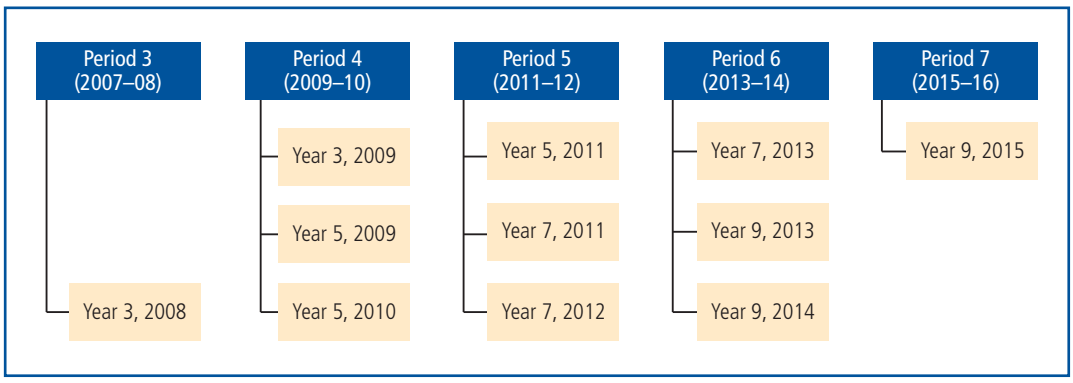


Figure 5: NAPLAN tests by period

Below, we outline possible combinations of NAPLAN and LSAC data, depending on the type of the analysis under consideration.

Longitudinal analysis with NAPLAN as a dependent variable

When NAPLAN scores are modelled as an outcome of different LSAC characteristics, it is important to measure these characteristics prior to NAPLAN testing.

Table 9 shows the correspondence between NAPLAN data and LSAC data when NAPLAN scores are modelled at year level, using Year 5 NAPLAN scores as an example. LSAC children sat Year 5 NAPLAN in 2009, 2010 and 2011; therefore, the most recent LSAC data collected at *the same time point* prior to Year 5 NAPLAN tests (2009–11) are Wave 3 data. It can be seen from Table 9 that the time gap between Wave 3 data collection and Year 5 NAPLAN testing varies from 1 month to 37 months, with the average time gap being 20 months.

Table 9: Mean, minimum and maximum time gap between Year 5 NAPLAN data (2009–11) and Wave 3 LSAC data (2008), by calendar year

NAPLAN	Wave	*N*	Time gap (months) = date(NAPLAN) – date(LSAC interview)		
			Mean	Minimum	Maximum
Year 5, 2009 (Period 4)	Wave 3, 2008 (Period 3)	919	10.8	1.2	13.3
Year 5, 2010 (Period 4) [a]	Wave 3, 2008 (Period 3)	2,792	22.0	15.3	25.0
Year 5, 2011 (Period 5) [b]	Wave 3, 2008 (Period 3)	238	33.4	29.1	36.8
Total		3,949	20.1	1.2	36.8

Note: Not all children with linked NAPLAN data participated at Wave 3. [a] Fourteen per cent of children sat Year 5 NAPLAN tests in 2010 after the LSAC Wave 4 interview; however, Wave 4 data cannot be used as the most recent LSAC data, because the time gap between Wave 4 and Year 5 NAPLAN for these children was on average less than a month. Therefore, Wave 4 data cannot be used in longitudinal designs as the data were measured prior to Year 5, 2010 NAPLAN data. [b] For children who sat Year 5 NAPLAN tests in 2011, the most recent LSAC data are Wave 4 not Wave 3. However, the proportion of these children is relatively low (6%) and use of Wave 4 data for this group does not affect the average time gap between Year 5 NAPLAN and the most recent LSAC data (18.9 months). Use of Wave 3 and Wave 4 LSAC measures complicates the modelling, as in such a design, not only NAPLAN data but also LSAC data are measured at different time points.

Table 10 shows the correspondence between NAPLAN and LSAC data when NAPLAN scores are modelled by period using NAPLAN data collected during LSAC Wave 4. In this scenario, Wave 4 NAPLAN data is modelled as a function of LSAC measures collected at Wave 3. When modelling NAPLAN by period, it is advisable to standardise NAPLAN scores for Year 3 and Year 5 separately.

When modelling NAPLAN scores as a function of LSAC characteristics/outcomes collected earlier, it is important to control for child's age at the time of NAPLAN test, time gap and year level, where appropriate.

Table 10: Mean, minimum and maximum time gap between NAPLAN data (2009–10) and Wave 3 LSAC data (2008), by year level

NAPLAN	Wave	*N*	Time gap (months) = date(NAPLAN) – date(LSAC interview)		
			Mean	Minimum	Maximum
Year 3, 2009 (Period 4)	Wave 3, 2008 (Period 3)	191	9.3	5.2	12.9
Year 5, 2009 (Period 4)	Wave 3, 2008 (Period 3)	919	10.8	1.2	13.3
Year 5, 2010 (Period 4) [a]	Wave 3, 2008 (Period 3)	2,792	22.0	15.3	25.0
Total		**3,902**	**18.8**	**1.2**	**25.0**

Note: Not all children with linked NAPLAN data participated at Wave 3. [a] Fourteen per cent of children sat Year 5 NAPLAN tests in 2010 after the LSAC Wave 4 interview; however, Wave 4 data cannot be used as the most recent LSAC data, because the time gap between Wave 4 and Year 5 NAPLAN for these children was on average less than a month. Therefore, Wave 4 data cannot be used in longitudinal designs as the data were measured prior to Year 5, 2010 NAPLAN data.

Longitudinal analysis with NAPLAN as an independent variable

When NAPLAN scores are modelled as a predictor of LSAC outcomes, it is important to use NAPLAN scores obtained prior to the measurement of outcomes in LSAC.

For example, consider LSAC outcomes measured at Wave 4. The most recent NAPLAN data available at a particular year level prior to Wave 4 data collection are Year 3 NAPLAN data. It can be seen from Table 11 that for the majority of children, Year 3 NAPLAN data were collected, on average, two years prior to the LSAC Wave 4 data collection.

Table 11: Mean, minimum and maximum time gap between Year 3 NAPLAN data (2008–09) and Wave 4 LSAC data (2010), by calendar year

NAPLAN	Wave	*N*	Time gap (months) = date(LSAC interview) – date(NAPLAN)		
			Mean	Minimum	Maximum
Year 3, 2008 (Period 3)	Wave 4, 2010 (Period 4)	2,762	26.0	22.3	33.1
Year 3, 2009 (Period 4)	Wave 4, 2010 (Period 4)	190	14.9	10.4	18.8
Total		**2,952**	**25.3**	**10.4**	**33.1**

Note: Not all children with linked NAPLAN data participated at Wave 4 and not all children who participated in Wave 4 had Year 3 NAPLAN data linked (as Year 3, 2007 children did not sit NAPLAN).

Table 12 shows the correspondence between NAPLAN and LSAC data when LSAC outcomes are modelled by period, using NAPLAN data collected during LSAC Wave 3. In this example, LSAC outcomes measured at Wave 4 are modelled as a function of NAPLAN data collected in the Wave 3 period. When modelling LSAC outcomes by period, it is advisable to standardise NAPLAN scores for Year 3 and Year 5 separately.

When modelling LSAC outcomes as a function of NAPLAN scores measured earlier, it is important to control for years of schooling, time gap and year level, where appropriate.

Table 12: Mean, minimum and maximum time gap between NAPLAN data (2008–09) and Wave 4 LSAC data (2010), by year level

NAPLAN	Wave	*N*	Time gap (months) = date(LSAC interview) – date(NAPLAN)		
			Mean	Minimum	Maximum
Year 3, 2008 (Period 3)	Wave 4, 2010 (Period 4)	2,762	26.0	22.3	33.1
Year 3, 2009 (Period 4)	Wave 4, 2010 (Period 4)	190	14.9	10.4	18.8
Year 5, 2009 (Period 4)	Wave 4, 2010 (Period 4)	891	13.8	10.3	19.7
Total		3,843	22.6	10.3	33.1

Note: Not all children with linked NAPLAN data participated at Wave 4.

Cross-sectional analysis

In cross-sectional design, it is not important whether children sit NAPLAN tests before or after the LSAC interview, provided both NAPLAN and LSAC measures are collected during the same period. For example, consider Wave 4 data collection. Table 13 provides the correspondence between NAPLAN data and LSAC Wave 4 data when the analysis is intended for a specific year level.

Table 13: Year 5 NAPLAN data (2009–10) and Wave 4 LSAC data (2010)

NAPLAN	Wave	*N*
Year 5, 2009	Wave 4, 2010	891
Year 5, 2010	Wave 4, 2010	2,733
Total		3,624

Note: Not all children with linked NAPLAN data participated at Wave 4.

Table 14 describes the NAPLAN data to be used when modelling LSAC outcomes measured at Wave 4 by period. As above, when modelling LSAC outcomes by period, it is advisable to standardise NAPLAN scores for Year 3 and Year 5 separately and consider controlling for child's age during NAPLAN testing and for each year level.

Table 14: Year 3 and Year 5 NAPLAN data (2009–10) and Wave 4 LSAC data (2010)

NAPLAN	Wave	*N*
Year 3, 2009	Wave 4, 2010	190
Year 5, 2009	Wave 4, 2010	891
Year 5, 2010	Wave 4, 2010	2,733
Total		3,814

Note: Not all children with linked NAPLAN data participated at Wave 4.

The options presented above are not exhaustive and have primarily been given to introduce the complexity of using NAPLAN data in the LSAC birth cohort study and provide a possible solution as to how to deal with this complexity. The logic may vary depending on the research questions. It should also be noted that examples of longitudinal analyses presented in section 4.5 are shown for NAPLAN and LSAC data measured only at one point in time, though not at contemporaneous time points. If a researcher would like to model NAPLAN or LSAC data measured at multiple times, the same logic can be applied.

5. Comparative analysis

5.1 LSAC NAPLAN scores vs national NAPLAN scores

This section describes a comparative analysis of national NAPLAN scores and NAPLAN scores in the LSAC sample overall and across different socio-demographic groups.

NAPLAN and LSAC demographic variable definitions

NAPLAN results are reported nationally, by states and territories, and at the national level by geo-location, Indigenous status, LBOTE, sex, parental education and parental occupation (MCEECDYA, 2009). While the same socio-demographic characteristics are available for the LSAC sample, comparisons across geo-locations and Indigenous status are not reported due to the small number of Indigenous children and children residing in remote areas in the LSAC sample. Given that LSAC is designed as a national study and there are limited data for some states/territories, a state/territory breakdown is omitted from this analysis.

Following NAPLAN definitions, LBOTE, parental education, and parental occupation are derived from LSAC data measured prior the NAPLAN testing as follows:

- A study child is classified as LBOTE if the study child, Parent 1 or Parent 2 speaks a language other than English at home.
- Parental education represents the highest level of educational attainment completed by either Parent 1 or Parent 2. Correspondence between levels of parental education in NAPLAN and LSAC is displayed in Appendix F. At the national level for NAPLAN, parental education is not available for all students, as it may not have been stated on the enrolment form. The proportion of all Year 3 students with parental education "not stated" was 45%. Information for Year 5 is not available.
- Parental occupation represents the highest level of occupational group of either Parent 1 or Parent 2. If a parent has more than one job, the occupation group of the main job is reported. Correspondence between occupational groups in NAPLAN and LSAC is reported in Appendix G. At the national level for NAPLAN, parental occupation is not available for all students, as it may not have been stated on the enrolment form. The proportion of all Year 3 students with parental occupation "not stated" was 47%. Information for Year 5 is not available.

