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Patterns of mobility among primary school children in the Northern Territory

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Disclaimer

The views and findings expressed in this report are those of the authors and do not necessarily reflect those of the data custodians and organisational partners.

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Executive summary

Past studies have reported high levels of student mobility in the Northern Territory (NT) which include movements within the NT and interstate or overseas movements. In particular, Aboriginal students have been reported to have higher mobility than non-Aboriginal students. Student mobility presents a substantial challenge for policymakers and educators, as it affects the delivery of education and may impact students' learning. Considering the impact student mobility may have on students' school engagement and academic performance and the gap in these areas between Aboriginal and non-Aboriginal students, it is critical to obtain an in-depth understanding of student mobility to inform evidence-based policies and practices to respond to challenges of student mobility.

This study aimed to investigate the following research questions:

1) the patterns of mobility of NT children in primary school years

2) the characteristics of clusters of children with different patterns of mobility.

A. Study design and analysis methods

This study investigated the patterns and characteristics of student mobility using linked administrative datasets for the period from 2005 to 2018. The research questions concern the 3 essential elements of student mobility: *the mobility event (how)*, *the localities involved (where)* and the *characteristics of students (who)*. A comprehensive set of analysis methods was employed to address these 3 elements and their various aspects regarding student mobility:

a. Descriptive statistics (focusing on *how students moved*, i.e. the mobility event) was used to quantify student mobility on the following measures:

- the number and proportion of students who moved
- the number of times students moved
- distribution of destination categories for episodes of mobility (moving to Northern Territory Government (NTG) school; moving to non-NTG school and moving interstate or overseas)
- the timing (month of a year) when students moved
- the year level when students moved.

b. Gephi network analysis (focusing on *where students moved from and moved to,* using source and destination localities) was used to estimate and visualise patterns of student mobility by:

- detecting whether and how the network of student mobility could be aggregated into clusters of localities with higher levels of internal connection than connection with other localities
- quantifying geographical student mobility into, out of and between remote localities and regions.

c. **Latent class analysis** (focusing on *who moved and who did not,* i.e. the students' characteristics in relation to their mobility patterns) was used for
    - detecting groups of students within the study cohort who share similar characteristics related to mobility
    - analysing additional demographic and educational characteristics of the groups of students.

Other important features of the study's methodology included:

- using linked administrative datasets to increase the detection of destination localities where students moved to after departing a school
- widening the definitions for student mobility to include long absences (referring to students who left school for extended periods of time without recommencing at a second school), which is important for the NT considering the comparatively low school attendance among Aboriginal students.

However, the study was not designed to answer the question - "*Why do students move*?" This question was outside the scope of the current study and will require a separate research project with a survey and interviews with families.

B. Patterns and characteristics of student mobility in the Northern Territory

Descriptive statistics

- A total of 68,089 students who enrolled in public primary schools in the NT between 2005 and 2018 were included in this study (40.4% being Aboriginal and 59.6% non-Aboriginal students).
- Aboriginal students were more likely than non-Aboriginal students to have episodes of mobility, and the proportion of both groups who ever moved increased over the study period. In the most recent 3 years of the study period (2015–2018), the proportion of students having any episode of mobility each year were 24.7% and 12.1% for Aboriginal and non-Aboriginal students respectively.
- The majority of both Aboriginal and non-Aboriginal students who ever moved, moved only once in the same calendar year, but Aboriginal students were more likely to move more than once each year.
- In terms of the destinations, Aboriginal students most often moved to another NTG school while non-Aboriginal students most often moved interstate or overseas.
- In the period 2016–2018, mobility tended to decrease as year level increased and was lowest among Year 6 students, for both Aboriginal and non-Aboriginal students.

Network analysis

- For Aboriginal students, 5 clusters of localities were identified in which student mobility between localities within in the cluster was more common than movement to other localities. The clusters were named: Darwin-Top End cluster (21.8% of all mobility); Arnhem Land cluster (covering both east and west Arnhem Land and

accounting for 7.7% of all mobility); Big Rivers West cluster (49.4% of all mobility); Big Rivers East cluster (7.1% of all mobility) and Central cluster (covering both Barkly and Central regions, 14.1% of all mobility).

- For non-Aboriginal students, 4 clusters were identified: Greater Darwin (10.9% of all mobility); Top End-Arnhem Land (12.8%); Big Rivers (3.9%); and Central (72.4%).

Latent class analysis

- Groupings of students with different characteristics of mobility were assessed for the annual Year 1 cohorts commencing from 2009 to 2012. Aboriginal and non-Aboriginal students were different across almost all demographic and mobility-related variables available for the study, which therefore required separate analysis by Aboriginal status.
- For the 3,631 Aboriginal students in the study cohort, the analysis identified 5 groups, with varying probability of the various mobility characteristics:
    - **Once-off movers,** (4.2% of the study cohort); tended to move only once, moved from remote to remote locations and included a probability of interstate movement (38.6%).
    - **Occasional movers**, (6.9% of cohort) moved twice, moved from urban to urban locations (97.2%) with similar probability of moving interstate (31.6%).
    - **Frequent movers** (1.9% of cohort) moved 3 or more times, commonly between urban and remote locations (68.7%) and with a higher probability of interstate movement (43.9%).
    - **Intrastate movers** were a large group (37.8% of cohort) who moved one or many times including from remote to remote locations (42.1%), urban to urban (32.5%) and urban to remote (24.4%). This group did not move interstate.
    - **Stayers** were the largest group (49.2% of cohort) and did not have a record of movement.
- For the 6,240 non-Aboriginal students in the study cohort, the analysis identified 6 groups. The 3 largest groups were termed: Stayers (57.7% of cohort) with no movement, Once-off interstate movers (19.7% of cohort) and Once-off intrastate movers (13.0% of cohort).

C. Student mobility in the East Arnhem region

Descriptive statistics

- The average annual number of Aboriginal students enrolled in public primary schools in East Arnhem was consistently higher than non-Aboriginal students during the study period.
- The proportion of students who moved each year increased after 2013 and in 2018 was 22.7% for Aboriginal students and 19.4% for non-Aboriginal students.

- The majority of Aboriginal and non-Aboriginal students who moved each year, moved only once. The proportion of students who moved 2 or more times in a year was higher among Aboriginal students.
- Among Aboriginal students, the annual number of episodes of mobility increased substantially from 2015 to 2018 with the majority of the increase occurring in the category of 'Moving to an NTG school'. Among non-Aboriginal students, the major category was 'Moved interstate or overseas'.

