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Research Paper

Investigating Algorithms to Report on Indigenous Status Where Status Differs for Student Records Across Years

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Investigating Algorithms to Report on Indigenous Status Where Status Differs for Student Records Across Years

National Centre for Education and Training Statistics

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INQUIRIES

The ABS welcomes comments on the research presented in this paper. For further information, please contact Mr Myles Burleigh, National Centre for Education and Training, on Canberra (02) 6252 6534 or email <education.statistics@abs.gov.au>.

INVESTIGATING ALGORITHMS TO REPORT ON INDIGENOUS STATUS WHERE STATUS DIFFERS FOR STUDENT RECORDS ACROSS YEARS

A Data Integration Feasibility Study

EXECUTIVE SUMMARY

Purpose

The purpose of this feasibility study is to investigate the consistency of the reporting of Indigenous status across time in education datasets, and where Indigenous status changes over time, investigating the most appropriate decision rules or 'algorithm' to determine Indigenous status for use in analysis and reporting.

In particular, the study looks at:

- How frequently does Indigenous status change across Tasmanian government school enrolment records?

- Do the analysis results change using different Indigenous status algorithms?

- Strengths and weaknesses of the different algorithms.

Key findings

Results of the analysis found that the reporting of Indigenous status across time and within years (where a student has multiple enrolments in one year) is very consistent within Tasmanian government school enrolments data. When assessing consistency for students enrolled in more than one year of school, 2% of student records were found to have an inconsistent Indigenous status across years.

This study explored a number of different algorithms for assigning a student's Indigenous status for use in analysis or reporting (where it differs over time): the 'original' method, the 'ever' method, the 'most recent' method, the 'majority' method, and the 'only' method. All methods produced very similar results, and for the vast majority of analysis questions all algorithms resulted in the same graphical pattern. For example, all algorithms showed that the majority of Aboriginal and Torres Strait Islander students had parents or guardians with no non-school qualifications or a Certificate I to IV, with very few having a parent or guardian with a Bachelor degree or above, although there was some small variation in the resulting percentages and numbers.

The results indicate that for a dataset with limited variation in Indigenous status reporting (such as Tasmanian government schools), any algorithm discussed in this report will produce an acceptable result. However, the researcher must recognise that some algorithms are prone to under- or over-estimation of Indigenous status,

which also results in the opposite effect for non-Indigenous numbers (i.e. if Aboriginal and Torres Strait Islander students are over-estimated, then other Australian students will be under-estimated).

In a dataset that has more variation in Indigenous status reporting, the differences between these algorithms may potentially become more pronounced. For example, if a dataset has known improvements in collection methods over the years, the 'original' algorithm, which assigns the Indigenous status that was reported on the original or earliest enrolment, would not be appropriate. Conversely, if data is known to be collected at the time of the student's enrolment but not rolled over every year, then a researcher would not want to choose an algorithm that did not pick up the information reported on the original or earliest enrolment, such as the 'most recent' algorithm.

In conclusion, although any of the analysed algorithms are suitable for use (depending on the research requirements and the quality of the data), the 'majority' algorithm produced consistent and 'middle of the range' results, in contrast to the 'ever' reported algorithm which produces consistently high Aboriginal and Torres Strait Islander results, and the 'only' algorithm which requires consistent reporting across all enrolments, and as a result produces consistently lower Aboriginal and Torres Strait Islander results.

The 'majority' algorithm has the advantage of taking into account more than one year of data, making it stringent, but not so stringent that it fails to take into account the potential for administrative error or the known non-response issues around reporting as being of Aboriginal or Torres Strait Islander origin.

Future data integration projects

This feasibility study has highlighted a number of considerations and actions that may inform future data integration projects and contribute to the successful establishment of integrated education and training datasets.

These include:

- replication of this analysis using a larger state, with a higher proportion of Aboriginal and Torres Strait Islander students. This will provide a larger Aboriginal and Torres Strait Islander population on which to conduct additional testing;

- work towards improvements for collecting parental background information and other student characteristic information, such as address and language background, within the National Schools Statistics Collection;

- continuing to work on data integration feasibility studies which integrate Census data with school enrolment data, with the aim of:

    o supplementing Indigenous status data where it is currently missing, incomplete or poor quality,

    o further analysis on the algorithms for assigning Indigenous status on a range of datasets for research and statistical purposes;

- carefully considering the appropriate algorithm for selecting student characteristics where they differ across multiple enrolments within a single enrolment year or across datasets. Where possible, outputs from data integration projects should be flexible and include a variety of characteristic data items that are based on different selection algorithms to allow the researcher to decide which demographic variables and selection conditions best suit the analysis task;

- further analysis on the directionality of changes to Indigenous status, and whether this is more likely to occur when moving schools, or when moving from primary to secondary school.

ACKNOWLEDGEMENTS

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A Data Integration Feasibility Study

ABSTRACT

The purpose of this feasibility study is to investigate the consistency of the reporting of Indigenous status across time in education datasets, and where Indigenous status changes over time, investigating the most appropriate decision rules or 'algorithm' to determine Indigenous status for use in analysis and reporting. In particular, the study looks at how frequently Indigenous status changes across Tasmanian government school enrolment records and whether analysis results change using different Indigenous status algorithms. It also examines the strengths and weaknesses of the different algorithms.

Results of the analysis found that the reporting of Indigenous status across time and within years (where a student has multiple enrolments in one year) is very consistent within Tasmanian government schools enrolments data. Overall, the different algorithms for choosing Indigenous status (where it differs over time) all produced very similar results and each algorithm would be suitable for use depending on the research task. For example, all algorithms showed that the majority of Aboriginal and Torres Strait Islander students had parents or guardians with no non-school qualifications or a Certificate I to IV, with very few having a parent or guardian with a Bachelor degree or above. Overall, the 'majority' algorithm produced the most consistent results and has the advantage of taking into account more than one year of data.

1. INTRODUCTION

The Council of Australian Governments (COAG) agreed in 2008 to a set of targets to help close the gap between Aboriginal and Torres Strait Islander people and other Australians. These targets focused on the areas of life expectancy, infant and child mortality, early childhood education, reading, writing and numeracy achievement, grade 12 attainment and employment outcomes (COAG, 2008).

For these closing the gap initiatives to be successful and well implemented, it is important that accurate and high quality information about Aboriginal and Torres Strait Islander people is available to contribute to policy formulation, program development, service delivery, funding decisions, and monitoring and evaluating the success of government initiatives. High quality analysis is difficult, however, when Indigenous status is not always reported consistently, or at all. The lack or inconsistency of the reporting of Indigenous status could be due to either the way

that the data is collected or updated, or it may be due to a personal decision as whether to identify as being of Aboriginal or Torres Strait Islander origin and concerns around repercussions of this (AIHW & ABS, 2012).

Data linking provides a benefit to the reporting of Indigenous status as it enables missing information from one dataset to be supplemented with responses from another dataset. An issue arises however when information is inconsistently reported within and/or across linked datasets. In this situation, it is important to use an informed and consistent approach for choosing the Indigenous status of an individual.

The purpose of this feasibility study is to investigate the consistency of the reporting of Indigenous status across time in the education sector, and where Indigenous status changes over time, investigating the most appropriate algorithm to determine Indigenous status for analysis and reporting.

In particular, the study looks at:

- How frequently does Indigenous status change across Tasmanian government school enrolment records?

- Do the analysis results change using different Indigenous status algorithms?

- Strengths and weaknesses of the different algorithms.

There are a number of different ways that a researcher could decide to report on Indigenous status when it changes over time. The method that is used may affect the resultant statistics and therefore it is important to have enough information on which to choose the appropriate algorithm.

This report will discuss some of the different methods for deriving Indigenous status where it changes across enrolment records, across time. It will also present results to show how the different algorithms can alter the resultant statistics.

It is important to note that, dependent on the data sets that are being linked, different quality and reporting issues may arise. This report looks at only reporting Indigenous status across time in a single source dataset. When using datasets from more than one source, further quality issues can arise and may make the decision of choosing an algorithm more complex. More information on issues to consider when choosing an algorithm for datasets which link datasets from different sources, can be found in the report *National Best Practice Guidelines for Data Linkage Activities Relating to Aboriginal and Torres Strait Islander People* (AIHW & ABS, 2012).