Population weights

LSAC estimates are calculated using weighted data. While it is crucial to use population weights to match the LSAC sample to the composition of the general NAPLAN population of children and adjust for between-waves attrition, these weights do not account for possible differences in the distribution of NAPLAN scores. The weighting takes into account the variation between different socio-demographic groups but does not account for variation within a particular socio-demographic group. For example, it could well be that, while the weighted socio-demographic distribution of LSAC families with children born between March 1999 and March 2000 matches the general population, participating families and children may be different on outcome/performance measures.

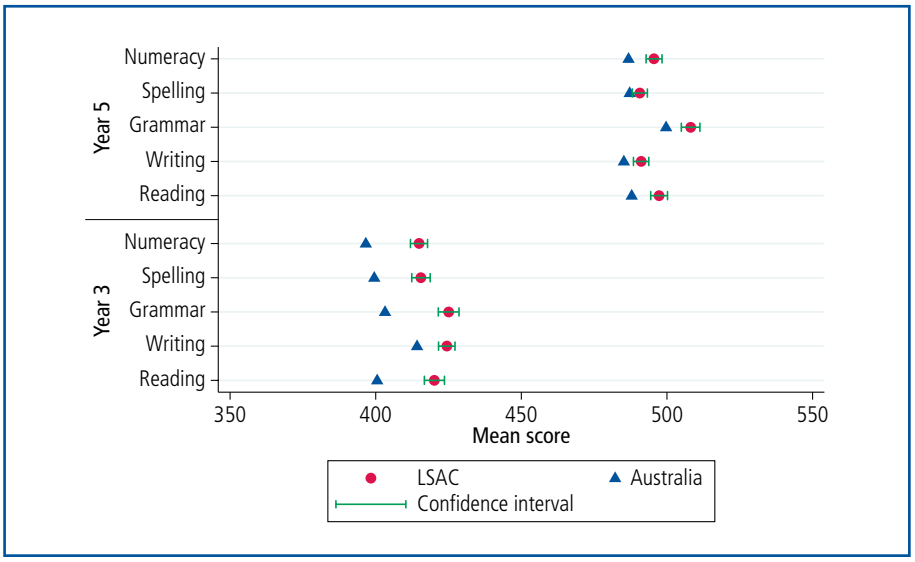
Comparison between LSAC NAPLAN and national NAPLAN scores

Children who were tested in Year 3 in 2008–09 and Year 5 in 2009–11 in the LSAC sample were compared with the national Year 3, 2008 and Year 5, 2010 NAPLAN test scores, respectively. NAPLAN scores for children who were tested in Year 7 are not reported due to the relatively small number of LSAC children who had sat this test by 2011. We consider the difference between the population mean and the corresponding estimated mean to be statistically significant if the population mean lies outside the confidence interval (CI) of the corresponding estimated mean. The

difference between two estimated means is considered statistically significant if the corresponding CIs do not overlap.[6]

Overall scores

Figure 6 and all subsequent figures represent NAPLAN mean scores for the LSAC sample and nationwide. The circles indicate the LSAC means, and the line segments represent the 95% confidence intervals of the estimated means. The triangles represent the population means and hence have no confidence intervals.



Source: LSAC NAPLAN Year 3, NAPLAN Year 5, 2009

Figure 6: LSAC NAPLAN and national NAPLAN scores, by tests and year levels

It can be seen that Year 3 LSAC children scored significantly higher on average across all tests. The main reason is that the Year 3 LSAC sample is a censored sample and not a representative sample of the Year 3 cohort; that is, children who entered school relatively young compared to their peers were not represented in Year 3 LSAC sample (i.e., Year 3 in 2007). The differences might be also due to the age differences between the LSAC sample and the corresponding nationwide population and availability of NAPLAN data by state. On average, children in the LSAC Year 3 cohort were 3 months older than the Year 3 NAPLAN national cohort in 2008. Edwards, Taylor, and Fiorini (2009) found that older children score significantly higher in cognitive tests than their younger classmates. Moreover, approximately 50% of children for whom Year 3 NAPLAN data were not available (because the children were in Year 3 in 2007) were from Queensland. According to national statistics (ACARA, 2008), in 2008, Queensland children scored significantly lower on all tests compared to all other states and territories except Northern territory. In addition, children in Queensland on average were 5 months younger and had spent one year less in school than children in Year 3 in all other states.

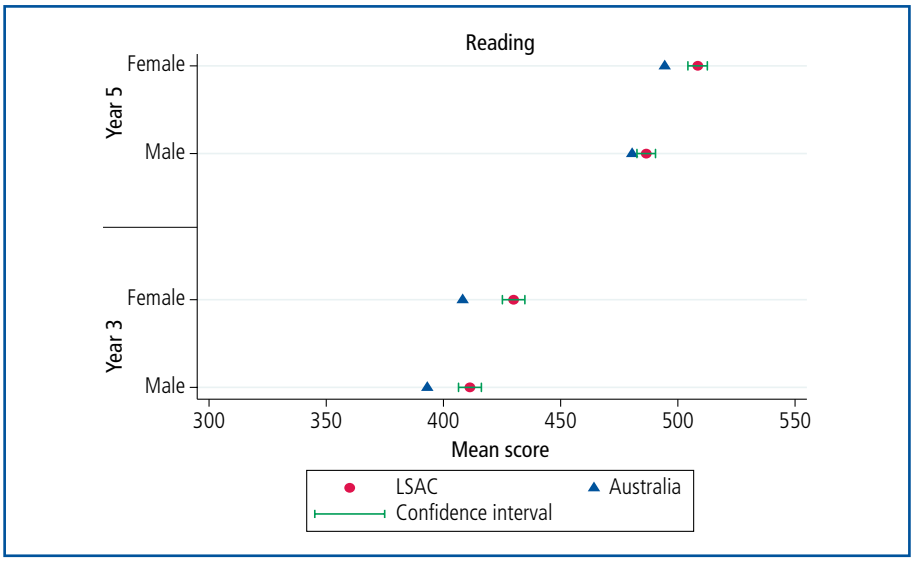
A similar pattern is observed across Year 5 NAPLAN results. While there are significant differences observed in NAPLAN results between LSAC children and the Australian population, the magnitude of the differences is smaller than in the Year 3 NAPLAN results. One explanation may be that the LSAC sample is not a representative sample of the year level cohort, even if population weights are employed. Although the weighting takes into account sample attrition, it does so only on the basis of the variables that were used to model such attrition (Sipthorp & Misson, 2009).

[6] It is worth noting that if CIs overlap, the difference between the two means still may be significantly different, but a *t*-test is required to confirm this. Given that the purpose of this report is to examine the representativeness of NAPLAN results in the LSAC sample, the comparison of NAPLAN results across different demographic groups within the LSAC sample is not tested unless the differences are obvious (that is, the CIs of corresponding means do not overlap).

Consequently, unmeasured or unobserved variables are not accounted for. For example, results of logistic regression show that NAPLAN data are less likely to be linked for children who had poorer development of receptive language and vocabulary, even after controlling for main socio-demographic characteristics. Moreover, these differences are persistent; even when comparing the LSAC NAPLAN with national NAPLAN scores only for metropolitan areas, the LSAC children scored significantly higher than Australian children. Therefore, an exclusion of remote and extremely remote areas from the LSAC sample is unlikely to be the reason for the observed disparity.

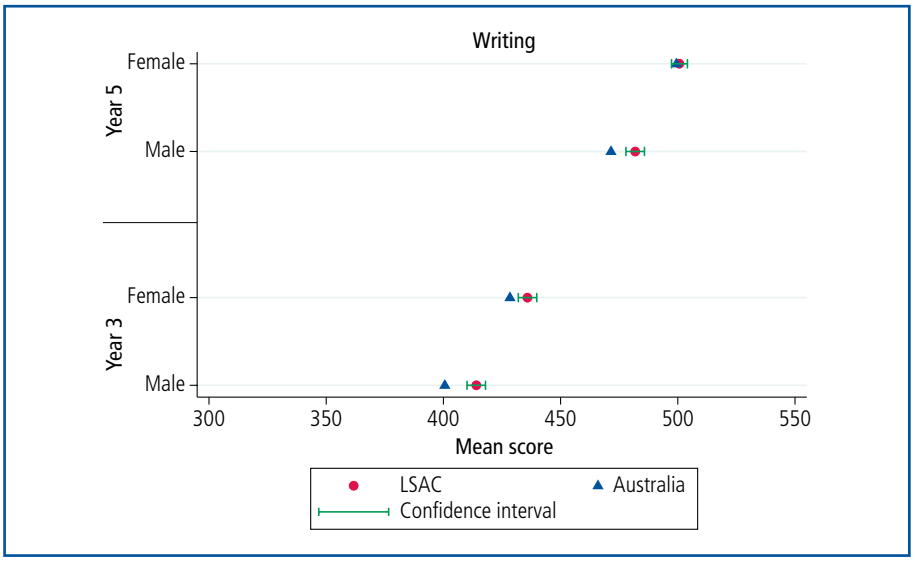
NAPLAN scores by study child's gender

Figures 7 to 11 show differences in the NAPLAN scores between the LSAC sample and the general NAPLAN population by gender for Year 3 and Year 5. It can be seen that girls on average scored consistently higher than boys on all tests except Numeracy, where boys performed slightly better. These results were observed for both Year 3 and Year 5 and were consistent across the LSAC sample and the general NAPLAN population. Overall, Year 3 of the LSAC sample scored significantly higher than children nationwide, while there was no significant difference in Year 5 NAPLAN scores between the LSAC sample and general NAPLAN population for girls in Spelling and Writing, and boys in Spelling and Numeracy.



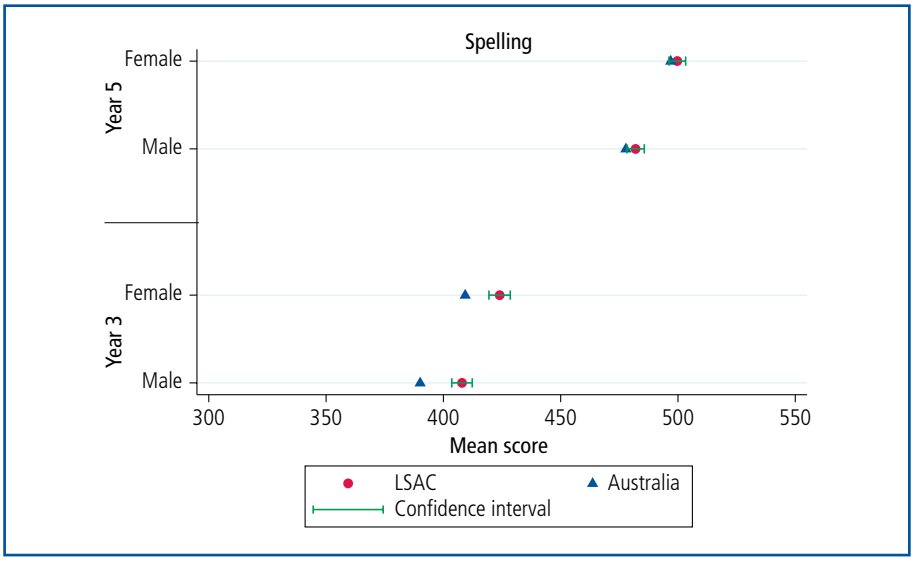
Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 7: LSAC NAPLAN and national NAPLAN Reading scores, by gender and year level