Network analysis

- For Aboriginal students, 3 clusters of localities were identified: West Arnhem (major localities included Gapuwiyak, Galiwinku and Ramingining), Nhulunbuy-Yirrkala (major localities included Nhulunbuy and Yirrkala), and East Arnhem South (major localities included Angurugu, Umbakumba and Milyakburra).
- Clusters of localities were not evident for non-Aboriginal students due to widely varied source and destination locations for mobility episodes.

Latent class analysis

- Grouping of students with different characteristics of mobility was assessed for the annual Year 1 cohorts from 2009 to 2012, with 527 Aboriginal students (59.1%) and 364 non-Aboriginal students (40.9%) in the analysis.
- For Aboriginal students, 2 groups were identified. Movers (190 students, 36.1%) and Stayers (337 students, 63.9%). The Movers largely moved within the NT and between NTG schools and tended to move from one remote location to another.
- For non-Aboriginal students, 3 groups were identified: Intrastate Movers, Interstate Movers and Occasional Movers (with 19, 52 and 293 students respectively).

D. Student mobility in the Central region

Descriptive statistics

- The number of Aboriginal students enrolled each year was consistently higher than non-Aboriginal students and the difference increased across the study period.
- Among Aboriginal students, there was a trend of an increasing proportion of students recording any mobility in a calendar year during the period of 2013–2018, starting from around 20% in 2013 and 2014 to 37.6% in 2018, an increase of around 88%. For non-Aboriginal students, the proportion of students who moved dropped sharply from around 20% in 2005–2012 to around 10% in 2013–2017, with an increase in 2018 (14.2%).
- The majority of both Aboriginal and non-Aboriginal students who moved, only moved once in the same calendar year.
- For Aboriginal students there was a trend of increase in the number of students who moved for all 3 levels of mobility (1, 2 and 3 or more times), in the period from 2013

to 2018. For non-Aboriginal students the major category of mobility was 'Move interstate or overseas'.

Network analysis

- For Aboriginal students, 7 clusters of localities were identified: Alice Springs, Finke-Titjikala, Central East, Yuendumu-Nyirripi, Central South, Central West and Central North.
- Clusters of mobility were not evident for non-Aboriginal students due to widely varied source and destination locations for the mobility episodes.

Latent class analysis

- Grouping of students with different characteristics of mobility was assessed for the annual Year 1 cohorts from 2009 to 2012, with 669 Aboriginal students (53.4%) and 584 non-Aboriginal students (46.6%).
- For Aboriginal students, 4 groups were identified: Frequent Movers (30 students, representing 4.5% of the cohort), Intrastate Movers (261 students, 39.0%), Once-off Movers (99 students, 14.8%) and Stayers (279 students, 41.7%).
    - Frequent Movers tended to have 2 or more episodes of mobility, only move from urban to remote or from remote to urban areas and move interstate or overseas. Intrastate movers could move from once to more than 5 times, tended to move from remote to remote areas or from urban to urban areas, rarely moved to non-NTG schools and never moved interstate or overseas. Once-off Movers tended to move only once, moved between remote areas and were more likely to move to non-NTG schools or out of the NT than Intrastate Movers.
    - Supplementary analysis found that Year 3 attendance decreased as the frequency of mobility increased across the 3 groups with mobility.
- For non-Aboriginal students, 4 groups were identified: Frequent Movers (54 students, representing 9.2% of the study cohort), Occasional Movers (155 students, 26.5%), Once-off Movers (56 students, 9.6%) and Stayers (319 students, 54.6%).
    - Frequent Movers tended to move twice and move only from urban to urban areas, were moderately likely to move out of the NT but rarely moved to non-NTG schools. Occasional Movers tended to move only once and only move either from urban to urban areas or from remote to remote areas, but rarely moved to non-NTG schools and never moved interstate or overseas. Once-off Movers only ever moved once and all these moves were interstate or overseas and from remote to remote areas.
    - Supplementary analysis found that the proportion of students with 80% or higher Year 3 attendance decreased, among the 3 groups with mobility, as the frequency of mobility increased.

E. Student mobility in the Big Rivers region

Descriptive statistics

- The number of Aboriginal students enrolled each year was consistently higher than non-Aboriginal students and the difference increased during the period from 2013 to 2018.
- During 2013–2018, there was a marked increase in the mobility of Aboriginal students from 17.7% of students in 2013 to 30.9% in 2018, an overall increase by 77.5%.
- The majority of Aboriginal and non-Aboriginal students who moved, only moved once in the same calendar year.
- From 2013 to 2018, there was an increasing trend in the number of Aboriginal students who moved for all levels of mobility (1, 2 and 3 or more times).
- For Aboriginal students, from 2013 to 2018, the dominant destination category was 'Moved to NTG school' and the number of mobility episodes under this category increased 3.4-fold. For non-Aboriginal students, the dominant destination category was 'Moved interstate or overseas' but the number of episodes under this category showed no evident trend over the whole study period.

Network analysis

- For Aboriginal students, 5 clusters of localities were detected. They were named to align with their general location within the Big Rivers region: Katherine-Big Rivers West, Big Rivers North, Lajamanu-Yuendumu, Big Rivers East, and Borroloola-Robinson River.
- Clusters of mobility were not evident for non-Aboriginal students due to widely varied source and destination locations for the mobility episodes.

Latent class analysis

- Analysis was conducted to identify characteristics of groups of students with different mobility patterns using the annual Year 1 student cohorts from 2009 to 2012, with 632 Aboriginal students (63.0%) and 371 non-Aboriginal students (37.0%).
- For Aboriginal students, 3 groups were identified: Frequent Movers (63 students, 10.0% of total), Occasional Movers (301 students, 47.6%) and Stayers (268 students, 42.4%).
    - Frequent Movers tended to have 3 or more episodes of mobility, predominantly moved from urban to remote or from remote to urban localities only, and a 23.5% probability of moving interstate or overseas. Occasional Movers tended to move 1 or 2 times, move only between remote localities, and were comparatively less likely (9.5%) to move interstate or overseas.
    - Supplementary analysis found some evidence of a difference between the 3 groups for Year 3 attendance. As an example, for the outcome of 80% or

more attendance, the respective proportions were Stayers 38.9%, Occasional movers 42.2% and Frequent movers 27.0%.