It is expected that the lessons learnt from this feasibility study will be transferable and applicable across all Australian student enrolments, which in the long term will assist in building a comprehensive picture of the educational pathways of all students in Australia.

2. BACKGROUND

Under a Memorandum of Understanding between the Australian Bureau of Statistics and the Tasmanian Department of Education, it was agreed that student enrolment unit record level data files for the 2006 to 2011 school enrolment years would be used for the purposes of ABS data integration feasibility studies.

These files contained two student identifiers, the Tasmanian government schools unique student identifier (Student ID) and a student Statistical Linkage Key (SLK 581) as used in many health linkage projects.

Other data items on the files aligned to the Data Collection Manual (DCM) standards for the National Schools Statistics Collection (NSSC) (ABS, 2013a), used for student enrolment unit record level data provision. As the NSSC DCM requirements have changed over 2006 to 2011, some data items were not available for all six years. Please see Appendix A of this report for more information.

In Tasmanian government schools, student characteristics and other background data on the enrolment record is automatically rolled over each year unless the parent or student specifically requests a change. If a student changes schools (i.e. moves from a primary school to a secondary school within the government system), existing information is rolled over from the previous enrolment unless a change is indicated by the parent or student.

3. QUALITY ASSURANCE PROCESS

In 2011–12 a preliminary feasibility study was undertaken by the ABS to understand the student populations across 2006 to 2011, in Tasmanian government schools. The quality assurance included comparing the URL data supplied for that study to unconfidentialised pre-published *Schools, Australia* (ABS, 2013b) data, sourced from the National Schools Statistics Collection for verification of accuracy and consistency. Comparisons included aggregated counts of schools, counts of students by grade level and by characteristics including Indigenous status.

The apparent retention rates table and the table showing counts of enrolments, counts of students, and counts of students with multiple enrolments in Tasmanian government schools, produced as part of the preliminary study were then replicated for the present study. This ensured that the same data were being used for both studies. The tables produced for this quality assurance process can be found in Appendix C.

4. LINKING METHODOLOGY

For the purposes of this study, student level data with a high quality unique identifier (Student ID) attached to each student record was required. The Tasmanian Department of Education collects data for the NSSC via the Government Schools Administrative Computer System, which requires extensive validation and quality assurance checks on the data submitted from each school. Due to the nature of this administrative system, the ABS National Centre for Education and Training Statistics project team considered the Student ID to be of a high quality.

The Student ID is a unique identifier assigned to each individual student enrolled in the Tasmanian government school education system, from pre-year 1 to senior secondary. The Student ID remains with the same student throughout their schooling in the Tasmanian government school system, even when moving between different Tasmanian government schools. A student enrolled in more than one Tasmanian government school at the same time (for example a student that attends one of their classes at a different school) would have the same Student ID recorded for both enrolments.

Each Student ID is unique to a single student and therefore if two exact matches of a Student ID are found within a dataset, this would indicate that the student has multiple enrolments.

Exact match linking was undertaken using the main school enrolment of the students, using the Student ID. Any records that did not have a corresponding match on the other file were not linked. Main school enrolments, and other important concepts, are defined in Appendix A of this report.

5. ANALYSIS OF INDIGENOUS STATUS REPORTING

The following analysis assesses how frequently a student's Indigenous status changes over time. This will allow an understanding of how consistently Indigenous status is being reported across enrolment years, which will illustrate the size of the potential issue for the Tasmanian government school enrolment data.

Following this, a number of algorithms for assigning Indigenous status (where it differs over time) will be analysed and assessed. The algorithms for assigning Indigenous status for the purposes of this study have been sourced from the *National Best Practice Guidelines for Data Linkage Activities Relating to Aboriginal and Torres Strait Islander People* (AIHW & ABS, 2012).

The results demonstrate the different outcomes that would result for the analysis work undertaken, depending on how Indigenous status is assigned for an individual, where reporting of Indigenous status differs over time. The algorithms included in this report are intended to be a guide to assist analysts in determining how they might derive Indigenous status from integrated education and training datasets. The choice of method used should ultimately be based on the purpose of the analysis work to be undertaken, the attributes and quality of the datasets to be linked, and the type of linkage method used. The limitations of these methods are discussed in AIHW & ABS (2012).

5.1 How frequently does Indigenous status change across enrolment records?

The following table shows the number and percentage of students for whom a change in Indigenous status was recorded across years in Tasmanian government schools. These results show that for students enrolled in more than one year of school between 2006 and 2011, the extent of discrepancies across years is small, with less than 2% of students recording an inconsistent Indigenous status across enrolment years.

5.1 Variation in Indigenous status for students enrolled in more than one year of school, by sex, Tasmania, 2006–2011[(a)(b)]

Sex	No change in Indigenous status		Indigenous status varies		Total students	
	no.	%	no.	%	no.	%
Males	39,530	98.09	768	1.91	40,298	100.00
Females	38,038	98.08	744	1.92	38,782	100.00
Total students	*77,568*	*98.09*	*1,512*	*1.91*	*79,080*	*100.00*

(a) Includes government school students only.
(b) Includes the Indigenous status reported on the student's main school enrolment record only.

When this analysis was repeated for students who were enrolled in all six years (2006–2011), the number of students for which Indigenous status varied is still low and there is only a small increase (0.6 percentage points) compared with students that are enrolled in only more than one year. This supports the assumption that the more years a student is enrolled, the higher the chance that the recorded Indigenous status may vary. Table 5.2 shows the variation in Indigenous status for students enrolled in six consecutive years.

5.2 Variation in Indigenous status for students enrolled in six consecutive years of school, by sex, Tasmania — 2006–2011[(a)(b)]

Sex	No change in Indigenous status		Indigenous status varies		Total students	
	no.	%	no.	%	no.	%
Males	14,331	97.42	379	2.58	14,710	100.00
Females	13,281	97.45	347	2.55	13,628	100.00
Total students	27,612	97.44	726	2.56	28,338	100.00

(a) Includes government school students only.
(b) Includes the Indigenous status reported on the student's main school enrolment record only.

5.2 How do reporting statistics change using different Indigenous status algorithms?

There are a number of different ways that a researcher could decide to report on Indigenous status when it is recorded inconsistently over time. The method that is used may affect the resultant statistics and therefore it is important to choose one that meets the needs of the research task being undertaken.

The algorithms that will be tested in this feasibility study for determining Indigenous status are:

Original

> This algorithm assigns the Indigenous status that was reported for the student on the original/earliest enrolment. Only the main school enrolment for students with multiple enrolments within a single year was used for this algorithm.

> **Benefits:** The data on the original enrolment year may be more populated than following years, if the following year's data is not rolled over, or not rolled over consistently.

> **Limitations:** One concern with the 'original' algorithm is that it is the oldest record on the dataset, and data may have been improved or updated since then. Also, it is only one year of data and is therefore prone to be affected by an administrative error, leading to incorrect identification of Indigenous status.

Ever

This algorithm assigns the Indigenous status as 'Aboriginal or Torres Strait Islander' if the student was ever identified as being of Aboriginal or Torres Strait Islander origin on at least one dataset. Only the main school enrolment for students with multiple enrolments within a single year was used for this algorithm.

Benefits: This algorithm is the least stringent in picking up whether a student has ever been reported as Aboriginal or Torres Strait Islander.

Limitations: A student only need be reported as being of Aboriginal or Torres Strait Islander origin once, over six years of data, to be categorised as an Aboriginal or Torres Strait Islander student. This algorithm is prone to over-counting due to false-positive Aboriginal or Torres Strait Islander identification.

Most recent

This algorithm assigns the Indigenous status that was reported for the student on the most recent/latest enrolment. Only the main school enrolment for students with multiple enrolments within a single year was used for this algorithm.

Benefits: The most recent data may be more up to date, or data collection improvements may have occurred since the original data collection year.

Limitations: This algorithm uses only one year of data and is therefore prone to be affected by an administrative error, leading to incorrect identification of Indigenous status.