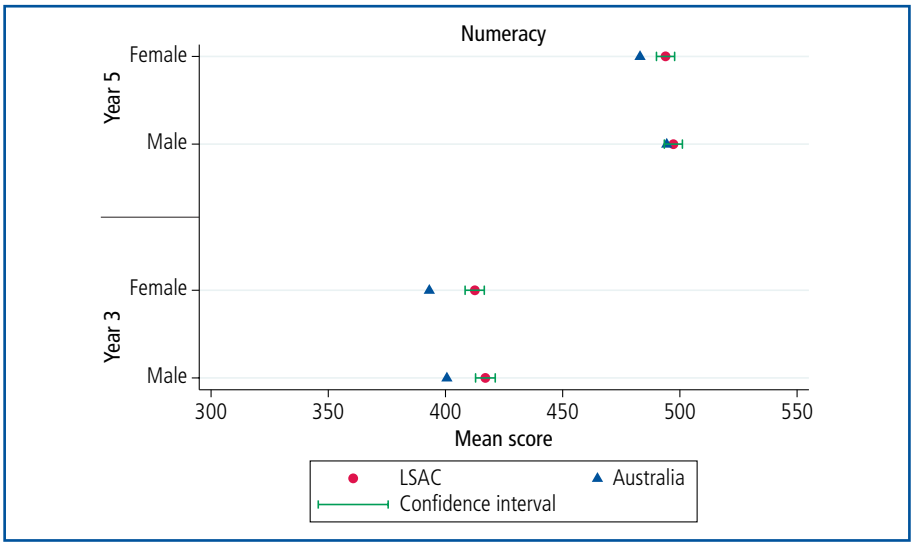
Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 8: LSAC NAPLAN and national NAPLAN Writing scores, by gender and year level



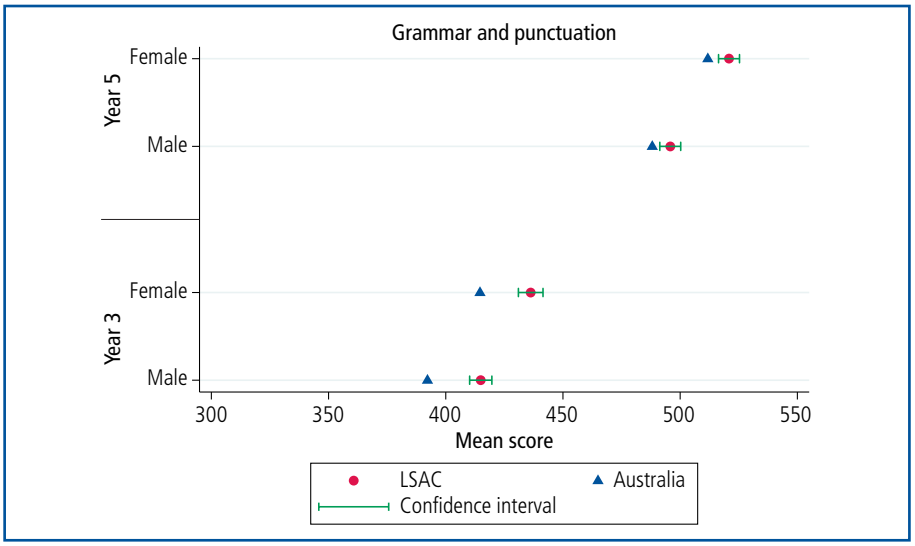
Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 9: LSAC NAPLAN and national NAPLAN Spelling scores, by gender and year level



Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 10: LSAC NAPLAN and national NAPLAN Numeracy scores, by gender and year level

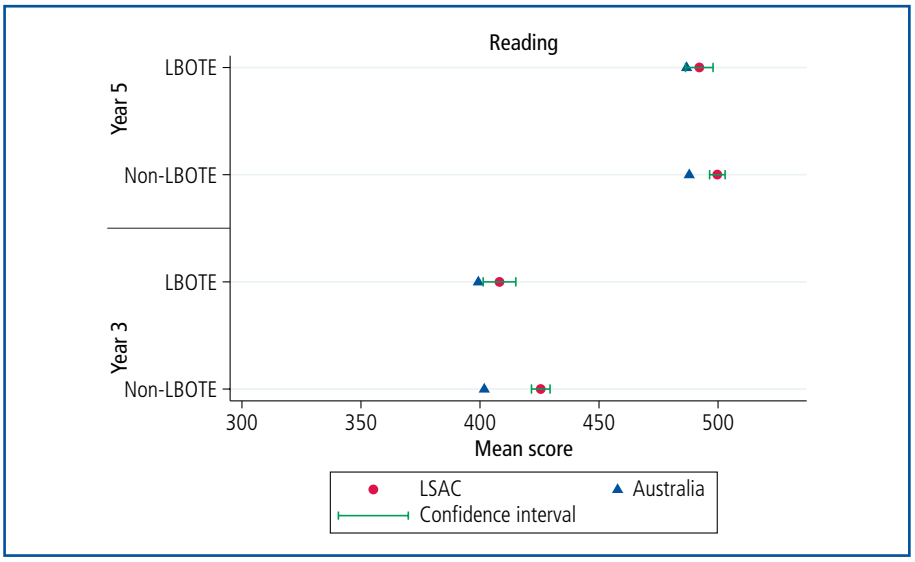


Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 11: LSAC NAPLAN and national NAPLAN Grammar and Punctuation scores, by gender and year level

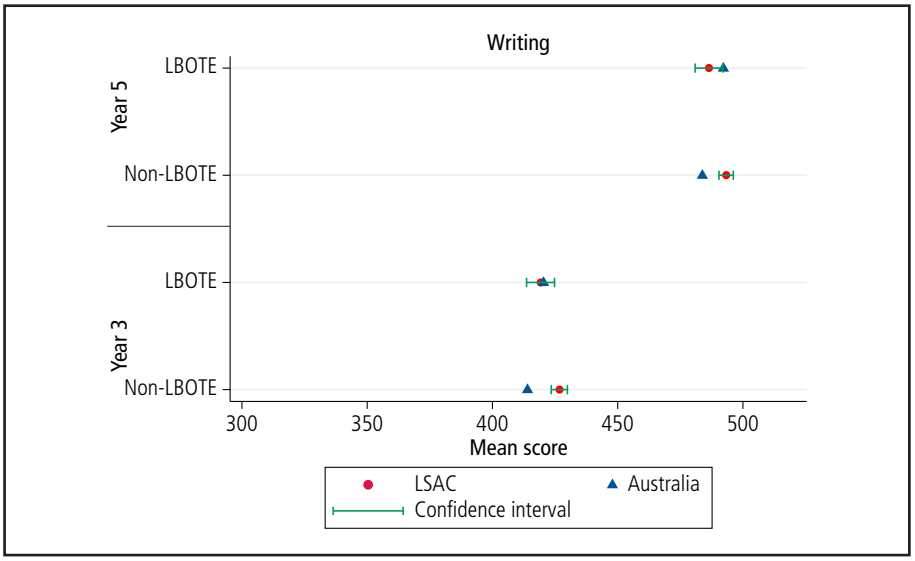
NAPLAN scores by LBOTE status

Figures 12 to 16 show differences in the NAPLAN scores between the LSAC sample and the general NAPLAN population by LBOTE status for Year 3 and Year 5. It can be seen that language background makes little difference to NAPLAN mean scores in either Year 3 or Year 5 for all measures except Reading and Grammar (Year 3). LSAC NAPLAN estimates deviated from population NAPLAN mean scores mainly for children from non-LBOTE background, where, on the whole, the former were significantly higher. Moreover, the pattern of scores by LBOTE was different in LSAC sample and nationwide. While national NAPLAN results suggest that children from LBOTE on average scored higher on all tests than children from non-LBOTE, a different tendency is observed in the LSAC sample. There were no significant differences between children from LBOTE and non-LBOTE in the LSAC sample.



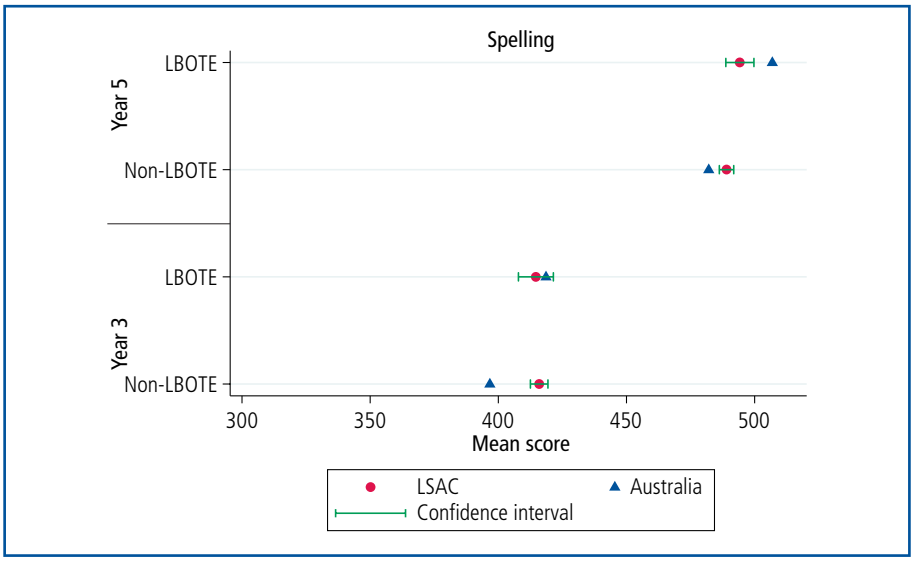
Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 12: LSAC NAPLAN and national NAPLAN Reading scores, by LBOTE and year level



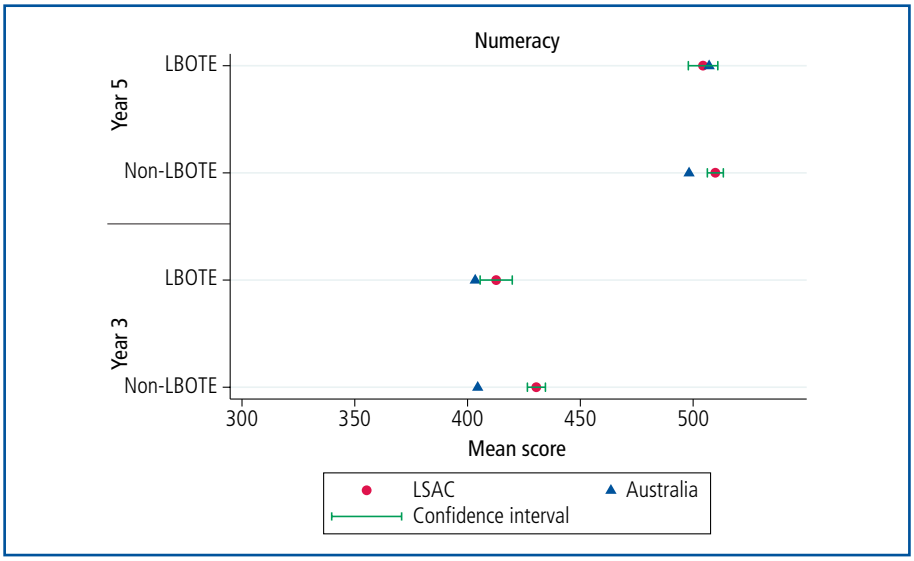
Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 13: LSAC NAPLAN and national NAPLAN Writing scores, by LBOTE and year level