- For non-Aboriginal students, 3 groups were identified: Urban Movers (79 students, 21.3% of total), Remote Movers (99 students, 26.7%) and Stayers (193 students, 52.0%).
    - Remote Movers tended to move only once and moved only between remote localities. Urban Movers were more likely to move more than once and mainly moved only between urban localities. Remote Movers were more than twice as likely to ever move interstate or overseas (31.1% vs 13.7%).
    - Post-hoc analysis found students were more likely to move for the first time in Year 1, followed by Year 2, in both groups with mobility.

F. Final notes

One important question that remains for a comprehensive understanding of student mobility is - "*Why do students move*?" This question was outside the scope of the current study and will require a separate research project with a survey and interviews with families. However, during the current study the investigators benefited from meeting regularly with experienced educators, including with advisory groups based in the 3 deep-dive regions. Members of these groups were generous with their contribution to the project and provided valuable interpretation of the patterns of movement. This information is included in this discussion but should not be seen to replace a detailed future investigation with the direct engagement of the families of students.

To the best of our knowledge, this is the first study to utilise an extensive repository containing linked person-level records from multiple datasets and a comprehensive set of analysis methods to investigate the 3 elements of student mobility. The importance of the study lies not only in the relevance of the results to inform NT's educational policy, practice enhancement and resource allocation, but also in it demonstrating the utility of the analysis methods for a broader understanding of and response to the high levels of population movement in the Northern Territory.

Chapter 1 Introduction

1.1 Introduction

The Australian education system for primary and secondary schools has been structured to deliver education incrementally at fixed school sites. This design carries an implicit assumption that, in general, students attending a school will come from a local catchment area and students will regularly attend the same school on a long-term basis.[1] In the Northern Territory (NT), education is compulsory for children in the age range of 6–17 years,[2] and a majority of NT students will attend at least 3 schools: primary school, middle school and high school. For these students, 'promotional' school changes from primary to middle and from middle to high school are necessary for their education, though such changes can be disruptive as students have to adjust to new classmates, new teachers, new classes and new schools.

For various reasons, many students have a greater number of school changes than those required for promotional changes. Such 'non-promotional' school changes are usually referred to as student mobility. However, an episode of student mobility may not result in the student's immediate enrolment in a new school and a student may delay enrolment either temporarily or permanently. A major reason for student mobility is when families change residence, with students leaving the original school and moving with their family. Both intrastate and interstate migration can lead to a change of residence and in turn student mobility. In addition to families moving residence, it has been widely reported that Aboriginal and Torres Strait Islander people (henceforth respectfully referred to as Aboriginal people in accordance with the preference of Aboriginal people in the NT) have a high level of temporary mobility as a result of a range of cultural, social and economic drivers.[4-8] These factors can also lead to high levels of both shorter-term and longer-term mobility among Aboriginal students.

Past studies have reported high levels of student mobility in the NT, including movement within the NT, interstate and overseas movements,[6,7] with Aboriginal students having higher mobility than their non-Aboriginal counterparts. Non-Aboriginal students are reported to have a high level of interstate mobility each year; while by contrast the mobility among Aboriginal students was more commonly within the NT and more common among Aboriginal students living in remote communities than those living in urban areas.[6,9] After an episode of mobility, some Aboriginal students may either stop attending school for an extended period or drop out of school altogether.

Students changing schools may cause some level of disruption to the normal delivery of education and affect the allocation of both funding and staffing resources in both the school from which the student moved and the new school.[1,10] At the school level, student mobility can affect the level and composition of service demand over time and space, and social and academic outcomes for both students who move and those who remain.[6,11] As for individual

students, changing schools frequently can disrupt their learning and negatively impact on their capacity to progress academically and also affect their school engagement.[1,6,10,12-16] As a result of these varying impacts, student mobility has been a major challenge for policymakers and educators within education systems.

1.2 Definitions and measurements of student mobility

While there is a large body of international and Australian literature investigating student mobility there is a lack of consensus on the definition of student mobility (called school mobility in some studies).[12,14,17-19] This inconsistency has complicated the utility of student mobility studies, including conceptualisation, naming, measurement, analysis, reporting, interpreting and translating research into policy and practice.

Some definitions of student mobility have been formulated to measure mobility at the school level. For example, the Joiners Plus Leavers (JPL) method was developed by Dobson et al.[17] and was later adopted by the United Kingdom Department for Children, Schools and Families as a consistent measure for mobility across all schools.[17] It has been widely used in many studies investigating student mobility both in Australia[12,14,16,18,20] and internationally. This method defined student mobility as any non-promotional school change, outside of those times expected for joining or leaving a school. It assesses student mobility by calculating the sum of all non-promotional enrolments and exits and expressing it as a percentage of the school's total enrolment for the same period. The joiners and leavers are students who join and leave the school outside of natural transition times respectively (hence referred to as non-promotional above). According to Dobson et al.[17] a mobility rate of 20–29% is considered 'high', while rates 30% or higher are considered 'very high'.

Taylor and Dunn[6] used 3 school-level measures to assess student mobility. The first one was for Student Movements, which were defined as movements between schools whenever students stop enrolment in one school and are enrolled in a different school. The Cumulative Enrolment Ratio was defined as 'the ratio of the total number of students enrolled compared to the average weekly enrolment (calculated across 40 school weeks per year) for a specified time period.[6] The Student Replacement Rate was defined as the average of student arrivals and student departures divided by the average student enrolment. The 3 measures together inform the amount of mobility relative to the total number of students enrolled for a specified period of time.

In this study, we investigated student mobility in relation to geographic location (which for the great majority of movements corresponded with the location of the school) and the characteristics of students in relation to their mobility. To the best of our knowledge, such investigation has not been previously reported in Australia.

1.3 Research questions

This study aimed to investigate the patterns of student mobility and characteristics of groups of children with varying patterns of movement. The expectations of the study were that an increased understanding of student mobility can inform policies and service models that respond to the needs of groups of students with different patterns of mobility including to inform the efficient and equitable delivery of education services.

The research questions of this study were:

1. What are the patterns of mobility of NT children in primary school years?
2. What are the characteristics of groups of children with different patterns of mobility?

Two types of mobility were investigated:

1. **School mobility,** which includes student movement:
   - from an NT Government (NTG) school to another NTG school
   - from an NTG school to a non-NTG school in the NT
   - from an NTG school to interstate.
2. **Geographic mobility,** which are the patterns of student movement: into, out of and between locations and between regions (with focused analysis of movement in East Arnhem, Big Rivers, Central regions).