Majority

This algorithm counts the number of Aboriginal or Torres Strait Islander / non-Indigenous responses for the student across all main school enrolments and assigns the response that achieves the greatest count. To be classified as an Aboriginal or Torres Strait Islander student, the student must have more than half of all responses recorded as Aboriginal or Torres Strait Islander. If the count of responses is equal, then the student was classified as non-Indigenous. Only the main school enrolment for students with multiple enrolments within a single year was used for this algorithm.

Benefits: Takes into account more than one year of data, but not as strict as the 'only' algorithm. This algorithm allows for some inconsistency of reporting.

Limitations: Difficult to implement if only two years of data, as it then becomes the same as the 'only' algorithm. When there is an even number of years of data (as for this study) the decision needs to be made whether 50% Aboriginal or Torres Strait Islander responses is recorded as an Aboriginal or Torres Strait Islander student, or not (e.g. this study required four out of six years to be recorded as Aboriginal or Torres Strait Islander for the 'majority' algorithm).

Only

A response of Aboriginal or Torres Strait Islander is only assigned if the student reports as being Aboriginal or Torres Strait Islander across all enrolments. Only the main school enrolment for students with multiple enrolments within a single year was used for this algorithm. This does not take into account differences in Indigenous status across multiple enrolments within a single year.

Benefits: A strict algorithm that will reduce false-positive identification of Indigenous status.

Limitations: Does not allow for occasional administrative errors or known issues with non-response of Indigenous status. May increase false-negative Aboriginal or Torres Strait Islander identification.

5.3 Students reported as Aboriginal or Torres Strait Islander on main school enrolments and enrolled in more than one year of school, by sex, Tasmania, 2006–2011[(a)]

Sex	Indigenous status algorithm					Total students
	Original	Most recent	Ever	Majority	Only	
	No.					
Males	2,935	3,250	3,436	3,055	2,668	40,298
Females	2,805	3,059	3,260	2,901	2,516	38,782
Total students	*5,740*	*6,309*	*6,696*	*5,956*	*5,184*	*79,080*
	%					
Males	7.28	8.06	8.53	7.58	6.62	100.00
Females	7.23	7.89	8.41	7.48	6.49	100.00
Total students	*7.26*	*7.98*	*8.47*	*7.53*	*6.56*	*100.00*

(a) Includes government school students only.

Table 5.3 demonstrates the differences in the number of Aboriginal or Torres Strait Islander students that are obtained by using the algorithms outlined above relating to each student's main school enrolment records only. For both males and females, the largest cohort of Aboriginal and Torres Strait Islander students was obtained by using the 'ever' algorithm, followed by the 'most recent' and 'majority' algorithms. In contrast, the smallest Aboriginal and Torres Strait Islander student numbers were obtained using the 'only' algorithm. While the differences between the resultant

statistics are not large, they differ enough to require a researcher to choose carefully the algorithm that is appropriate for the study to be undertaken, to ensure that the most accurate statistics are being produced.

In comparison, table 5.4 demonstrates how the algorithms for assigning Indigenous status can change when the student is enrolled in six consecutive years of schooling. This shows the effect of the different algorithms' on a higher number of enrolment years and whether they are able to produce similar results over the longer period of enrolment.

Similar or slightly higher percentages resulted for each category when compared to the results from table 5.3. The 'ever' algorithm produced the highest number of Aboriginal and Torres Strait Islander students, followed by the 'most recent' and 'majority' algorithms. The 'only' algorithm continues to produce the lowest number of Aboriginal and Torres Strait Islander students. This demonstrates that the algorithms are effective despite being applied over a longer time frame where it is more likely that discrepancies in reporting Indigenous status would arise.

5.4 Students reported as Aboriginal or Torres Strait Islander on main school enrolments and enrolled in six consecutive years of school, by sex, Tasmania, 2006–2011[(a)]

| Sex | Indigenous status algorithm | | | | | Total students |
	Original	Most recent	Ever	Majority	Only	
			No.			
Males	1,164	1,341	1,419	1,223	1,040	14,710
Females	1,097	1,239	1,315	1,148	968	13,628
Total students	2,261	2,580	2,734	2,371	2,008	28,338
			%			
Males	7.91	9.12	9.65	8.31	7.07	100.00
Females	8.05	9.09	9.65	8.42	7.10	100.00
Total students	7.98	9.10	9.65	8.37	7.09	100.00

(a) Includes government school students only.

Focusing the analysis on students enrolled in six consecutive years greatly reduces the size of the cohort for analysis. Therefore, the following analysis uses a broader approach by looking at students enrolled in more than one year of school between 2006 and 2011.

Another method for testing the appropriateness of the algorithms is to apply the algorithms to all enrolments for a student, both within and across years. Table 5.5 repeats the 'majority' and 'only' methods for choosing Indigenous status, but includes the Indigenous status recorded for multiple records within a single enrolment year.

5.5 Variation in Indigenous status for all student enrolments across and within years, by sex, Tasmania, 2006–2011[(a)(b)]

| Sex | Indigenous status algorithm | | | | Total enrolments | |
| | Majority | | Only | | | |
	no.	%	no.	%	no.	%
Males	3,055	7.58	2,657	6.59	40,298	100.00
Females	2,899	7.48	2,497	6.44	38,782	100.00
Total enrolments	*5,954*	*7.53*	*5,154*	*6.52*	*79,080*	*100.00*

(a) Includes government school students only.
(b) Includes the Indigenous status reported on all of the student's enrolment records, including where the student has multiple enrolments within the same year, for students enrolled in more than one year.

When compared to table 5.3 (which looks at main school enrolments), the results in table 5.5 show very similar outcomes for the tested algorithms. This suggests that there is only a very small discrepancy occurring for Indigenous status within a single year for students with multiple enrolments.

Due to the findings indicating that including all enrolments (not just main school records) does not affect the results to a large degree, the following analysis considers the characteristics recorded for students' main school enrolments only.

6. CHARACTERISTICS OF THE ABORIGINAL AND TORRES STRAIT ISLANDER SUB-POPULATION

6.1 Are results affected by the Indigenous status algorithm?

While looking at the total numbers of students who are assigned Aboriginal or Torres Strait Islander status using the various algorithms outlined in Section 5 is a useful way to determine the accuracy of those measures, it is also important to see what effect the algorithms may have on the resultant statistics when analysing characteristics of Aboriginal and Torres Strait Islander students.

Figure 6.1 shows the proportion of Aboriginal and Torres Strait Islander students across each education level. In terms of the algorithms used to assign a student's Indigenous status, most algorithms produced similar results in terms of the overall trend, except for the 'original' category, which resulted in a slightly lower percentage of Aboriginal and Torres Strait Islander students in primary schooling compared with those in secondary schooling.

6.1 Education level of students reported as Aboriginal or Torres Strait Islander, by identification algorithm, Tasmania, 2006–2011[a][b]
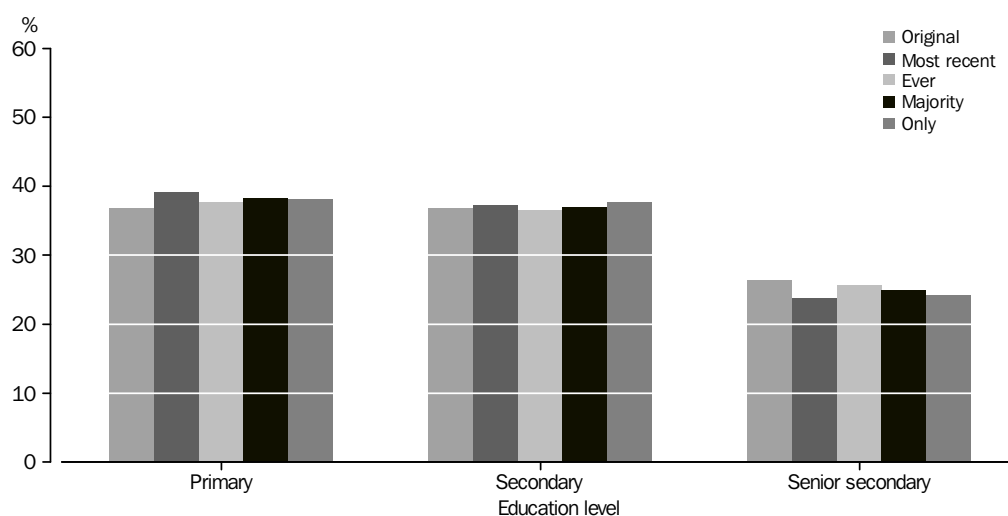
(a) Includes government school students only.
(b) Includes the Indigenous status reported on the student's main school enrolment record only.