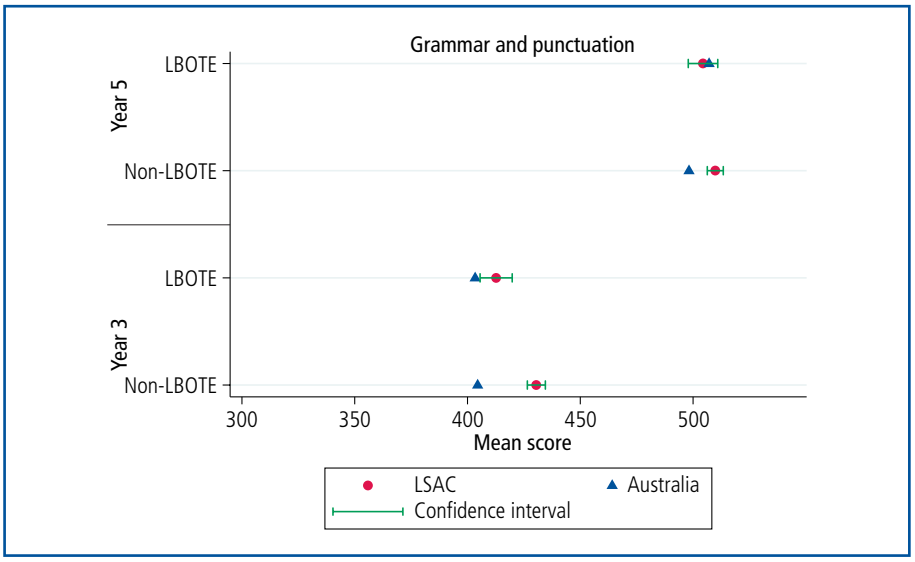
Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 14: LSAC NAPLAN and national NAPLAN Spelling scores, by LBOTE and year level



Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 15: LSAC NAPLAN and national NAPLAN Numeracy scores, by LBOTE and year level



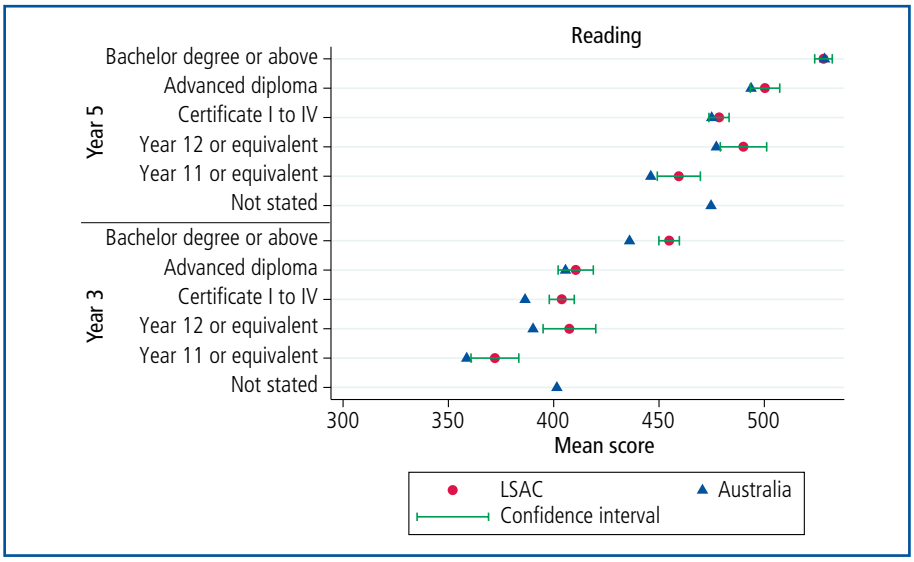
Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 16: LSAC NAPLAN and national NAPLAN Grammar and Punctuation scores, by LBOTE and year level

NAPLAN scores by parental education

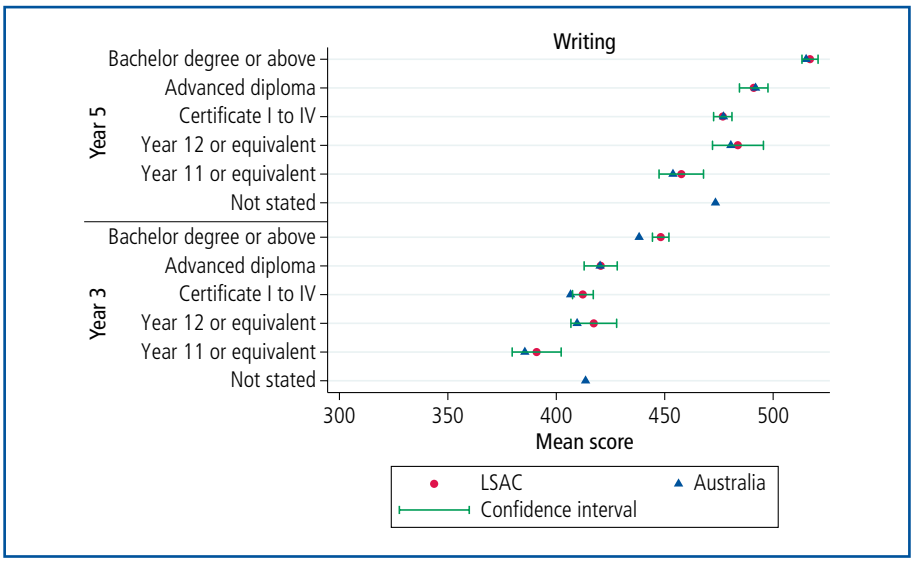
Figures 17 to 21 represent differences in NAPLAN scores between the LSAC sample and general NAPLAN population by parental education across Year 3 and Year 5. LSAC Year 3 children scored, on average, significantly higher on Reading, Spelling, Numeracy, and Grammar and Punctuation tests than the general population of NAPLAN children, regardless of the education level of their parents. The LSAC children from families where the highest educational attainment was an advanced diploma or Year 11 or equivalent scored statistically similarly to Australian children from the corresponding educational groups. There were no statistically significant differences in Year 5 NAPLAN scores between the LSAC sample and general NAPLAN population across different educational groups.

Overall, the mean scores progressed according to parental education qualification for both Year 3 and Year 5 cohorts and across all tests, with the highest scores being where one parent at least had a degree and the lowest where no parent had completed Year 12. The results suggest that different educational composition is related to differences between the national and LSAC sample, and it is consistent with non-response analysis.



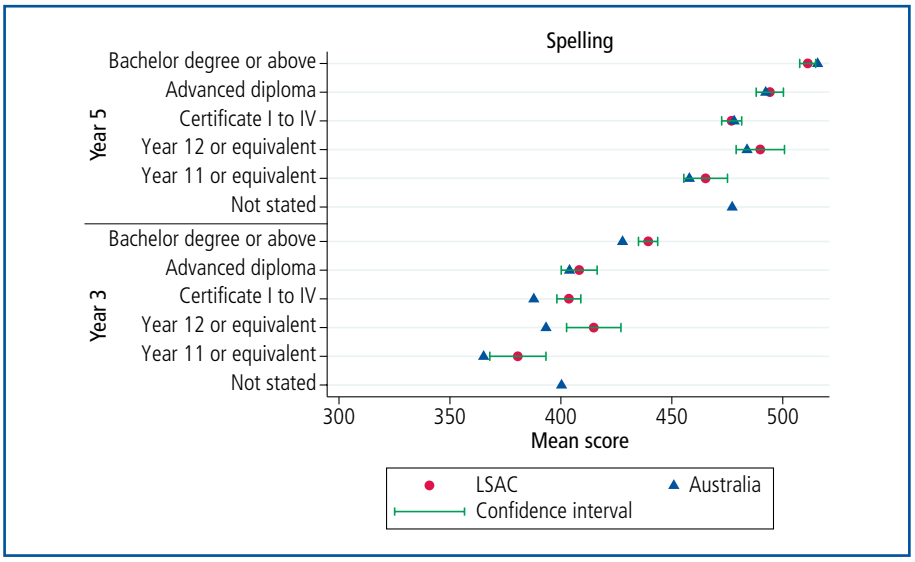
Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 17: LSAC NAPLAN and national NAPLAN Reading scores, by parental education and year level



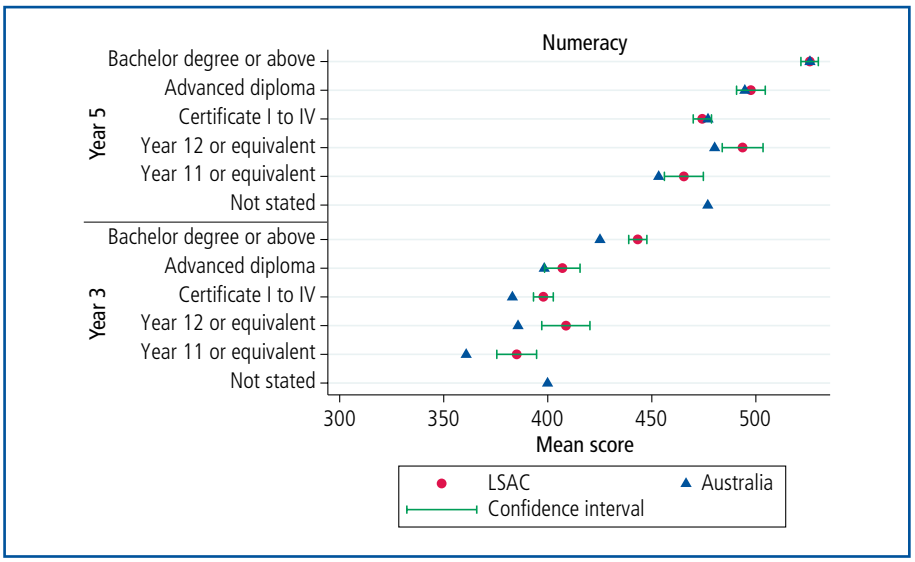
Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 18: LSAC NAPLAN and national NAPLAN Writing scores, by parental education and year level



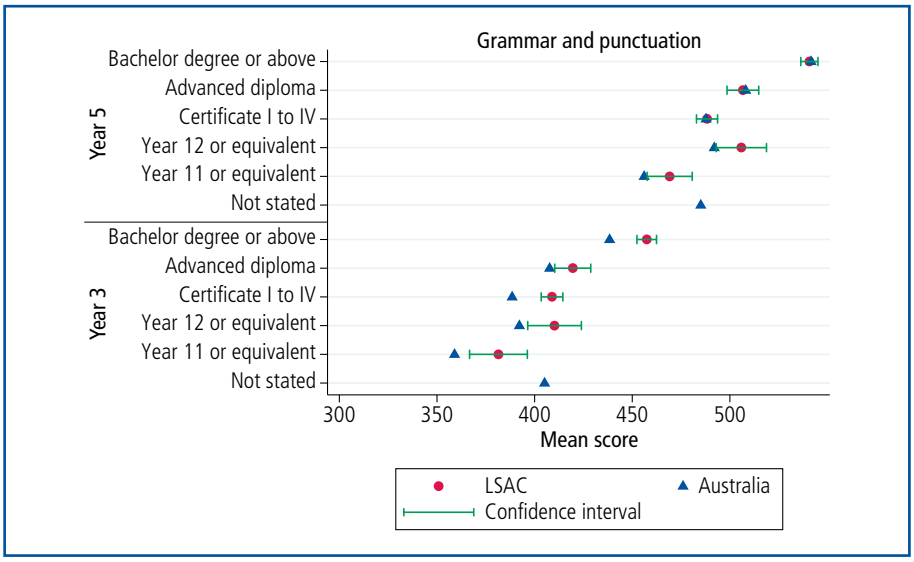
Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 19: LSAC NAPLAN and national NAPLAN Spelling scores, by parental education and year level



Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 20: LSAC NAPLAN and national NAPLAN Numeracy scores, by parental education and year level