Chapter 2 Methods and materials

2.1 Study design, participants and data sources

This was a retrospective observational study using linked individual-level data to investigate the patterns and characteristics of mobility among students of NTG schools. The study population consisted of primary school students enrolled in Year 1 to Year 6 in NTG primary schools during the period of 2005–2018. Students were selected into the study population from the Enrolment dataset provided by the NT Department of Education.

As the study aimed to investigate the destinations of student movement after departing a school during primary school years, enrolment and attendance records had some limitations. The limitations included a lack of information for students who stopped attending schools and then enrolled in non-NTG schools or who moved interstate or overseas. We therefore used a range of linked, de-identified administrative datasets in the NT Child Youth and Development Research Partnership (CYDRP) data repository to determine destinations. The data repository and its linkage process of these datasets have been described elsewhere.[21] The datasets used in this project are described below:

- **NT Government School Attendance and Enrolment** datasets: These datasets contain records of enrolment and daily attendance records for students of NTG schools. They were used to select children into the study cohort and to determine the status, timing and destinations of mobility.
- **NAPLAN** datasets: This dataset contained records for the outcomes of National Assessment Program – Literacy and Numeracy (NAPLAN) assessments from all NT schools, including both NTG and non-NTG schools. During the primary school period, NAPLAN is administered during Year 3 and Year 5. Results for NAPLAN assessments in Year 7 and Year 9 were not used as students were likely to change schools between Year 6 (the last year of primary school) to Year 7, (the first year of middle school) which is typically a promotional exit and not an episode of student mobility for the purposes of this study.
- **Immunisation** dataset:
    - In using immunisation records for determining the locations of students, we included all records in the search in order to maximise the coverage.
    - The utility of using immunisation records for this purpose can be demonstrated by the influenza vaccines. According to the *NT Immunisation Schedule, Children*[22,23] Aboriginal children aged 5–19 years should receive influenza vaccines annually and the vaccines are usually administered at community clinics. If a child has an immunisation record but does not appear in school attendance or enrolment data, this child can be deemed as still living in the NT but not attending an NTG school. The location of the administering clinics was used as a proxy for the child's residential location and the destination of the episode of mobility.

- **Primary Care Information System** (PCIS) dataset: This dataset contained clinical records of individuals who visited remote clinics managed by the NT Government. The data covered approximately half of all NT remote clinics. If a student had a consultation record in PCIS during an episode of student mobility for which the destination was not otherwise determined, the community where the clinic was located was deemed as the destination of the episode of mobility.
- **Hospital Separations** dataset: This dataset contained hospital separation data for all 6 NT public hospitals, including information on patients' residential locations. The recorded residential location at the time of an admission was used as the destination for an episode of mobility.
- **Emergency Department** dataset: This contained records of presentations to the Emergency Department of the 6 public hospitals in the NT, including patients' residential locations. The recorded residential location at the time of a presentation was used as the destination for an episode of mobility.

The information for location or community varied between the available datasets and was therefore standardised within the analysis to the Australian Bureau of Statistics (ABS) Statistical Area Level 2 (SA2). SA2 geography generally corresponds to an urban suburb or remote community, however in remote areas an SA2 may include more than one small community or a number of homelands. NT child protection data was also considered for use in the study however the only location variable in the Child Protection dataset was postcode. Postcodes for remote areas in the NT cover multiple locations and were therefore too granular for documenting mobility.

2.2 Definitions and categories of student mobility

As both longer and shorter terms of students' departures or absences from school can impact the delivery of school education episodes, we included both episodes of mobility due to changing schools as well as extended periods of absence from school. An episode of student mobility was defined by any of the following events within 2 categories:

A. A student was recorded as ceasing enrolment in one NTG school before the end of Year 6 (as recorded in the Enrolment dataset). The outcome of such mobility was classified under the following 4 subcategories:
    1. Moved to another NTG school: defined by an enrolment record in another NTG school starting after the departure from the original school
    2. Moved to a non-NTG school
    3. Moved interstate or overseas
    4. Other reasons or unknown.
B. A student was recorded as having 20 or more consecutive school days of un-notified absence. Under the Attendance - Compliance Guidelines for the NT Department of Education,[25] a student is defined to be in a Passive status of enrolment 'when the student has recorded 20 consecutive school days of un-notified absence and/or

unacceptable reason and the school has not received notification that the child is enrolled in another school.' In this report these extended periods of absence are referred to as a 'long absence'.

For Category A, we used information recorded in the field 'Reason for leaving' in the Enrolment dataset to classify enrolment records under the 4 subcategories. This field recorded the reasons why students terminated their enrolment and left school. Subcategories A-1 to A-3 were the major categories in this data field and could be readily assigned to these 3 subcategories. A range of other minor categories which could not be assigned to these 3 subcategories were lumped into subcategory A-4. For the 'long absence' category, both Enrolment and Attendance datasets were used to detect gaps in attendance.

Additionally, a proportion of students had concurrent enrolment records in more than one school and attendance data also showed that they attended these schools either alternatively or concurrently for various lengths of time. The study has used the status of **'dual enrolment'** for these students. Dual enrolment occurred for various reasons. Some students attended a second school for a specific class not available in their original school. In some cases, dual enrolment may also occur due to an administrative delay at the original school, before removing the student from the school enrolment list. The following rules were applied for the study after consultation with staff within the Department of Education:

1. Where the overlapping of 2 enrolment periods was 10 days or shorter, the dual enrolment is assumed to be an administrative delay, and enrolment at the second school is applied as an episode of mobility.
2. Episodes of dual enrolment exceeding 10 days were excluded as an episode of mobility. This included situations in which the entire enrolment period at the second school overlapped with the enrolment period at the first school.