Figure 6.2 shows the results for highest non-school qualification held by the parents or guardians of students. This includes the highest non-school qualification of both parents (if reported). For example, if parent 1 completed a Bachelor degree and parent 2 completed no non-school qualification, then the qualification for that student's highest parental non-school qualification would be 'Bachelor degree or above'.

6.2 Highest non-school qualification achieved by parents/guardians of students reported as Aboriginal or Torres Strait Islander, by identification algorithm, Tasmania, 2009–2011[(a)(b)(c)]
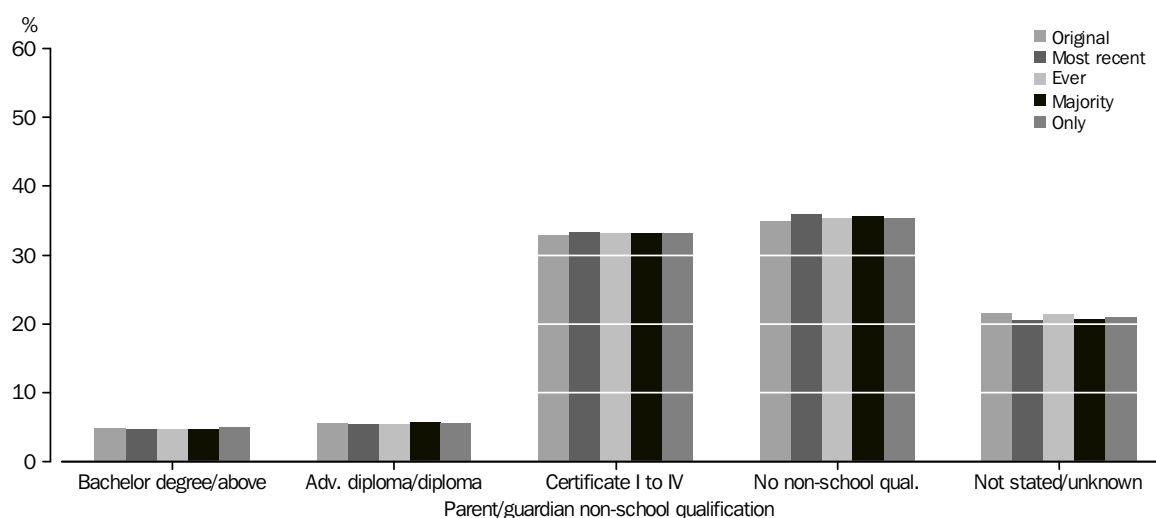

(a) Includes government school students only.
(b) Includes the Indigenous status reported on the student's main school enrolment record only.
(c) Includes the highest known qualification of either parents (or guardians), if available.

The results (figure 6.2) show that the majority of Aboriginal and Torres Strait Islander students had parents or guardians with no non-school qualifications or a Certificate I to IV, with very few having a parent or guardian with an advanced diploma/diploma or Bachelor degree or above. All algorithms show a similar trend for this characteristic, although the 'most recent' algorithm produced a slightly lower percentage of parents with a not stated/unknown response. This may reflect improvements in data collection and reporting in more recent years.

It is important to note that parental background information was only available from 2009, and therefore students not enrolled in 2009 to 2011 have not been included in these results. Despite this, there was still a high level of not stated/unknown responses for this sub-population as it was not a requirement of the NSSC to collect this information. The effect of these responses could be minimised with improvements to the collection of parental background information for the NSSC. Integrating Census of Population and Housing data with school enrolment data would also assist, as missing or incomplete parental information could be supplemented from Census data.

Figures 6.3 and 6.4 show the proportion of students of school leaving age[1] that left school between 2006 and 2010 by Indigenous status. It is important to note that the 'leavers' cohort represented in this graph does not include those students enrolled in 2011, as there is no way to tell whether these students continued their schooling during 2012.

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1   In Tasmania, students may leave school after completing grade 10 as long as they continue other forms of education or training until they turn 17 years of age – *Youth Participation in Education and Training (Guaranteeing Futures) Act 2005* (Tasmanian Government, 2005).

6.3 Last completed grade of students reported as Aboriginal or Torres Strait Islander, by identification algorithm, Tasmania, 2006–2011[(a)(b)(c)]
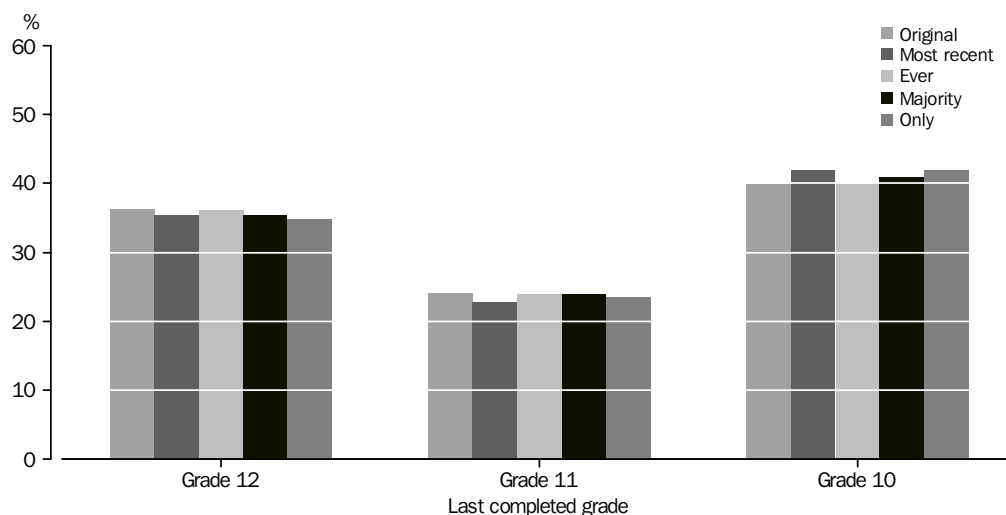
(a) Includes government school students only.
(b) Includes the Indigenous status reported on the student's main school enrolment record only.
(c) Includes students classified as 'leavers' defined above.

6.4 Last completed grade of students reported as non-Indigenous, by identification algorithm, Tasmania, 2006–2011[(a)(b)(c)]
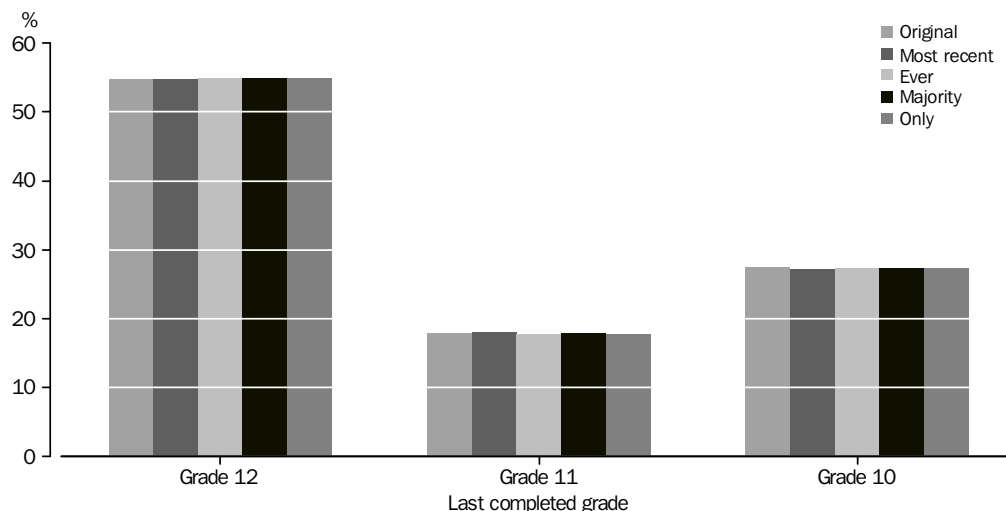
(a) Includes government school students only.
(b) Includes the Indigenous status reported on the student's main school enrolment record only.
(c) Includes students classified as 'leavers' defined above.