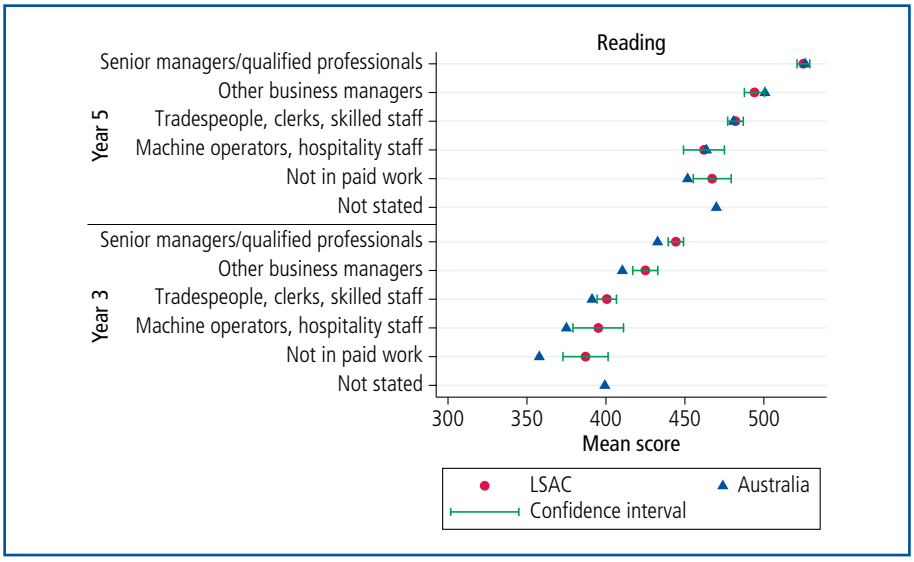


Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 21: LSAC NAPLAN and national NAPLAN Grammar and Punctuation scores, by parental education and year level

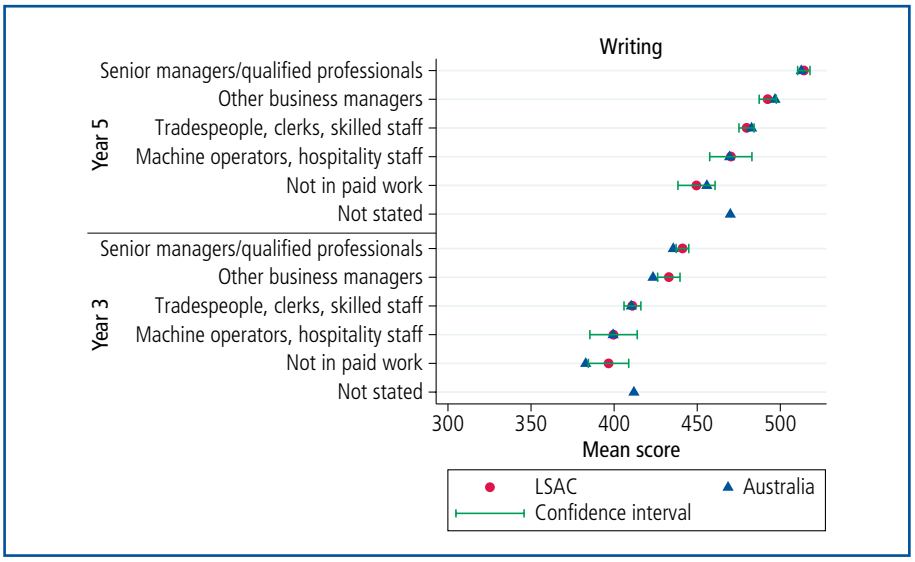
NAPLAN scores by parental occupation

Figures 22 to 26 represent differences in NAPLAN scores between LSAC children and the general NAPLAN population by the occupational status of their parents for Year 3 and Year 5. Consistent with previous results, LSAC Year 3 children performed significantly better than the general NAPLAN population, while there were no significant differences across Year 5 children. Also, the pattern of differences between occupational groups was similar between the LSAC sample and the general NAPLAN population and between year levels, with children from lower occupational groups reporting lower NAPLAN scores on all tests. As for parental education, occupational composition of parents in LSAC sample could be related to differences in overall NAPLAN scores between the national and LSAC samples.



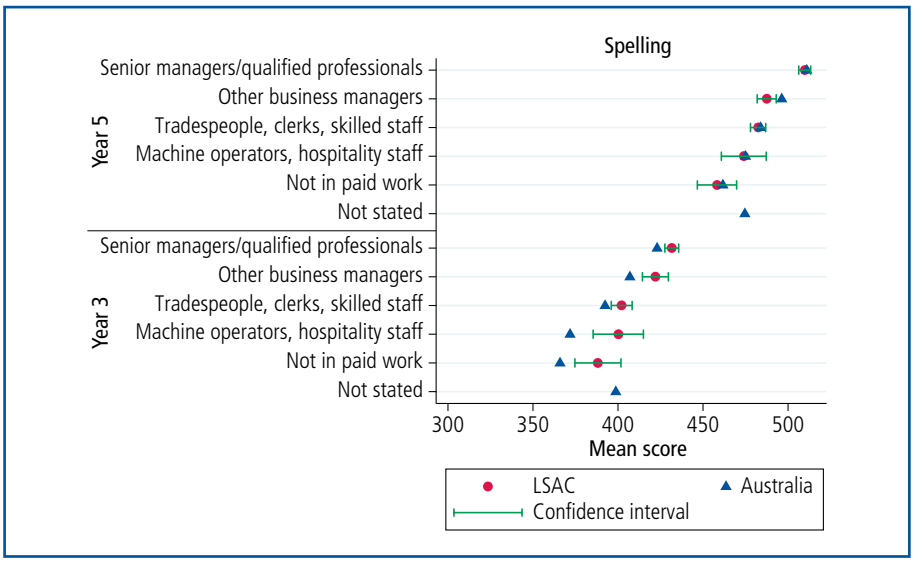
Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 22: LSAC NAPLAN and national NAPLAN Reading scores, by parental occupation and year level



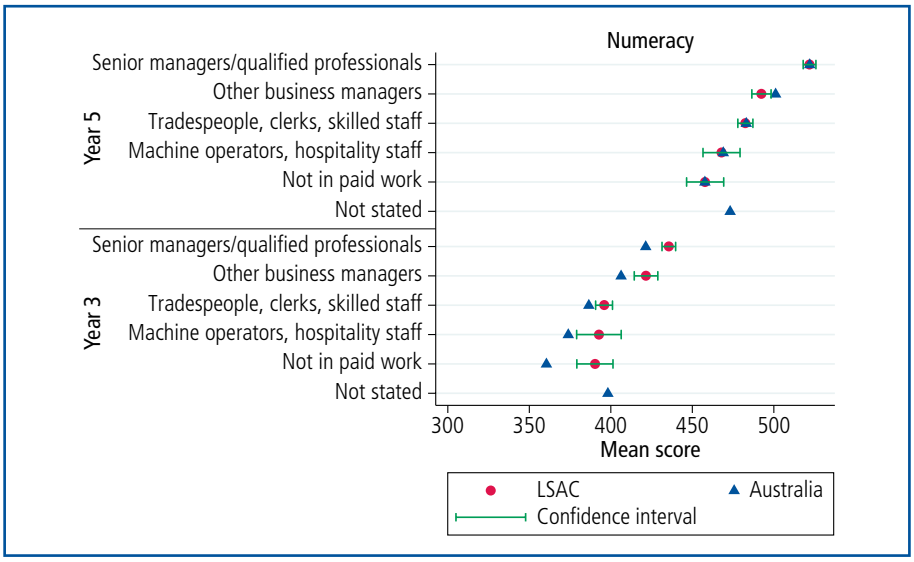
Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 23: LSAC NAPLAN and national NAPLAN Writing scores, by parental occupation and year level



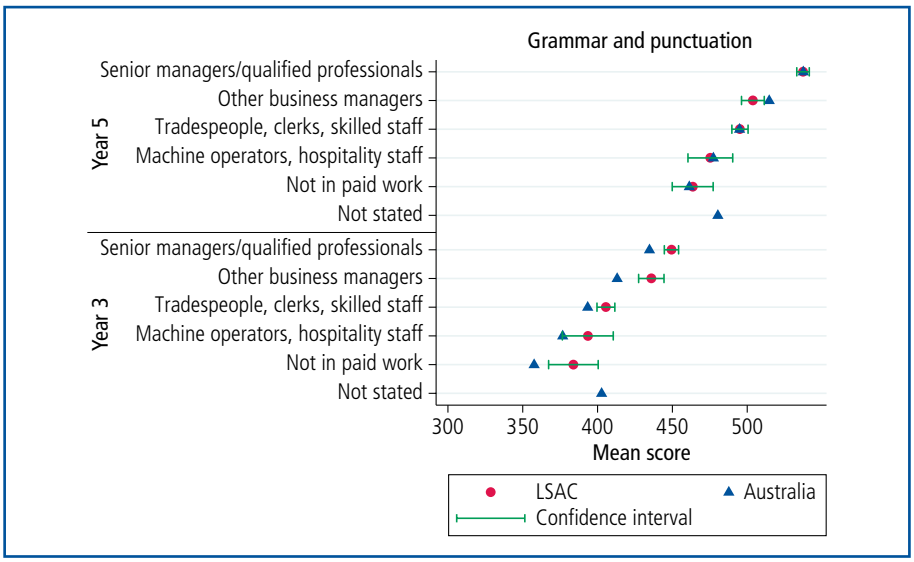
Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 24: LSAC NAPLAN and national NAPLAN Spelling scores, by parental occupation and year level



Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 25: LSAC NAPLAN and national NAPLAN Numeracy scores, by parental occupation and year level



Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Figure 26: LSAC NAPLAN and national NAPLAN Grammar and Punctuation scores, by parental occupation and year level

National minimum standards and NAPLAN scaled scores

The NAPLAN scaled scores might also be presented in bands rather than as a single value. Table 15 represents how the bands correspond to the scaled scores.

Table 15: Correspondence between NAPLAN bands and scaled scores

Bands	Scaled scores
Band 1	0 ≤ 270
Band 2	271 ≤ 322
Band 3	323 ≤ 374
Band 4	375 ≤ 426
Band 5	427 ≤ 478
Band 6	479 ≤ 530
Band 7	531 ≤ 582
Band 8	583 ≤ 634
Band 9	635 ≤ 686
Band 10	687 ≤ 1000

Source: VCAA, 2009, p. 6

A ten-band continuum "represent[s] the increasing complexity of the skills and understandings assessed by NAPLAN from Years 3 to 9" (MCEECDYA, 2009, p. 2). At each year level, student performance is reported within six of these bands:

- Year 3: results reported in Band 1 to Band 6
- Year 5: results reported in Band 3 to Band 8
- Year 7: results reported in Band 4 to Band 9
- Year 9: results reported in Band 5 to Band 10.

For each year level, the lowest band represents students who are below the national minimum standard, the second lowest band represents students who are at the NMS, and the other four bands represent students who are above the NMS. For example, Year 3 students will be below the NMS if their scaled scores are within Band 1, while Year 5 students will be below the NMS if their scaled scores are within Band 3 or below. More information on deriving and reporting NAPLAN scores can be found in the reports by MCEECDYA (2009) and VCAA (2009).

Tables 16 to 20 report NAPLAN scores for LSAC children and the general NAPLAN population by year level and test year. It can be seen that, depending on the test, between 17% and 20% of children in Year 5, 2009, between 6% and 13% of children in Year 3, 2008, and between 5% and 13% of children in Year 3, 2009 had scores at or below the NMS on all NAPLAN tests. The proportion of exempt students in the LSAC sample is very small. Across all year levels, regardless of the year, the proportion of children within the LSAC sample who scored above the NMS was higher and the proportion of children who scored at or below NMS was lower than within the general NAPLAN population of children. Even though the sample size of Year 3, 2009 is too small for any robust conclusions, the same pattern is observed.