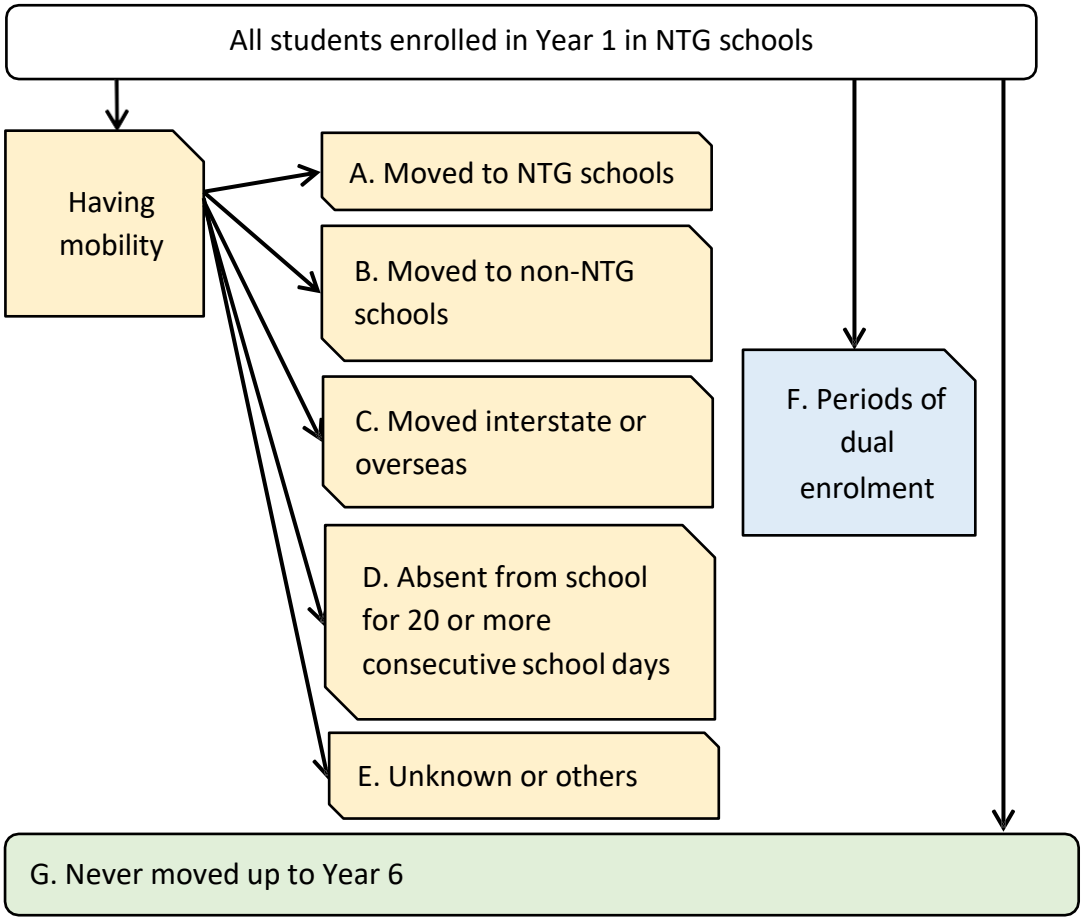
To further refine mobility activities, we identified students with dual enrolment in the Enrolment dataset and checked their attendance data in the Attendance dataset to exclude spells of attendance shorter than 10 days from the count of episodes of mobility.

As enrolment records for **distance education** facilities[i] were not associated with in-person attendance, students attending distance education were excluded in analysis. Also excluded from analysis were students who died during primary school years.

The various outcomes from the investigation of the status of the mobility of students are summarised in Figure 1.

[i] These included: Northern Territory School of Distance Education, Alice Springs School of The Air and Katherine School of The Air.

Figure 2.1: Possible outcomes for episodes of student mobility



Our preliminary analysis found inconsistencies in the recording of enrolment and attendance. For some students who did not change school, there was only one enrolment record for each calendar year; but for other similar students there were multiple enrolment records in the same calendar year. This inconsistency indicated it was not reliable to rely solely on a departure date to identify an episode of mobility. Further, we also found some students with attendance records for which there were no corresponding enrolment records and students with full day attendance records in multiple schools on the same day.

To improve data quality, the NT Department of Education introduced new processes of recording enrolment and attendance in 2013.[26] These enhancements created a break in the data series, making it inappropriate to compare the enrolment and attendance data prior to 2013 with the data for 2013 and onwards. Where appropriate, we have commented in the report, on the potential impact of this change in data collection processes on the results and present the results separately for the period prior to 2013 and the period of 2013–2018.

Data fields in the Enrolment dataset used for identifying episodes of student mobility included the following:

1. School id: a unique identifier for each NTG school

2. Enrolment date: the date on which a period of enrolment started; this is almost always recorded
3. Departure date: the date on which a period of enrolment finished; this is missing for many enrolment periods
4. Reason for leaving: the reason for students leaving school and terminating their enrolment
5. Passive flag: As explained above, this indicates a status of passive enrolment
6. Destination school name: containing information on the school the student intended to move to (information recorded was usually provided by parents, but might not always be correct)
7. Enrolment status: indicating the status of enrolment, which can be Current Main, Current Subsidiary (both used for dual registration) or Guest Pupil.

2.3 Search for destinations of episodes of student mobility

To determine the destinations of episodes of mobility, we first searched enrolment and attendance records for episodes of student mobility and classified these episodes under the categories listed in section 2.2. The starting point for the search was the date of the first enrolment record in any NTG school in Year 1 or, if students enrolled later than Year 1, any later primary school years in which they commenced school. The end point was 1st November in the year when a student was enrolled in Year 6 or the last day of enrolment in any NTG school, whichever came later. The choice of the end point on 1 November was to exclude early departures at the end of Year 6, which were not uncommon in our study population and may be promotional exits.

All episodes of mobility classified as 'Moved to a NTG school' involved a change from an existing school. We used the community or suburb in which the new school was located as the destination for the episode of mobility.

For episodes of mobility classified as 'Moved to a non-NTG school' or 'long absence', we conducted the following procedures sequentially to determine the dates and destinations for these episodes of mobility:

a) If a different school was recorded in the enrolment record for the episode of mobility, the community or suburb where the school was located was used as the destination and the date of enrolment in the new school was regarded as the date of the episode of mobility. The choice of this date instead of the last day of the previous enrolment period was necessary because of the high proportion of enrolment records which did not contain a departure date. This was also applied to the episodes classified under the category of 'Moved to a NTG school'.
b) Where there was no relevant information available in the Enrolment dataset, we searched the linked datasets listed in section 2.1 for their destinations. The search was conducted in the following sequence:
    a. Immunisation dataset
    b. Emergency Department dataset

c. Hospital Separations dataset
d. PCIS dataset
e. NAPLAN dataset (Years 3 and 5 only)

c) We searched in the Attendance dataset for periods of 'long absence'. All non-school days, public holidays and term breaks were excluded. We also calculated the length of each of these periods of long absence. This was used as the period in which the search in linked datasets for destinations was conducted.
d) For episodes of 'moved to a non-NTG school', the last known day for their last enrolment or attendance record before the episode of mobility was used as the date of occurrence for the episode. We searched the linked datasets for records during 180 days after the student's departure from the original school. Our preliminary analysis found the longer the duration used for the search, the greater the yield of matches. However, the chance of the location found in the search not being the immediate destination for an episode of mobility was likely to increase as the duration for the search increased. We therefore set the duration for the search at 180 days.