It should also be noted that due to only having access to government school data and without taking into account interstate moves, the analysis for 'leavers' in grades 10 and 11 is limited, as students may have moved to a non-government school or interstate and not actually be a 'school leaver'.

The analysis demonstrates that a higher number of Aboriginal and Torres Strait Islander students left school at the end of grade 10 compared with grades 11 and 12. In comparison, the highest proportion of other Australian students completed grade 12 before leaving school.

In terms of the algorithms for assigning Indigenous status, the differences between the methods are minimal and they all present very similar results for these comparisons.

Overall, these analyses show that the 'only' Indigenous status algorithm appears to be slightly under-representing Aboriginal and Torres Strait Islander students for all disaggregations, whereas the 'ever' Indigenous status algorithm is slightly over-representing the results. It is also worth noting that the 'original', 'most recent', and 'majority' algorithms are consistently presenting very similar results. This indicates that students reporting as Aboriginal or Torres Strait Islander in their earliest or latest enrolments are also reporting as Aboriginal or Torres Strait Islander for the majority of their enrolments.

It is essential that a researcher choose the algorithm that best suits the analysis being undertaken. For example, the 'only' and 'ever' Indigenous status algorithms would be quite useful to use if the researcher is showing those students with consistent/ inconsistent collection or reporting of Indigenous status across time.

The 'most recent' and the 'majority' algorithms have resulted consistently in numbers around the median for all results, unlike the 'ever' or 'only' algorithms, which consistently result in the highest or lowest number of Aboriginal and Torres Strait Islander students. This seems to suggest that the 'most recent' and 'majority' algorithms are not prone to over- or under-estimation of Aboriginal and Torres Strait Islander students. The 'most recent' algorithm could also be seen to make use of characteristics obtained from a more accurate dataset when compared to earlier datasets, given recent changes and improvements to data collection methods.

The 'majority' algorithm is a more robust, due to taking into account more than one year's worth of data. It also allows for occasional administrative error or inconsistent reporting, unlike the 'only' algorithm, which does not allow for one year of data being inconsistent.

6.2 Further analysis on 'most recent' and 'majority' algorithms

The following analysis compares the 'most recent' and 'majority' algorithms by looking at parental level of education completed and the school remoteness indicator, which according to the Index of Community Socio-Educational Advantage (ICSEA) scale are strong indicators of the educational advantage of a student. It has also been demonstrated that there is a strong relationship between a student's level of educational advantage and their actual educational achievement. For more information on ICSEA, see Appendix A of this report.

It is important to note that 'non-school education of parents' was not provided on the 2006 to 2008 data files as provision of this information was not a requirement for the NSSC at that time. Therefore, if a student was not enrolled between the years of 2009 and 2011, then they are not included in the results shown in figures 6.5 and 6.6. No parental information was provided from students enrolled in Polytechnic and Academy institutions. This information will be provided from 2012 onwards.

Figures 6.5 and 6.6 show that using the 'most recent' algorithm or the 'majority' algorithm both achieve very similar analysis results, with Aboriginal and Torres Strait Islander students more likely to have parents whose highest education achievement was grade 10 or equivalent, followed by grade 9 or equivalent. In contrast, results demonstrate that other Australian students' had a higher percentage whose parents' had completed grade 12 or equivalent, followed by grade 10 or equivalent. Figures 6.5 and 6.6 demonstrate that either algorithm would result in the same story.

6.5 Students enrolled in government schools, by most recent Indigenous status and highest school qualification achieved by parents, Tasmania, 2009–2011[(a)(b)(c)]
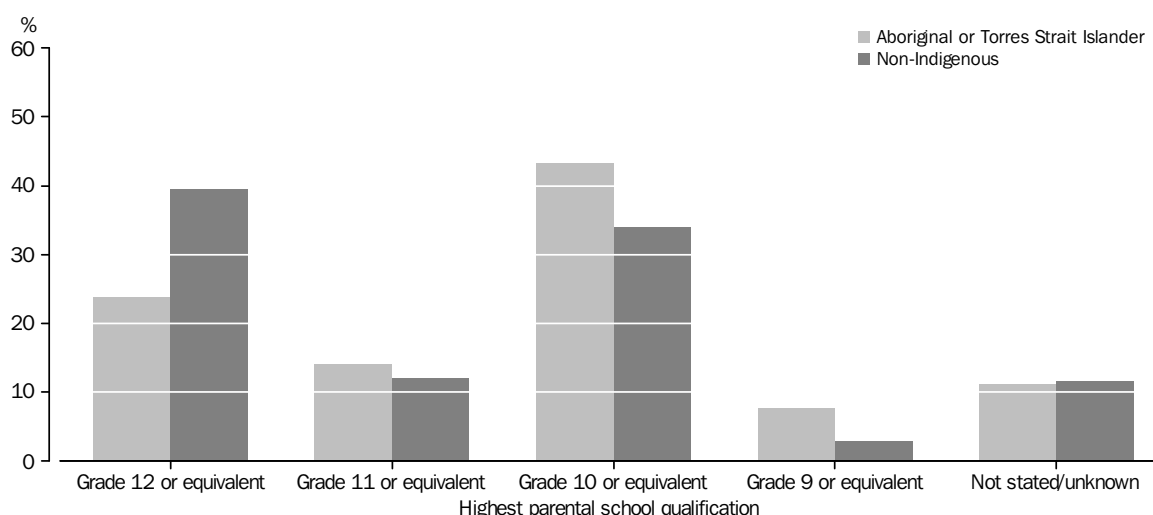
(a) Includes government school students only.
(b) Includes the Indigenous status reported on the student's main school enrolment record only.
(c) Includes the highest known qualification of either parents (or guardians), if available.

6.6 Students enrolled in government schools, by 'majority' Indigenous status and highest school qualification achieved by parents, Tasmania, 2009–2011[(a)(b)(c)]

Legend: Aboriginal or Torres Strait Islander; Non-Indigenous

X-axis: Highest parental school qualification (Grade 12 or equivalent, Grade 11 or equivalent, Grade 10 or equivalent, Grade 9 or equivalent, Not stated/unknown)
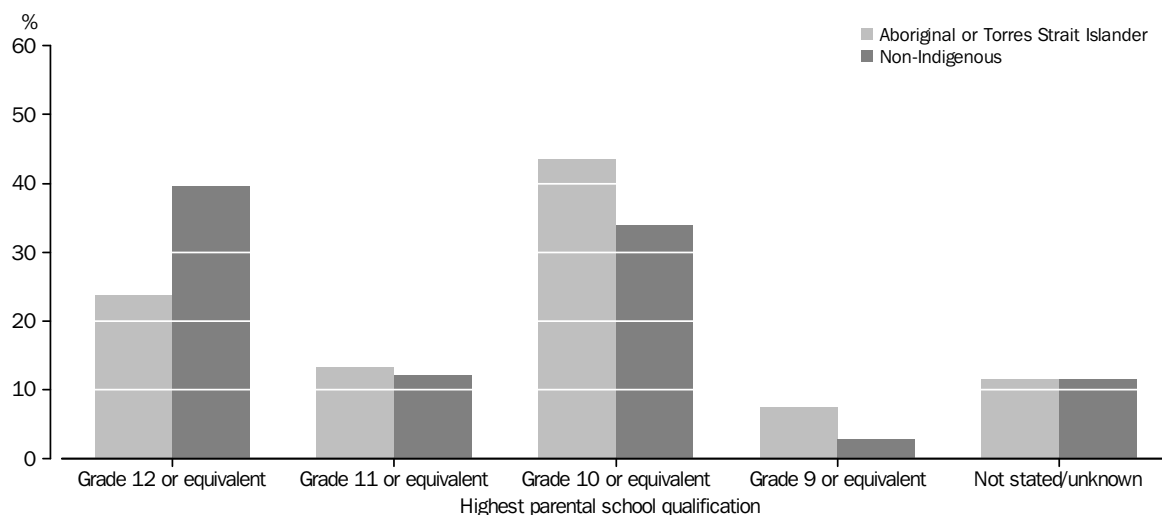
(a) Includes government school students only.
(b) Includes the Indigenous status reported on the student's main school enrolment record only.
(c) Includes the highest known qualification of either parents (or guardians), if available.