Table 16: National minimum standards for Reading, by year level

		Exempt % (*N*)	Below NMS % (*N*)	At NMS % (*N*)	Above NMS % (*N*)
Year 3	LSAC	0.6 (18)	3.3 (100)	8.9 (270)	87.1 (2,619)
	National	1.7	6.1	12.0	80.1
Year 5	LSAC	0.5 (18)	5.7 (223)	10.0 (395)	83.8 (3,298)
	National	1.9	4.4	11.2	82.5

Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Table 17: National minimum standards for Writing, by year level

		Exempt % (*N*)	Below NMS % (*N*)	At NMS % (*N*)	Above NMS % (*N*)
Year 3	LSAC	0.6 (18)	2.0 (60)	4.8 (144)	92.6 (2,790)
	National	1.8	2.9	6.5	88.9
Year 5	LSAC	0.5 (18)	4.2 (166)	9.1 (359)	86.2 (3,389)
	National	1.9	2.4	6.3	89.4

Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Table 18: National minimum standards for Spelling, by year level

		Exempt % (*N*)	Below NMS % (*N*)	At NMS % (*N*)	Above NMS % (*N*)
Year 3	LSAC	0.6 (18)	2.8 (84)	8.4 (253)	88.2 (2,657)
	National	1.7	5.8	10.1	82.4
Year 5	LSAC	0.5 (18)	4.4 (174)	12.1 (475)	83.1 (3,272)
	National	1.9	5.9	9.5	82.7

Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Table 19: National minimum standards for Numeracy, by year level

		Exempt % (*N*)	Below NMS % (*N*)	At NMS % (*N*)	Above NMS % (*N*)
Year 3	LSAC	0.6 (18)	2.1 (63)	8.0 (239)	90.3 (2,688)
	National	1.7	3.3	10.8	85.0
Year 5	LSAC	0.5 (18)	3.3 (131)	10.7 (419)	85.6 (3,367)
	National	1.8	4.2	11.8	82.2

Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

Table 20: National minimum standards for Grammar and Punctuation, by year level

		Exempt % (*N*)	Below NMS % (*N*)	At NMS % (*N*)	Above NMS % (*N*)
Year 3	LSAC	0.6 (18)	3.2 (96)	6.0 (179)	90.3 (2,716)
	National	1.7	6.5	10.6	85.2
Year 5	LSAC	0.5 (18)	4.6 (181)	8.8 (348)	86.1 (3,392)
	National	1.9	5.7	9.0	83.4

Source: LSAC NAPLAN Year 3 (2008, 2009) vs national NAPLAN Year 3 (2008); LSAC NAPLAN Year 5 (2009, 2010, 2011) vs national NAPLAN Year 5 (2010)

To sum up, the Year 3 children of the LSAC sample scored significantly higher on all tests compared with the corresponding population of Australian children who were tested in Year 3 in 2008. This trend was consistent across different socio-demographic groups; that is, not only did LSAC children score higher overall than Australian children, but they also scored higher across different socio-demographic characteristics. The Year 5 children of the LSAC sample had similar scores on all tests compared with the corresponding population of Australian children who were tested in Year 5 in 2010. Year 5 results were also consistent across different socio-demographic groups. It is important to emphasise that the pattern of scores within different socio-demographic groups in the LSAC sample was similar to the national NAPLAN population.

In particular, regardless of year level, girls scored higher than boys on all tests except Numeracy. Year 3 children with a language background other than English scored similarly to children with an English language background on all tests except Reading and Grammar, where the latter scored higher. Year 5 children with a language background other than English had similar scores to the children with an English language background.

Children in both Years 3 and 5 with parents who had more educational and/or formal training qualifications scored higher than children whose parents were less well educated and had unqualified jobs. In addition, the proportion of children exempt or below the national minimum standard was smaller in the LSAC sample than in the NAPLAN population of Australian children for Year 3 and Year 5.

The discrepancy in NAPLAN results between the LSAC sample and the general NAPLAN population is not surprising. First of all, this can be attributed to differences between the population of children born in 1999–2000 and the population of children in the same school year level, especially for children in Year 3. School starting ages vary across states and territories and depend on children's readiness for school. As a result, the age of children within the same school year level can vary substantially. The LSAC sample is a birth cohort sample of children born in 1999–2000 who are enrolled in different school year levels. Secondly, although population weights are used to take into account between-waves attrition, these weights do not adjust NAPLAN scores for those families who withdrew from the study.

5.2 Association between NAPLAN scores and LSAC learning measures

It is important to examine the correlation between the NAPLAN scores and the corresponding learning and cognitive measures in the LSAC database. It should be acknowledged, however, that the learning and cognitive measures in the LSAC are different from those in the NAPLAN tests, which were primarily designed as tools to measure national achievement in literacy and numeracy among children of different ages. Moreover, the NAPLAN tests were administered at a different time to LSAC's main wave interviews (in some instances over 11 months afterwards) and under different conditions (in-home LSAC interview versus in-school NAPLAN test). Therefore, although we should expect moderate correlations between NAPLAN test scores and the learning and cognitive measures in LSAC, it is unrealistic to expect large correlations. This section aims to assess the association between NAPLAN test scores and LSAC measures of learning and cognitive development of children in Year 3 and Year 5.

LSAC learning and cognitive measures

For the purpose of this report, the following LSAC measures of children's learning and cognitive development are of particular interest: measures of verbal and non-verbal intelligence, teachers' ratings of the target children's language/literacy and numeracy progress, and parents' ratings of the target children's reading and mathematics.

- *Receptive vocabulary and non-verbal ability* were assessed with a short version of the Peabody Picture Vocabulary Test (PPVT) and the Matrix Reasoning test from the Wechsler Intelligence Scale for Children, 4th edition (WISC-IV), respectively. While the PPVT and Matrix Reasoning tests are not designed to directly assess academic performance, they are the most commonly used measures of cognitive skills; therefore, it is important to examine the association between these measures and the NAPLAN test results.
- *Teachers' evaluations.* The teachers' assessments were based on the Academic Rating Scale, which includes two measures: a language and literacy measure and a numeracy and mathematical thinking skills measure. The teachers' ratings could be the best proxy for the academic achievements of a study child and to be strongly correlated with the corresponding NAPLAN test results.
- *Parents' evaluations.* Parents were asked to rate their study child's academic progress relative to the child's classmates, using a five-value scale ranging from 1 (much better) to 5 (much worse). Ratings were obtained for children's progress in reading and mathematics. For ease

of interpretation, the rating scales were reversed so that the larger value referred to the child's higher progress. We expected that the parents' ratings of reading and mathematical achievement would be at least moderately correlated with the NAPLAN Reading and Numeracy tests, respectively.

As the proposed analysis is cross-sectional and aims to examine the correlation of NAPLAN scores and LSAC educational outcomes during the same period, LSAC measures for Year 3 are derived from Wave 3 data and LSAC measures for Year 5 are derived from Wave 4 data.

The degree of association between NAPLAN results and LSAC learning and cognitive measures was calculated using correlation analysis. The analysis was performed separately for Year 3 and Year 5, regardless of the calendar year in which the test was taken. The Pearson correlation was used to test the association of NAPLAN results with the intelligence measures and teachers' evaluations (as all of these variables are continuous), while the polyserial correlation was used to test the association between NAPLAN scores and parents' ratings (as parents' ratings are represented by ordinal variables). While calculating the correlation matrix, we used pairwise deletion of missing cases instead of case-wise deletion. Case-wise deletion of missing cases would lead to a considerable reduction in sample size, as missing data are relatively randomly distributed between cases, and variables and teacher's ratings are missing for about 20% and 15% of cases for Year 3 and Year 5 respectively.

Correlation results

Correlation results for Years 3 and 5 are displayed in Tables 21 and 22 respectively. All correlation coefficients are positive and statistically significant at the 1% confidence level. We consider the correlation coefficient r to be small if its absolute value is less than or equal to 0.3, medium if its absolute value is more than 0.3 but less than or equal to 0.5, and large if it is more than 0.5 in magnitude (Cohen, 1988).

Examination of Table 21 suggests that LSAC teachers' and parents' ratings are consistent with corresponding NAPLAN tests. That is, Year 3 NAPLAN results on Reading, Spelling, and Grammar and Punctuation tests are strongly correlated with teachers' language and literacy ratings (r = .64 for all), and strongly correlated with parents' evaluations of reading progress (r = .54, r = .59, and r = .45, respectively). Similarly, Year 3 NAPLAN results on Numeracy are strongly correlated with teachers' ratings of mathematical thinking (r = .61) and moderately correlated with parental evaluation of mathematical achievement (r = .49).

Writing skills were not directly assessed either by teachers or parents; however, it is expected that Year 3 NAPLAN writing results would be at least moderately correlated with teachers' assessments of language and literacy and parents' assessments of reading progress (r = .58 and r = .46, respectively. Large correlations between teachers' ratings and corresponding NAPLAN tests provide support that teachers are the best informants of children's academic performance.

The PPVT is moderately correlated with Year 3 NAPLAN results on all but the Writing and Spelling tests, with the largest correlation coefficient being with the Reading test (r = .44). These results are also consistent, given that PPVT measures receptive language and vocabulary and the level of understanding of spoken words.

The Matrix Reasoning test is moderately correlated with all NAPLAN tests but the Writing test, with the largest correlation coefficient being with the Numeracy test (r = .49). That is also consistent with expectations, as the Matrix Reasoning test measures non-verbal problem-solving ability.

Correlation analysis for Year 5 data reveals similar trends as for Year 3, but with slightly smaller correlation coefficients between NAPLAN results and parents' ratings (see Table 22).

Table 21: Correlation coefficients for NAPLAN scores and LSAC learning and cognitive measures, Year 3, 2008–09

NAPLAN / LSAC	Reading	Writing	Spelling	Grammar and Punctuation	Numeracy
Receptive vocabulary					
PPVT	.44	.29	.29	.38	.42
	N = 2,904	*N* = 2,910	*N* = 2,910	*N* = 2,907	*N* = 2,905
Non-verbal ability					
Matrix Reasoning	.42	.34	.37	.41	.49
	N = 2,906	*N* = 2,912	*N* = 2,912	*N* = 2,909	*N* = 2, 907
Academic Rating Scale (teachers' rating)					
Language and literacy	.64	.58	.64	.64	.58
	N = 2,439	*N* = 2,443	*N* = 2,443	*N* = 2,441	*N* = 2,440
Mathematical thinking	.56	.51	.57	.56	.61
	N = 2,426	*N* = 2,430	*N* = 2,430	*N* = 2,428	*N* = 2,427
Parents' rating					
Reading progress	.54	.46	.59	.45	.52
	N = 2,924	*N* = 2,929	*N* = 2,929	*N* = 2,925	*N* = 2,926
Math progress	.38	.33	.39	.36	.49
	N = 2,924	*N* = 2,929	*N* = 2,929	*N* = 2,926	*N* = 2925

Table 22: Correlation coefficients for NAPLAN scores and LSAC learning and cognitive measures, Year 5, 2009–11

NAPLAN / LSAC	Reading	Writing	Spelling	Grammar and Punctuation	Numeracy
Receptive vocabulary					
PPVT	.55	.30	.32	.44	.43
	N =887	*N* =885	*N* =884	*N* =886	*N* =886
Non-verbal ability					
Matrix Reasoning	.40	.36	.36	.43	.49
	N =3,739	*N* =3,735	*N* =3,742	*N* =3,742	*N* =3,739
Academic Rating Scale (teachers' rating)					
Language and literacy	.60	.56	.65	.62	.59
	N = 3,083	*N* =3,083	*N* =3,087	*N* =3,087	*N* =3,084
Mathematical thinking	.52	.51	.57	.54	.61
	N =3,001	*N* =3,002	*N* =3,006	*N* =3,006	*N* =3,002
Parents' rating					
Reading progress	.34	.34	.38	.33	.42
	N =3,766	*N* =3,763	*N* =3,770	*N* =3,770	*N* =3,766
Math progress	.31	.31	.35	.31	.46
	N =3,766	*N* =3,763	*N* =3,770	*N* =3,770	*N* =3,766

6. Conclusion

There are a number of benefits of having a longitudinal national assessment program such as NAPLAN linked to LSAC. The NAPLAN data measure the development of children's achievements from Year 3 to Year 9 on five different domains: Reading, Writing, Spelling, Numeracy, and Grammar and Punctuation, and therefore these scales allow assessment and comparison of children's achievements across year levels and over time. It also provides an opportunity to test how the cognitive and learning measures used in LSAC are associated with NAPLAN test scores, and allows an examination of the association between children's achievements and different individual and family characteristics, both cross-sectionally and longitudinally. This, in turn, enhances the value of LSAC data to policy-makers and academic researchers.