The level of location information was not consistent across the linked datasets used in this search (see Table 2.1). We therefore used the most refined level of available location information. On this basis, we retained all location data at the level of suburb/community (Immunisation & Hospitalisation datasets) when available. For the PCIS dataset, we used the community of the remote clinic as the location. For NAPLAN, we used the community/suburb of the school. For the Emergency Department dataset, we used the coordinates of the central point of the Statistical Area Level 2 (SA2) area as the destination location. Episodes of mobility for which the destinations could not be determined were classified under 'Unknown or others'.

Table 2.1: Types of location data available in the linked administrative datasets used in the search for destinations of episodes of student mobility

Dataset	Location data
Immunisation data	community/suburb/locality
Emergency Department	SA2
Hospitalisation	locality code
PCIS	clinic name/community
NAPLAN (Y3&5)	school id

2.4 Statistical analysis

2.4.1 Descriptive and inferential statistics

We first prepared descriptive statistics to describe the general characteristics of students and student mobility stratified by Aboriginal status. Differences between groups of students

were assessed with t-test or chi-square ($\chi 2$) test as appropriate. Analyses were conducted using Stata version 17 (Stata Corporation, College Station, TX, USA). A 2-tailed p-value <0.05 or a regression coefficient (COEF) with 95% confidence interval (CI) not inclusive of the unity was used to provided evidence for difference.

2.4.2 Network analysis using Gephi

For the investigation of the geographic patterns of student mobility, we performed network analysis with Gephi (Version 0.9.1).[27] Gephi is an open-source program which enables users to produce interactive, graphical visualisations of networks and conduct analysis of a variety of network characteristics. In Gephi, a network consists of 2 fundamental elements: nodes and edges. Nodes are usually the individuals or locations being studied while edges represent the connections between nodes. The 'degree' of a node is the sum of all edges connected to it. In the case of directed networks, degrees can be classified as either in-degrees (the number of incoming edges) or out-degrees (the number of outgoing edges). The degree of a node is then the sum of in-degrees and out-degrees. The weight of an edge may be assigned to be a measure of the edge while the weighted degree of a node is the sum of the weight of all the edges connected to it.

The focus of network analysis is on detecting groups of nodes which are more connected with nodes with the same group than with those outside of the group. In Gephi terms, these groups are called *communities*. Nodes within a *community* have more edges among them than they have to other nodes in the network than would be expected at random.[28] Gephi uses the Louvain method as the 'community detection algorithm' to unfold and identify distinctive communities in large networks.[29] The algorithm creates a modularity class value for each *community* and this can be used to assign different colours to the identified *communities* in the visualisations. To avoid confusing the *communities* detected with Gephi with the communities used in terms such as 'remote NT communities', we refer to the *communities* identified with Gephi as "clusters" of localities.

In this study, we used the community or suburb of the residential location of a student or the school a student was enrolled in as the node. We did not use schools as nodes because the destinations of episodes of mobility were not necessarily schools (for example, destinations of long absence could be localities). We regarded an episode of mobility as a directed edge (i.e. directional, from the source node to the target node) and the number of episodes of mobility recorded between 2 communities/suburbs as the weight of that edge. The weighted degree of a node was calculated as the sum of the episodes of mobility (both incoming and outgoing) of the node. We presented nodes in proportional sizes in the range of 5–15, according to their ranking in weighted degree. We also calculated the average weighted degree for each session of network analysis, which was calculated by dividing the sum of weighted degrees by the total number of nodes. The average weighted degree measures the average number of episodes of mobility per locality in this study.

For the visualisations of networks, we imported data on student mobility into Gephi as geodata and applied the Geo-layout to produce visualisations of the networks on a background map of the NT. As the number of localities was high and some localities were close to one another, many localities appeared overlapped either in full or partially in the visualisation. To improve the presentation, we adjusted the locations of these localities slightly. Therefore, the localities shown in the visualisations should not be deemed as being at their exact location. For areas with localities very close to one another (such as suburbs of Darwin and Alice Springs), it was not possible to shift their locations to successfully achieve this purpose, so we elected to keep them as they were in the visualisations. We first filtered the data by applying a suitable degree range to exclude unconnected nodes and edges to facilitate the detection of clusters of connected localities with modularity analysis. We started the modularity analysis with the default setting, which included the randomised function, 'Resolution = 1.0' and the number of classes starting from zero. This approach uses a randomly selected starting point to optimise the distribution of nodes each time the modularity analysis is conducted. When necessary, we varied the degree range and/or the resolution of modularity analysis to achieve optimal results. In addition, for regional deep-dives, we calculated and reported the numbers of inflows, outflows and within-region mobility for the region and the clusters detected with modularity analysis. For individual locality within each detected cluster, we calculated and reported the numbers of inflows and outflows as well as their destination or source localities.

As the length of paths and the associated network characteristics within the networks were not the focus of this investigation, measures related to path lengths (such as closeness and betweenness centrality) were not analysed.

Our preliminary analysis showed significant differences between Aboriginal and non-Aboriginal students across the various mobility related variables included in the analysis. We therefore did not conduct network analysis for all students combined but stratified the analyses for Aboriginal and non-Aboriginal students separately.

2.4.3 Latent class analysis

Latent Class Analysis (LCA) is a statistical method which can identify unobserved, homogeneous latent groups (classes) of study participants based on a set of observed variables. For this component of analysis, we hypothesised that there were distinct groups of students in the study cohort who shared similar characteristics and patterns of mobility. We used LCA to detect such groups of students, estimate the probability of a student belonging to their respective group (expressed as proportions of the whole study cohort) and the number of children in each group, and analysed the characteristics of each group identified.