Figures 6.7 and 6.8 show the proportion of Aboriginal and Torres Strait Islander and other Australian students and the remoteness of the school in which they are enrolled, with figure 6.7 using the 'most recent' algorithm and figure 6.8 using the 'majority' algorithm.

It is important to note that the 'remoteness of school' variable was only provided in the 2011 data file. Prior to 2011 'remoteness of school' was not a reporting requirement of the NSSC. Therefore, if a student was not enrolled in 2011, they are not included in the results shown in figures 6.7 and 6.8. The Tasmanian Department of Education will be providing this information in 2012 and future years.

The results show that either algorithm produces extremely similar percentages and the same graphical pattern, with the vast majority of both Aboriginal and Torres Strait Islander and other Australian students attending school in a metropolitan or provincial area. Both graphs also show a slightly higher proportion of Aboriginal and Torres Strait Islander students are enrolled in schools in remote and very remote areas, compared with other Australian students.

6.7 Students enrolled in government schools, by remoteness of school and most recent Indigenous status, Tasmania, 2011[a][b]
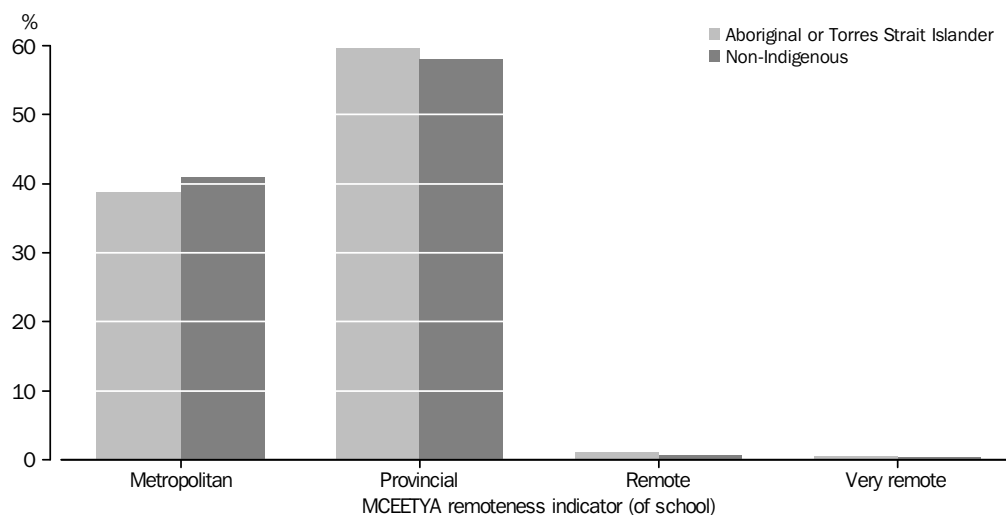
MCEETYA remoteness indicator (of school)

(a) Includes the Indigenous status reported on the student's main school enrolment record only.
(b) Incorporates the 'most recent' Indigenous status algorithm to determine the Indigenous status for students enrolled in more than one year.

6.8 Students enrolled in government schools, by remoteness of school and majority Indigenous status, Tasmania, 2011[a][b]
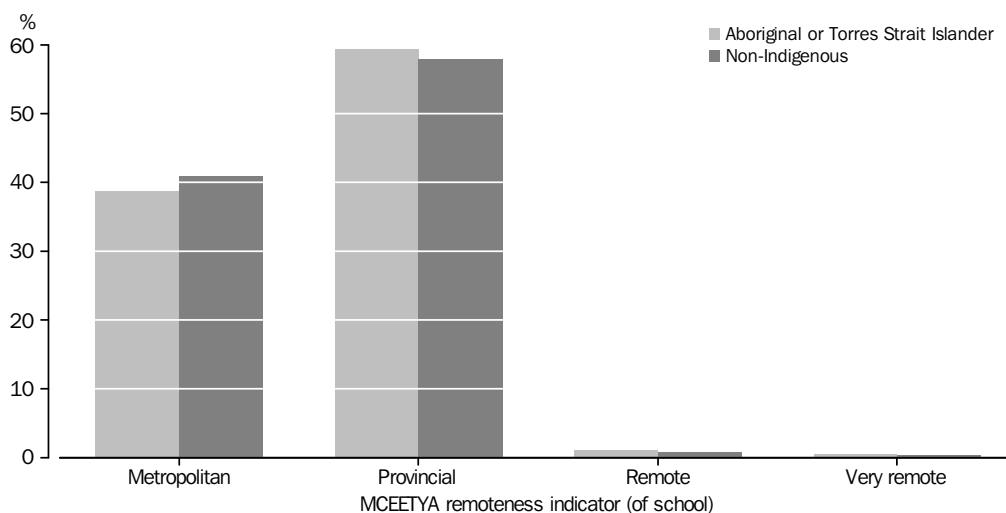
MCEETYA remoteness indicator (of school)

(a) Includes the Indigenous status reported on the student's main school enrolment record only.
(b) Incorporates the 'majority' Indigenous status algorithm to determine the Indigenous status for students enrolled in more than one year.

7. SUMMARY OF RESULTS USING DIFFERENT INDIGENOUS REPORTING ALGORITHMS

Based on the analysis of information on Indigenous status across student enrolment records and the algorithms used to resolve records with conflicting responses, the following assessment is made of the potential quality of the different algorithms for assigning Indigenous status.

Original

The 'original' algorithm produced very similar results to the other algorithms for all analyses, except for the education level analysis, where the pattern was slightly different. The strong results of this algorithm may reflect that only 2% of records had an Indigenous status that differed across years. In a lower quality dataset, this algorithm may not perform well, due to the fact that it is a single year of data, and also the oldest record on the dataset.

Ever

The 'ever' algorithm resulted in the highest number of reported Aboriginal and Torres Strait Islander students for all analysis results, however the differences were not large enough to affect the percentages, with most percentage results being very similar to the other algorithms. This result may also reflect the high quality of Indigenous reporting on the Tasmanian dataset. The 'ever' algorithm is prone to a false negative effect for non-Indigenous students. For example, if a student is recorded in the dataset as non-Indigenous for five years, but then Aboriginal or Torres Strait Islander for one year (potentially an administrative or reporting error) this student is then categorised as Aboriginal or Torres Strait Islander for the purpose of analysis or reporting.

Most recent

The 'most recent' algorithm produced the same patterns for analysis results as the other algorithms. Numerically, this algorithm produced numbers that were not the highest, nor the lowest, suggesting that it is not prone to over- or under-counting. It is also more likely to include higher quality data due to data collection and reporting improvements.

Majority

The 'majority' algorithm produced the same patterns for analysis results as the other algorithms. Numerically, this algorithm produced numbers that were not the highest, nor the lowest, suggesting that it is not prone to over- or under-counting. A benefit of this algorithm is that it takes into account more than one year of data.

Only

The 'only' algorithm produced the same patterns for analysis results as the other algorithms. Numerically, this algorithm produces the lowest numbers for Aboriginal and Torres Strait Islander students, due to not allowing for any potential administrative errors or reporting differences.