In this report, we have used K cohort LSAC data and NAPLAN results from 2008 to 2011. Out of 4,983 K cohort children, NAPLAN data were linked for 4,159 children. By 2011, out of the eligible LSAC NAPLAN sample, Year 3 NAPLAN results were linked for 74% of all LSAC Wave 1 children. Twenty-five per cent of children did not have Year 3 NAPLAN results, as they were enrolled in Year 3 in 2007, when NAPLAN assessment had not yet been implemented. Year 5 NAPLAN results were linked for 97% of children. For 3% of Year 5 children the NAPLAN data were not matched. Year 7 NAPLAN results were linked for 23% of children, with 75% of children not yet having Year 7 NAPLAN results due to their only being enrolled either in Year 5 or 6 in 2011.

Overall, when comparing the Year 3 NAPLAN scores across LSAC children and all Australian children tested in 2008, the former scored significantly higher. While the LSAC Year 5 children also had higher scores compared to the general population of Australian Year 5 children tested in 2010, the magnitude of the difference was not large. Regardless of year level, the proportion of children exempt or below the national minimum standard was smaller in the LSAC sample than Australia-wide, especially for Year 3 children. The differences in results were mainly due to the fact that the LSAC NAPLAN sample cannot be considered as a representative sample of Australian children in a specific year level, even after accounting for attrition. In addition, differences in Year 3 results were also due to the censoring of LSAC children enrolled in Year 3 in 2007. Importantly, results from this study suggest that while there are differences in the mean NAPLAN scores between the general population and the LSAC sample for both Year 3 and Year 5, the same patterns of variation in NAPLAN scores by demographic variables can be observed. Moreover, for Year 5 children, due to the small number of children enrolled in Year 7 by 2011, Year 7 LSAC NAPLAN results were not compared against national statistics.

Correlations between NAPLAN and LSAC cognitive and learning measures were moderate to large, with similar measures being more highly correlated than others. The NAPLAN measures were associated in the expected directions with LSAC cognitive and learning measures such as verbal and non-verbal ability, and teachers' and parents' ratings of literacy and numeracy.

While it is of great benefit to use NAPLAN data along with LSAC data, a researcher should always keep in mind that:

- the LSAC NAPLAN data are not representative of national NAPLAN scores, even after controlling for attrition;
- analyses of NAPLAN data in LSAC should be performed at year level or period, not calendar year;
- LSAC outcome measures are collected for children of the same age but with different years of schooling, while NAPLAN data are collected for children of different age but with the same years of schooling;
- Year 3 NAPLAN results for K cohort children are available only for 74% of the eligible LSAC NAPLAN sample, which should be taken into account when performing longitudinal analyses and comparison against national statistics; and
- great care should be taken when deciding on what NAPLAN and LSAC data to use, including:
  - whether the analysis is longitudinal or cross-sectional;
  - whether the NAPLAN scores are being considered as a dependent or independent variable; and

– whether the analysis is being performed by year level or period.

Despite the caveats in the use of NAPLAN data with the LSAC sample, there is tremendous potential for the use of these data and, taking a longitudinal view, allows a researcher to develop a further understanding of the factors that enhance and impede children's achievements at school.

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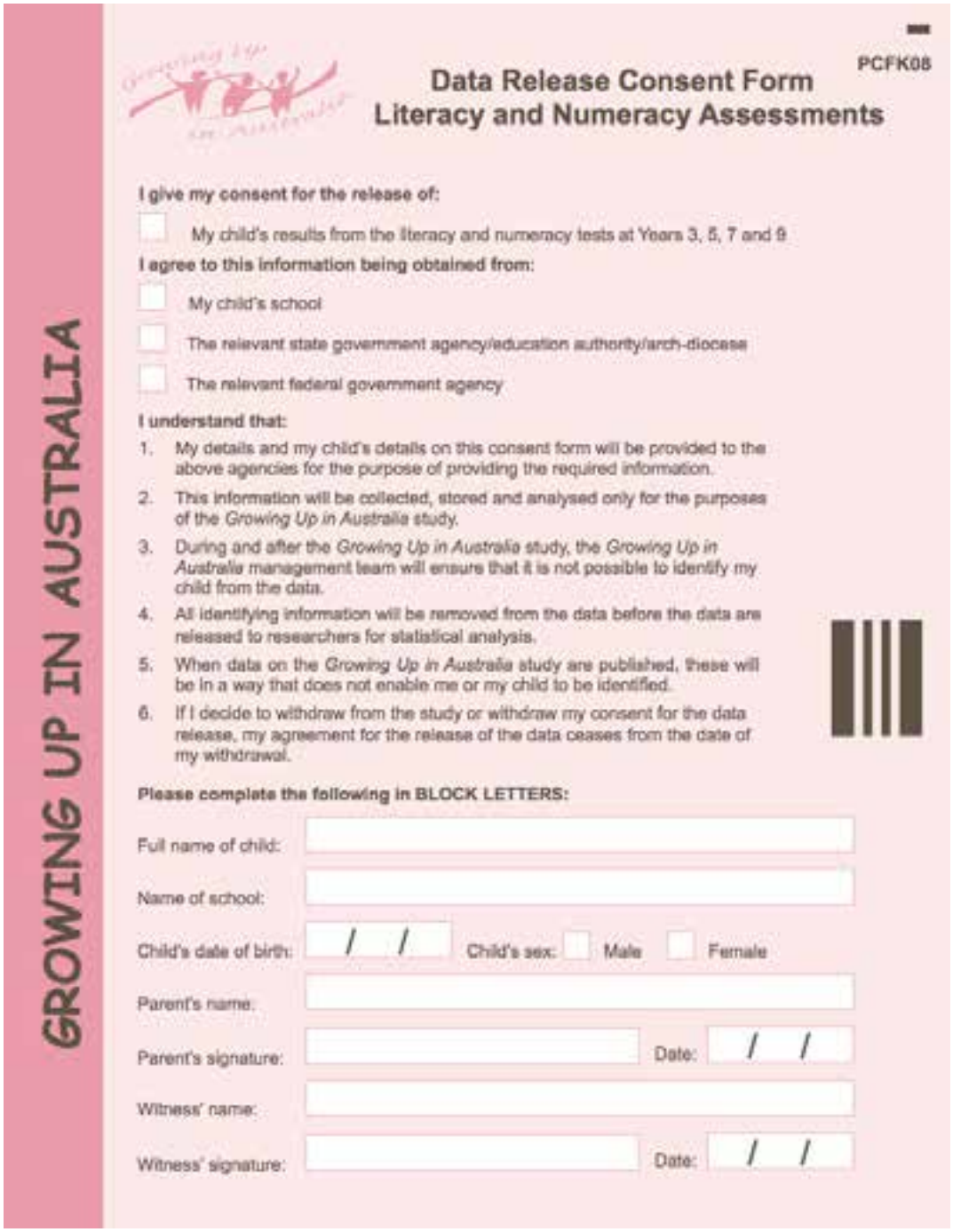
Appendixes

Appendix A: NAPLAN consent form, Wave 3



GROWING UP IN AUSTRALIA

PCFK08

Data Release Consent Form
Literacy and Numeracy Assessments

I give my consent for the release of:

☐ My child's results from the literacy and numeracy tests at Years 3, 5, 7 and 9

I agree to this information being obtained from:

☐ My child's school

☐ The relevant state government agency/education authority/arch-diocese

☐ The relevant federal government agency

I understand that:

1. My details and my child's details on this consent form will be provided to the above agencies for the purpose of providing the required information.
2. This information will be collected, stored and analysed only for the purposes of the *Growing Up in Australia* study.
3. During and after the *Growing Up in Australia* study, the *Growing Up in Australia* management team will ensure that it is not possible to identify my child from the data.
4. All identifying information will be removed from the data before the data are released to researchers for statistical analysis.
5. When data on the *Growing Up in Australia* study are published, these will be in a way that does not enable me or my child to be identified.
6. If I decide to withdraw from the study or withdraw my consent for the data release, my agreement for the release of the data ceases from the date of my withdrawal.

Please complete the following in BLOCK LETTERS:

Full name of child:

Name of school:

Child's date of birth: / / Child's sex: ☐ Male ☐ Female

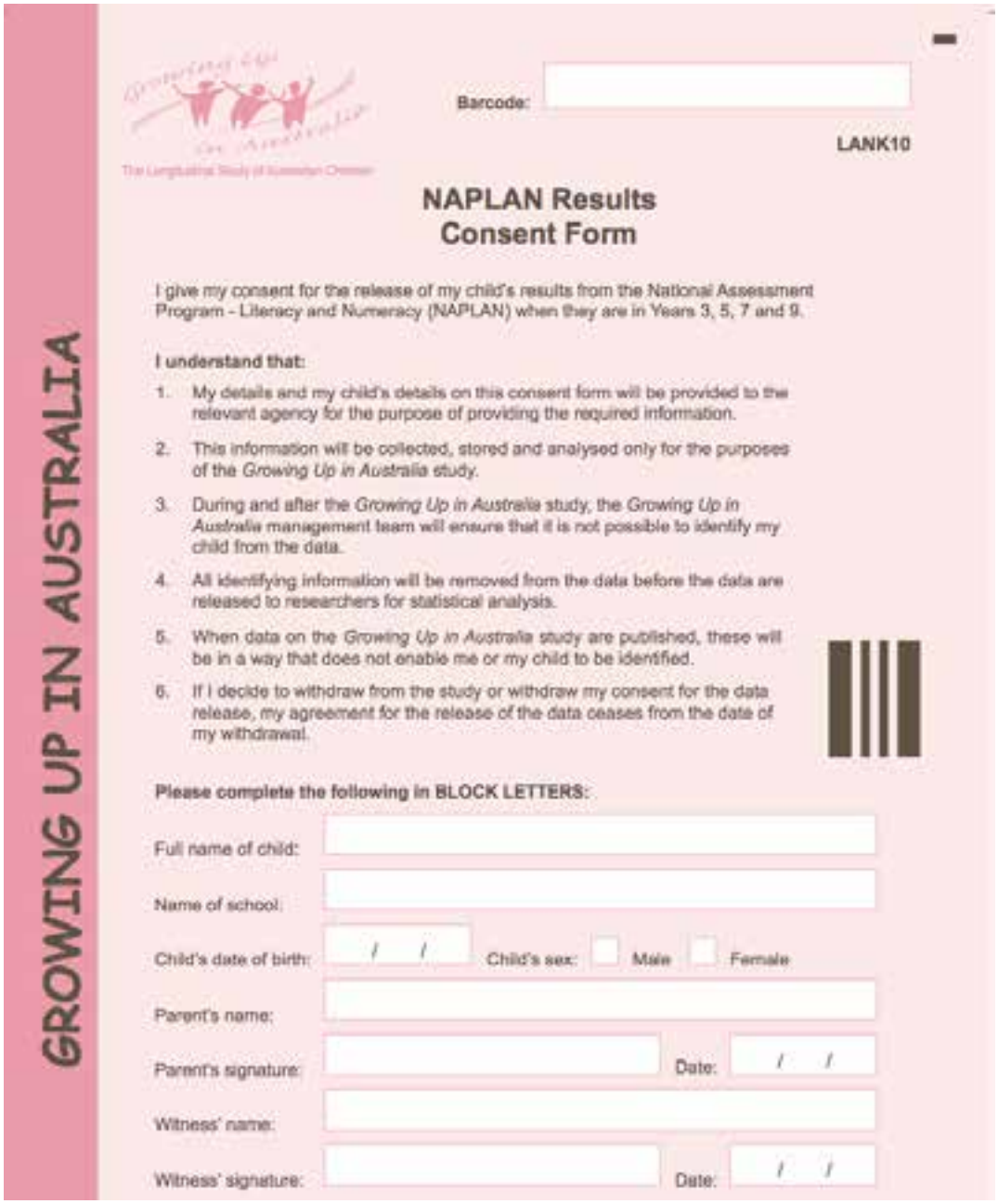
Parent's name:

Parent's signature: Date: / /

Witness' name:

Witness' signature: Date: / /

Appendix B: NAPLAN consent form, Wave 4



GROWING UP IN AUSTRALIA

The Longitudinal Study of Australian Children

Barcode:

LANK10

NAPLAN Results Consent Form

I give my consent for the release of my child's results from the National Assessment Program - Literacy and Numeracy (NAPLAN) when they are in Years 3, 5, 7 and 9.

I understand that:

1. My details and my child's details on this consent form will be provided to the relevant agency for the purpose of providing the required information.
2. This information will be collected, stored and analysed only for the purposes of the *Growing Up in Australia* study.
3. During and after the *Growing Up in Australia* study, the *Growing Up in Australia* management team will ensure that it is not possible to identify my child from the data.
4. All identifying information will be removed from the data before the data are released to researchers for statistical analysis.
5. When data on the *Growing Up in Australia* study are published, these will be in a way that does not enable me or my child to be identified.
6. If I decide to withdraw from the study or withdraw my consent for the data release, my agreement for the release of the data ceases from the date of my withdrawal.

Please complete the following in BLOCK LETTERS:

Full name of child:

Name of school:

Child's date of birth: / / Child's sex: Male Female

Parent's name:

Parent's signature: Date: / /

Witness' name:

Witness' signature: Date: / /

Appendix C: NAPLAN data structure

Variable name	Variable label	Categories
hicid	HICID	Number
cohort	Cohort	B B cohort; K K cohort
consent	Consent	1 Obtained; 2 Refused; 3 Filled in incorrectly; 4 Form not returned
stream	Stream	Number
rprey	Pre-Year 1 repeated	1 Yes; 0 No
ry1	Year 1 repeated	1 Yes; 0 No
ry2	Year 2 repeated	1 Yes; 0 No
ry3	Year 3 repeated	1 Yes; 0 No
ry4	Year 4 repeated	1 Yes; 0 No
ry5	Year 5 repeated	1 Yes; 0 No
ry6	Year 6 repeated	1 Yes; 0 No
ry7	Year 7 repeated	1 Yes; 0 No
ry8	Year 8 repeated	1 Yes; 0 No
ry9	Year 9 repeated	1 Yes; 0 No
repeated	Ever Repeated Year Level	1 Prior to NAPLAN; 2 During NAPLAN period; 3 Both
y3read	Year 3 Reading	Number
y3write	Year 3 Writing	Number
y3spel	Year 3 Spelling	Number
y3gram	Year 3 Grammar and Punctuation	Number
y3num	Year 3 Numeracy	Number
y3state	Year 3 State	1 NSW; 2 VIC; 3 QLD; 4 SA; 5 WA; 6 TAS; 7 NT; 8 ACT
y3status	Year 3 Status	1 Completed all; 2 Absent but not for all tests; 3 Absent all; 4 Exempt; 5 No match; -9 not applicable (no consent)
y3ytest	Year 3 Calendar Year of Test	Number
y3age	Age	Number
y5read	Year 5 Reading	Number
y5write	Year 5 Writing	Number
y5spel	Year 5 Spelling	Number
y5gram	Year 5 Grammar and Punctuation	Number
y5num	Year 5 Numeracy	Number
y5state	Year 5 State	1 NSW; 2 VIC; 3 QLD; 4 SA; 5 WA; 6 TAS; 7 NT; 8 ACT
y5status	Year 5 Status	1 Completed all; 2 Absent but not for all tests; 3 Absent all; 4 Exempt; 5 No match; -9 not applicable (no consent)
y5ytest	Year 5 Calendar Year of Test	Number
y5age	Age	Number
y7read	Year 7 Reading	Number
y7write	Year 7 Writing	Number
y7spel	Year 7 Spelling	Number
y7gram	Year 7 Grammar and Punctuation	Number
y7num	Year 7 Numeracy	Number
y7state	Year 7 State	1 NSW; 2 VIC; 3 QLD; 4 SA; 5 WA; 6 TAS; 7 NT; 8 ACT
y7status	Year 7 Status	1 Completed all; 2 Absent but not for all tests; 3 Absent all; 4 Exempt; 5 No match; -9 not applicable (no consent)
y7ytest	Year 7 Calendar Year of Test	Number
y7age	Age	Number
y9read	Year 9 Reading	Number

Variable name	Variable label	Categories
y9write	Year 9 Writing	Number
y9spel	Year 9 Spelling	Number
y9gram	Year 9 Grammar and Punctuation	Number
y9num	Year 9 Numeracy	Number
y9state	Year 9 State	1 NSW; 2 VIC; 3 QLD; 4 SA; 5 WA; 6 TAS; 7 NT; 8 ACT
y9status	Year 9 Status	1 Completed all; 2 Absent but not for all tests; 3 Absent all; 4 Exempt; 5 No match; -9 not applicable (no consent)
y9ytest	Year 9 Calendar Year of Test	Number
y9age	Age	Number
ry3read	Repeated Year 3 Reading Score	Number
ry3write	Repeated Year 3 Writing Score	Number
ry3spel	Repeated Year 3 Spelling Score	Number
ry3gram	Repeated Year 3 Grammar Score	Number
ry3num	Repeated Year 3 Numeracy Score	Number
ry3state	Repeated Year 3 State	1 NSW; 2 VIC; 3 QLD; 4 SA; 5 WA; 6 TAS; 7 NT; 8 ACT
ry3status	Repeated Year 3 Status	1 Completed all; 2 Absent but not for all tests; 3 Absent all; 4 Exempt; 5 No match; -9 not applicable (no consent)
ry3ytest	Repeated Year 3 Calendar Year of Test	Number
ry5read	Repeated Year 5 Reading Score	Number
ry5write	Repeated Year 5 Writing Score	Number
ry5spel	Repeated Year 5 Spelling Score	Number
ry5gram	Repeated Year 5 Grammar Score	Number
ry5num	Repeated Year 5 Numeracy Score	Number
ry5state	Repeated Year 5 State	1 NSW; 2 VIC; 3 QLD; 4 SA; 5 WA; 6 TAS; 7 NT; 8 ACT
ry5status	Repeated Year 5 Status	1 Completed all; 2 Absent but not for all tests; 3 Absent all; 4 Exempt; 5 No match; -9 not applicable (no consent)
rg5ytest	Repeated Year 5 Calendar Year of Test	Number
ry7read	Repeated Year 7 Reading Score	Number
ry7write	Repeated Year 7 Writing Score	Number
ry7spel	Repeated Year 7 Spelling Score	Number
ry7gram	Repeated Year 7 Grammar Score	Number
ry7num	Repeated Year 7 Numeracy Score	Number
ry7state	Repeated Year 7 State	1 NSW; 2 VIC; 3 QLD; 4 SA; 5 WA; 6 TAS; 7 NT; 8 ACT
ry7status	Repeated Year 7 Status	1 Completed all; 2 Absent but not for all tests; 3 Absent all; 4 Exempt; 5 No match; -9 not applicable (no consent)
ry7ytest	Repeated Year 7 Calendar Year of Test	Number
ry9read	Repeated Year 9 Reading Score	Number
ry9write	Repeated Year 9 Writing Score	Number
ry9spel	Repeated Year 9 Spelling Score	Number
ry9gram	Repeated Year 9 Grammar Score	Number
ry9num	Repeated Year 9 Numeracy Score	Number
ry9state	Repeated Year 9 State	1 NSW; 2 VIC; 3 QLD; 4 SA; 5 WA; 6 TAS; 7 NT; 8 ACT
ry9status	Repeated Year 9 Status	1 Completed all; 2 Absent but not for all tests; 3 Absent all; 4 Exempt; 5 No match; -9 not applicable (no consent)
ry9ytest	Repeated Year 9, Calendar Year of Test	Number

Appendix D: Descriptive statistics for logistic regression

	Percentage
Parental characteristics	
Education	
Bachelor degree (ref.)	38.1
Advanced diploma	9.9
Certificate	32.2
Year 12	8.8
Year 11 or below	10.9
Mother's working status	
35 or more (ref.)	20.1
Less than 35	36.3
Not working	43.6
LBOTE	29.6
Child's characteristics	
Female	49.1
Tests	**Mean (*SD*)**
WAI (25–100)	64.0 (8.1)
SDQ (0–35)	9.4 (5.3)
PPVT (25–85)	64.2 (6.2)

Appendix E: Definition of parental education in NAPLAN and LSAC

NAPLAN	LSAC
Bachelor degree and above	Postgraduate diploma
	Graduate diploma/graduate certificate
	Bachelor degree
Advanced diploma/diploma	Advanced diploma
Certificate I–IV	Certificate III/IV (including trade certificate)
	Certificate I/II
Year 12 or equivalent	Year 12 or equivalent
Year 11 or equivalent or below	Year 11 or equivalent
	Year 10 or equivalent
	Year 9 or equivalent
	Year 8 or equivalent
Not stated	(no cases)

Appendix F: Definition of parental occupation in NAPLAN and LSAC

NAPLAN definition	LSAC definition (ASCO code) [a]
Senior management and qualified professionals	999–2999
Other business managers and associate professionals	3000–3999
Trades people, clerks, skilled office, sales and service staff	4000–7999
Machine operators, hospitality staff, assistants, labourers	8000–9999
Not in paid work in previous 12 months	Unemployed/not in labour force
Not stated	(only 0.2% cases)

Note: [a] Australian Standard Classification of Occupations (ASCO) codes (ABS, 1997).

Appendix G: List of shortened forms

ABS	Australian Bureau of Statistics
ACARA	Australian Curriculum, Assessment and Reporting Authority
AIFS	Australian Institute of Family Studies
FaHCSIA	Australian Government Department of Families, Housing, Community Services and Indigenous Affairs
LBOTE	Language background other than English
LSAC	Longitudinal Study of Australian Children
MCEECDYA	Ministerial Council for Education, Early Childhood Development and Youth Affairs
NAPLAN	The National Assessment Program—Literacy and Numeracy
NMS	National minimum standard
PPVT-III	Peabody Picture Vocabulary Test, 3rd edition
SDQ	Strengths And Difficulties Questionnaire
VCAA	Victorian Curriculum and Assessment Authority
WAI	Who Am I
WISC-IV	Wechsler Intelligence Scale for Children, 4th edition