In fitting LCA models, we included the following variables related to student mobility as categorical variables:

- Number of mobility episodes (in categories of 0, 1, 2, 3–4, 5+)
- Ever moved to a non-NTG school (true or false)
- Ever moved interstate or overseas (true or false)
- Ever moved between urban locations (referring to 'regional centres', which were Darwin, Palmerston, Katherine, Nhulunbuy, Tennant Creek and Alice Springs) and remote locations, and consisting of the following categories:
    - No movement at all
    - Ever moved from remote to remote only
    - Ever moved from urban to urban only
    - Ever moved from remote to urban or from urban to remote
    - Mixed patterns of movement (having more than one type mentioned above)

After determining the best fit LCA model, we conducted post-hoc analysis on the following variables for each class (variables marked with * were sourced from the Student Information dataset provided by the Department of Education):

- Sex
- Aboriginal status
- Speaking English as a second language (ESL)*
- Annual attendance rate for Preschool (3 levels: <60%, 60–79%, ≥80%)
- Annual attendance rate for Year 3 (3 levels: <60%, 60–79%, ≥80%)
- Not participating in NAPLAN for both Year 3 and Year 5 (recorded as 'absent' in NAPLAN dataset)
- Calendar month of mobility (calculated as the proportion of all episodes of mobility)
- Year level at first episode of mobility
- Region (6 regions: Darwin, Top End, East Arnhem, Big Rivers, Barkly, Central; this variable was not included for the regional deep-dives, calculated as the proportion of all episodes of mobility originating from the region).

Our preliminary analysis found inconsistencies in recording enrolment and attendance, which were most likely caused by administrative lag in updating students' records. Most of these inconsistencies occurred in the earlier part of the study period. To reduce any bias that may result from these inconsistencies, we restricted the LCA to Year 1 enrolment cohorts from 2009 to 2012. This selection provided for the inclusion of students with the potential for complete follow-up from Year 1 to Year 6, and within the end point of available data in 2018. Data for students enrolled in Year 1 in 2013 were not included because some of these students may not have completed Year 6 in 2018.

We applied the following inclusion criteria to select the study cohort for LCA:

1. A student's first enrolment record was Year 1 in the years from 2009 to 2012
2. A student's first enrolment record was in an NT Government school
3. The age of the student at first enrolment was between 5 and 7 years.

All records of enrolment and attendance from Year 1 to Year 6 of the selected students were included in the analysis. We first performed univariate analysis with chi-squared analysis on demographic and mobility-related variables to assess the differences between Aboriginal and non-Aboriginal students. The LCA was conducted using Mplus (version 8.8) following guidelines published in recent literature.[30,31] We started with a 2-classes solution and iteratively increased the number of classes up to 6 classes where appropriate or until all the likelihood-ratio tests performed yielded a statistically non-significant p-value.

A number of statistical criteria were used to assess the model fit. Firstly, we used the following statistical criteria in the determination of the number of classes for the best fit model: Consistent Akaike information criterion (AIC), Bayesian information criterion (BIC) and adjusted BIC (aBIC). Lower values of these measures indicate better model fit. We mainly used the lowest values of aBIC produced by the series of LCA models we produced to guide our model selection. Further, we used entropy to assess the quality of classification (values closer to 1.0 indicate better discrimination between classes and thus better model), and the likelihood-ratio between the different models. In addition, for each model, we performed Vuong-Lo-Mendell-Rubin test (VLMR-LRT), Lo-Mendell-Rubin adjusted likelihood-ratio test (LMR-A-LRT) and the bootstrapped parametric likelihood ratio test (PB-LRT) to determine whether the current model with *k* classes was better compared with the previous model tested with *k-1* classes. Finally, we also considered the interpretability of the models.

Chapter 3 Student mobility across the Northern Territory

Key findings

Descriptive statistics

- A total of 68,089 students who enrolled in public primary schools in the NT between 2005 and 2018 were included in this study (40.4% being Aboriginal and 59.6% non-Aboriginal students).
- Aboriginal students were more likely than non-Aboriginal students to have episodes of mobility, and the proportion of both groups who ever moved increased over the study period. In the most recent 3 years of the study period (2015–2018), the proportion of students having any episode of mobility each year were 24.7% and 12.1% for Aboriginal and non-Aboriginal students respectively.
- The majority of both Aboriginal and non-Aboriginal students who ever moved, moved only once in the same calendar year, but Aboriginal students were more likely to move more than once each year.
- In terms of destinations, Aboriginal students most commonly moved to another NTG school while non-Aboriginal students most commonly moved interstate or overseas.
- In the period 2016–2018, mobility tended to decrease as year level increased and was lowest among Year 6 students, for both Aboriginal and non-Aboriginal students.

Network analysis

- For Aboriginal students, 5 clusters of localities were identified in which student mobility between localities within the cluster was more common than movement to other localities. The clusters were named: Darwin-Top End cluster (21.8% of all mobility); Arnhem Land cluster (covering both east and west Arnhem Land and accounting for 7.7% of all mobility); Big Rivers West cluster (49.4% of all mobility); Big Rivers East cluster (7.1% of all mobility) and Central cluster (covering both Barkly and Central regions, 14.1% of all mobility).
- For non-Aboriginal students, 4 clusters were identified: Greater Darwin (10.9% of all mobility); Top End-Arnhem Land (12.8%); Big Rivers (3.9%); and Central (72.4%).

Latent class analysis

- Groupings of students with different characteristics of mobility were assessed for the annual Year 1 cohorts commencing from 2009 to 2012. Aboriginal and non-Aboriginal students were different across almost all demographic and mobility-related variables available for the study, which therefore required separate analysis by Aboriginal status.
- For the 3,631 Aboriginal students in the study cohort, the analysis identified 5 groups, with varying probability of the various mobility characteristics:

- **Once-off movers** (4.2% of the study cohort), tended to move only once, moved from remote to remote locations and included a probability of interstate movement (38.6%).
- **Occasional movers** (6.9% of cohort), moved twice, moved from urban to urban locations (97.2%) with similar probability of moving interstate (31.6%).
- **Frequent movers** (1.9% of cohort), moved 3 or more times, commonly between urban and remote locations (68.7%) and with a higher probability of interstate movement (43.9%).
- **Intrastate movers** were a large group (37.8% of cohort) who moved one or many times including from remote to remote (42.1%), urban to urban locations (32.5%) and urban to remote (24,4%). This group did not move interstate.
- **Stayers** were the largest group (49.2% of cohort) and did not have a record of movement.

- For the 6,240 non-Aboriginal students in the study cohort, the analysis identified 6 groups. The 3 largest groups were termed: **Stayers** (57.7% of cohort) with no movement, **Once-off interstate movers** (19.7% of cohort) and **Once-off intrastate movers** (13.0% of cohort).