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Australian Institute of Health and Welfare and Australian Bureau of Statistics (2012) *National Best Practice Guidelines for Data Linkage Activities Relating to Aboriginal and Torres Strait Islander People*, Cat. No. IHW 74, AIHW, Canberra. <http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=10737422213>

Council of Australian Governments (COAG) (2008) *National Indigenous Reform Agreement (Closing the Gap)*. <http://www.federalfinancialrelations.gov.au/content/npa/health_indigenous/indigenous-reform/national-agreement_sept_12.pdf>

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All URLs viewed on 25 February 2014

APPENDIXES

A. EXPLANATORY NOTES

A.1 Creating a student level file prior to linking

The Student ID was used to create a student level file. The Student ID may not always provide a unique identifier. Due to the Student ID being allocated at the school level, there may be instances where the Student ID is not unique to each student (e.g. through administrative error). A student may also be assigned more than one Student ID during the course of their schooling (e.g. where a student changes schools but their administrative information has not been accessed or found).

Despite this potential for error, for the purposes of this feasibility study, the Student ID is considered to be of a high quality.

A.2 Multiple enrolments and selecting student characteristics

Students may legitimately have more than one enrolment record within a given year for a number of reasons:

- many students legitimately enrol at multiple campuses/schools in order to complete courses that are not offered through their main school campus;

- students who are being home-schooled are required in some states to enrol at a school campus, for the purpose of accessing resources or completing supervised examinations;

- some students are highly mobile and may change schools without cancelling their prior enrolment;

- some multiple enrolments may be due to clerical error or repair.

Student characteristics may differ across multiple enrolments, so it is important to select the appropriate student record that matches the requirements of the particular research and analysis project being undertaken. It is important to note that there are many different algorithms which can be used to select individual student level characteristics when they differ across multiple enrolments for the one year, including selecting:

- the characteristics from the main school of enrolment (where the student spends the most number of hours enrolled at the school);

- the most commonly reported characteristics across the enrolments;

- the characteristics based on random selection;

- the characteristics based on attributes of the school enrolled (e.g. school size, school grade level, or school location).

For the purposes of this study, there was an existing main school flag on the datasets, which was used to assign each student's main school enrolment.

Where student characteristics differed across years, the most recent characteristic was chosen for all analyses (other than the Indigenous algorithms) in this report. This reflected the assumption that the more recent information would be more valid and also incorporates potential data collection improvements which have occurred over time.

A.3 Pre-existing data quality issues

As the NSSC data requirements have changed over the period from 2006 to 2011, some data items were not available for all six years of data. These data items included parental background information (such as occupation, school/non-school education) and main language spoken at home, which were only available on the 2009 to 2011 data files for students attending Tasmanian government schools. No parental information was provided from students enrolled in Polytechnic and Academy institutions. This information will be provided from 2012 onwards.

Data for student enrolments in Kindergarten grade level were only available on the 2006 to 2009 data files as these files were provided by the Tasmanian Department of Education via a separate data request. Data for the 2010 and 2011 years was attained from the NSSC submission, which does not include Kindergarten enrolment data. Therefore, all Kindergarten data was excluded from the analysis in this report.

It should be noted that the Tasmanian Polytechnic and Academy institutions use a different student administration system to the Tasmanian government schools. This has meant that some students could have been issued with a new Student ID when enrolled in these institutions, which would affect the linkage of these students across enrolment years when based on Student ID. As a result, there is a chance that some students do not appear to have continued a Tasmanian government school education across 2006 to 2011, when they actually have, just under the assignment of a different Student ID. The Tasmanian Department of Education has introduced processes in place to improve the consistent use and allocation of the Student ID across the Tasmanian government education sector.

In terms of data quality, there were a number of Student IDs on the 2010 and 2011 datasets that were of an invalid length due to leading zeros being lost through data file conversion processes, with the appropriate length being 11. Student IDs with lengths of 7 were not amended as they contained letters and it was presumed that these were correct. However, Student IDs with a length of 9 or 10 were corrected by adding '0' or '00' to the beginning of these Student IDs to ensure that they were the correct length.

B. KEY CONCEPTS AND DEFINITIONS

B.1 Main school enrolment

The main school enrolment for a student is the enrolment which is considered the primary enrolment for that student, and from which variables are used for analysis.

Students may legitimately have more than one enrolment record within a given year for a number of reasons:

- many students legitimately enrol at multiple campuses/schools in order to complete courses that are not offered through their main school campus

- students who are being home-schooled are required in some states to enrol at a school campus, for the purpose of accessing resources or completing supervised examinations

- some students are highly mobile and may change schools without cancelling their prior enrolment

- some multiple enrolments may be due to clerical error or repair.

B.2 Education levels

The Tasmanian government school education levels are defined as:

- *Primary schooling:* Students enrolled in pre-year 1 through to grade 6

- *Secondary schooling:* Students enrolled in grade 7 through to grade 10

- *Senior secondary schooling:* Students enrolled in grade 11 and grade 12. This can include students in Year 13 and those classified in 'senior secondary other', which are students aged 21 years and over.

B.3 Index of Community Socio-Educational Advantage (ICSEA) Scale

ICSEA is a scale that represents levels of educational advantage. A value on the scale is assigned to each school in Australia based on an averaged level for all students in the particular school. Through the *My School* website (ACARA, 2013), it provides a way to compare schools based on the performance in literacy and numeracy of students – obtained from the *National Assessment Program – Literacy and Numeracy* (NAPLAN) data – to that of similar schools serving students with statistically similar backgrounds (ACARA, 2011; ACARA, 2012).

The reason for creating the ICSEA scale is that research has shown that details of a parents' occupation and level of education completed are good indicators of the educational advantage of a student. It has also been demonstrated that there is a strong relationship between a student's level of educational advantage and their actual educational achievement. Therefore, ICSEA can be used as a determinant of whether a school is educationally advantaged or educationally disadvantaged, or somewhere in between, depending on the characteristics of the students who attend that school.

The formula for ICSEA is as follows:

ICSEA = SEA (direct/indirect) + remoteness +
percentage Aboriginal and Torres Strait Islander students +
percentage disadvantaged language background other than
English (LBOTE)[2] students

The SEA component of ICSEA uses two alternative data sources:

(a) Information on parent occupation, school education, non-school education and language background obtained from student enrolment records (direct data – used in the first instance unless found to be less accurate or have significant levels of missing data).

(b) ABS data from the Census of Population and Housing (indirect data – used if direct data is less accurate). This measure does not relate to the actual parents of students enrolled at the school. Instead, it is only an area based measure.

B.4 MCEETYA remoteness status

The MCEETYA remoteness status is a measure of the school's level of remoteness. There are three remoteness zones: metropolitan, provincial and remote.

- *Metropolitan* refers to mainland State capital city mainland and city –based areas and major urban statistical districts.

- *Provincial* refers to central and regional areas.

- *Remote* refers to isolated and highly remote areas (very remote is sometimes reported separately).

It should be noted that this is separate to and does not correlate directly to the ABS remoteness status, based on the Australian Statistical Geographical Standard (ASGS).

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2   LBOTE combined with the percentage of parents with an education of grade 9 equivalent or below.

B.5 False-positive / false-negative

In the case of Indigenous status, a false-positive occurs if a student is falsely identified as being Aboriginal or Torres Strait Islander through the use of an analysis algorithm, when in fact they are non-Indigenous. A false-negative has the opposite effect, whereby an algorithm determines that a student who is Aboriginal or Torres Strait Islander is included as non-Indigenous.

C. QUALITY ASSURANCE PROCESS

C.1 Counts of enrolments, students and students with multiple enrolments for Tasmanian government schools, by sex, 2006–2011[a]

	Number of enrolments	*Number of students*	
	No. of records on file	*No. of unique student identifiers*	*Number of students with multiple enrolments*
2006			
Males	31,489	31,263	187
Females	31,193	30,511	508
Total	*62,682*	*61,774*	*695*
2007			
Males	31,022	30,782	203
Females	30,370	29,770	463
Total	*61,392*	*60,552*	*666*
2008			
Males	30,708	30,428	226
Females	29,897	29,360	431
Total	*60,605*	*59,788*	*657*
2009			
Males	30,851	30,376	455
Females	29,809	29,103	647
Total	*60,660*	*59,479*	*1,102*
2010			
Males	31,475	30,432	910
Females	30,521	29,056	1,187
Total	*61,996*	*59,488*	*2,097*
2011			
Males	31,552	30,631	769
Females	29,945	28,905	863
Total	*61,497*	*59,536*	*1,632*

(a) Applies the sex captured on the student's most recent main school enrolment record.

C.2 Apparent retention rates, by sex, Tasmania, 2008–2011[a]

Grade range	Apparent retention rates (%)			
	2008	2009	2010	2011
MALES				
Grade 7 – grade 9	101.1	100.7	101.0	100.4
Grade 7 – grade 10	–	100.0	101.4	101.9
Grade 10 – grade 12	54.1	55.0	64.3	63.5
Grade 7 – grade 12	–	–	–	63.5
FEMALES				
Grade 7 – grade 9	98.7	99.6	100.7	100.2
Grade 7 – grade 10	–	97.5	100.5	102.4
Grade 10 – grade 12	69.8	71.2	82.0	78.7
Grade 7 – grade 12	–	–	–	76.8
PERSONS				
Grade 7 – grade 9	99.9	100.2	100.8	100.3
Grade 7 – grade 10	–	98.9	101.0	102.2
Grade 10 – grade 12	61.9	62.9	73.0	70.5
Grade 7 – grade 12	–	–	–	69.7

(a) Applies the sex captured on the student's most recent main school enrolment record.

D. ACCOMPANYING TABLES

D.1 Students reported as Aboriginal or Torres Strait Islander and enrolled in more than one year of school, by education level, Tasmania, 2006–2011[a][b]

| Education level | Indigenous status algorithm | | | | | Total students |
	Original	Most recent	Ever	Majority	Only	
			No.			
Primary	2,110	2,467	2,528	2,278	1,975	32,559
Secondary	2,117	2,349	2,448	2,198	1,957	23,625
Senior secondary	1,513	1,493	1,720	1,480	1,252	22,896
Total students	5,740	6,309	6,696	5,956	5,184	79,080
			%			
Primary	6.48	7.58	7.76	7.00	6.07	100.00
Secondary	8.96	9.94	10.36	9.30	8.28	100.00
Senior secondary	6.61	6.52	7.51	6.46	5.47	100.00
Total students	7.26	7.98	8.47	7.53	6.56	100.00

(a) Includes government school students only.
(b) Includes the Indigenous status reported on the student's main school enrolment record only.

D.2 Students reported as Aboriginal or Torres Strait Islander and enrolled in more than one year of school, by highest non-school qualification achieved by parents, Tasmania, 2009–2011[a][b][c]

| Highest non-school qualification | Indigenous status algorithm | | | | | Total students |
	Original	Most recent	Ever	Majority	Only	
			No.			
Bachelor degree or above	233	256	270	241	213	10,346
Advanced diploma/diploma	272	292	314	288	244	5,864
Certificate I to IV (including trade certificate)	1,585	1,802	1,896	1,680	1,431	22,260
No non-school qualifications	1,689	1,944	2,023	1,803	1,529	15,593
Not stated/unknown	1,043	1,106	1,229	1,050	903	11,599
Total students	4,822	5,400	5,732	5,062	4,320	65,662
			%			
Bachelor degree or above	4.83	4.74	4.71	4.76	4.93	15.76
Advanced diploma/diploma	5.64	5.41	5.48	5.69	5.65	8.93
Certificate I to IV (including trade certificate)	32.87	33.37	33.08	33.19	33.13	33.90
No non-school qualifications	35.03	36.00	35.29	35.62	35.39	23.75
Not stated/unknown	21.63	20.48	21.44	20.74	20.90	17.66
Total students	100.00	100.00	100.00	100.00	100.00	100.00

(a) Includes government school students only.
(b) Includes the Indigenous status reported on the student's main school enrolment record only.
(c) Includes the highest known qualification of either parents (or guardians), if available.

D.3 Students reported as Aboriginal or Torres Strait Islander and enrolled in more than one year of school, by last completed grade, Tasmania, 2006–2011[a][b]

	Indigenous status algorithm					Total students
Education level	Original	Most recent	Ever	Majority	Only	
	No.					
Grade 12	484	480	524	471	426	8,880
Grade 11	322	309	348	317	286	3,067
Grade 10	532	568	580	546	512	4,739
Total students of school leaving age	*1,338*	*1,357*	*1,452*	*1,334*	*1,224*	*22,247*
	%					
Grade 12	36.17	35.37	36.09	35.31	34.80	39.92
Grade 11	24.07	22.77	23.97	23.76	23.37	13.79
Grade 10	39.76	41.86	39.94	40.93	41.83	21.30
Total students of school leaving age	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

(a) Includes government school students only.
(b) Includes the Indigenous status reported on the student's main school enrolment record only.

D.4 Students reported as non-Indigenous and enrolled in more than one year of school, by last completed grade, Tasmania, 2006–2011[a][b]

	Indigenous status algorithm					Total students
Education level	Original	Most recent	Ever	Majority	Only	
	No.					
Grade 12	8,396	8,400	8,356	8,393	8,356	8,880
Grade 11	2,745	2,758	2,719	2,736	2,719	3,067
Grade 10	4,207	4,171	4,159	4,183	4,159	4,739
Total students of school leaving age	*15,348*	*15,329*	*15,234*	*15,312*	*15,234*	*22,247*
	%					
Grade 12	54.70	54.80	54.85	54.81	54.85	39.92
Grade 11	17.89	17.99	17.85	17.87	17.85	13.79
Grade 10	27.41	27.21	27.30	27.32	27.30	21.30
Total students of school leaving age	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

(a) Includes government school students only.
(b) Includes the Indigenous status reported on the student's main school enrolment record only.

D.5 Students enrolled in more than one year of school, by highest parental school qualification and Indigenous status (most recent and majority), Tasmania, 2006–2011[(a)(b)(c)]

| | Indigenous status algorithm | | | |
| | Most recent | | Majority | |
Grade completed	Aboriginal or Torres Strait Islander	Non-Indigenous	Aboriginal or Torres Strait Islander	Non-Indigenous
	No.			
Grade 12 or equivalent	1,288	23,841	1,203	23,926
Grade 11 or equivalent	757	7,323	682	7,398
Grade 10 or equivalent	2,332	20,402	2,207	20,527
Grade 9 or equivalent	414	1,726	383	1,757
Not stated/unknown	609	6,970	587	6,992
Total students	*5,400*	*60,262*	*5,062*	*60,600*
	%			
Grade 12 or equivalent	23.85	39.56	23.77	39.48
Grade 11 or equivalent	14.02	12.15	13.47	12.21
Grade 10 or equivalent	43.19	33.86	43.60	33.87
Grade 9 or equivalent	7.67	2.86	7.57	2.90
Not stated/unknown	11.28	11.57	11.60	11.54
Total students	*100.00*	*100.00*	*100.00*	*100.00*

(a) Includes government school students only.
(b) Includes the Indigenous status reported on the student's main school enrolment record only.
(c) Includes the highest known qualification of either parents (or guardians), if available.

D.6 Students enrolled in more than one year of school, by MCEETYA remoteness indicator and Indigenous status (most recent and majority), Tasmania, 2011[(a)(b)(c)]

| | Indigenous status algorithm | | | |
| | Most recent | | Majority | |
MCEETYA remoteness indicator	Aboriginal or Torres Strait Islander	Non-Indigenous	Aboriginal or Torres Strait Islander	Non-Indigenous
	No.			
Metropolitan	1,689	19,327	1,577	19,439
Provincial	2,596	27,396	2,414	27,578
Remote	49	372	47	374
Very remote	25	174	24	175
Total students	*4,359*	*47,269*	*4,062*	*47,566*
	%			
Metropolitan	38.75	40.89	38.82	40.87
Provincial	59.55	57.96	59.43	57.98
Remote	1.12	0.79	1.16	0.79
Very remote	0.57	0.37	0.59	0.37
Total students	*100.00*	*100.00*	*100.00*	*100.00*

(a) Includes government school students only.
(b) Includes the Indigenous status reported on the student's main school enrolment record only.
(c) Includes the highest known qualification of either parents (or guardians), if available.

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