3.1 Overview of chapter

This chapter presents the results of analyses of the patterns and characteristics of student mobility for all students enrolled in NT Government schools between 2005 and 2018. We report descriptive information for student mobility in section 3.2. Firstly, we report the number of students with a record of enrolment each calendar year. This represents the size of the study cohort and provides the denominators for calculating the proportion of students who moved. The level of student mobility is presented in section 3.2.2. Next, in section 3.2.3, we present results for categories of student mobility by the type of destination. For the purpose of examining seasonal patterns of mobility episodes, the timing of mobility episodes by month of year is presented in section 3.2.4. These results are presented as the average monthly number of episodes of mobility by 4 time periods, 2005–2008, 2009–2012, 2013–2015 and 2016–2018. Finally, in section 3.2.5, we present the frequency of student mobility by year level to demonstrate the differences in the number of episodes of mobility between year levels of primary school.

The results for the analysis of the patterns of student mobility are presented in section 3.3. The focus of this analysis was on the *clusters of localities* with greater student mobility between them (than expected by random) and the number of episodes of mobility recorded for these localities, including both the source localities (the places from which students left school) and the target localities (the destinations for students after leaving a school). We report the results of network analysis, using Gephi software, with geo-layout visualisations to display the clusters of localities identified in Gephi together with the associated network

statistics. We first present the results for all NT Aboriginal students followed by results for non-Aboriginal students.

In the final section, section 3.4, the focus is on students. This analysis identified *groups of students* who shared similar characteristics in relation to mobility. As described in section 2.4.3, the study cohort selected for this analysis were Year 1 students enrolled during the period 2009–2012 and thus likely to complete primary school by 2018. In section 3.5.1, we compare the characteristics of Aboriginal and non-Aboriginal students using the variables available for the LCA and from supplementary or "post-hoc" analysis. As this comparison demonstrated substantial differences between Aboriginal and non-Aboriginal students for almost all variables, we conducted separate LCA for each population. The results for Aboriginal and non-Aboriginal students are presented in section 3.4.2 and section 3.4.3, respectively.

3.2 Descriptive statistics

Descriptive statistical analysis was performed after excluding enrolment records for those who were deceased or otherwise excluded, including records not relevant to the primary school period and records for distance education (including records for Katherine School of the Air, Alice Springs School of the Air, and Northern Territory School of Distance Education). Of the remaining 68,089 students, Aboriginal status was not recorded or unknown for 381 students. These were excluded from the analysis, leaving a total of 67,708 students in the final study cohort (40.4% being Aboriginal and 59.6% non-Aboriginal). As described in section 2.2, where appropriate, we accommodate the potential impact of the enhanced enrolment recording processes introduced in 2013 and describe the statistics separately for the period prior to 2013 and the period between 2013 and 2018 (referred to as Period 1 and Period 2, respectively).

3.2.1 Annual student enrolment and mobility

On average, there were 14,610 students ever enrolled in public primary schools in the NT each year between 2005 and 2018. There was no evident trend in numbers of either Aboriginal or non-Aboriginal students in Period 1, but from the start of Period 2, in 2013, there was an evident increase in the number of students enrolled for both Aboriginal students (from 5,629 in 2013 to 6,802 in 2018) and non-Aboriginal students (from 9,266 in 2013 to 9,680 in 2018, Figure 3.1).

As shown in Figure 3.2, in Period 1, the proportion of Aboriginal students enrolled who had any episode of mobility remained at about 15% between 2005 and 2010, and then increased to 17%–18% in 2011–2012. In Period 2, there was a decrease between 2012 and 2014, after which the proportion increased sharply from 15.9% in 2014 to 26.2% in 2018, an increase of 64.8%. Among non-Aboriginal students, during Period 1, the proportion of students with an episode of mobility decreased from 20.0% in 2005 to 13.3% in 2010 and then, similar to

Aboriginal students for the same period, increased to 16% and 18% in 2011 and 2012. At the beginning of Period 2, the proportion of non-Aboriginal students with an episode of mobility dropped to much lower levels (9.7% and 7.8% in 2013 and 2014 respectively). The proportion then increased to 12.4% in 2018, which, like Aboriginal students, was also a substantial 59.0% increase.

Judging by the more recent results in Period 2, Aboriginal students were more likely than non-Aboriginal students to have an episode of mobility. The proportion of students who had any mobility had been increasing for both groups of students during this period. In the most recent 3 years of the study period (2015–2018), an average of 24.7% of Aboriginal students had an episode of mobility each year while for non-Aboriginal students the average proportion was 12.1%, an approximately 2-fold difference.

Figure 3.1: Number of students ever enrolled in NTG schools in a calendar year, for Aboriginal, non-Aboriginal and total students, Northern Territory, 2005–2018

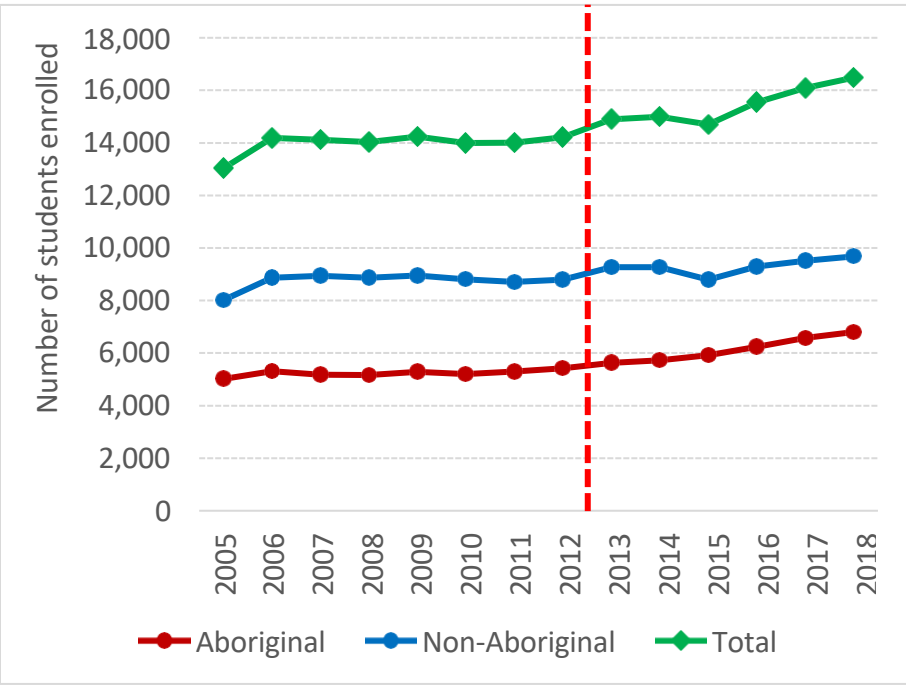
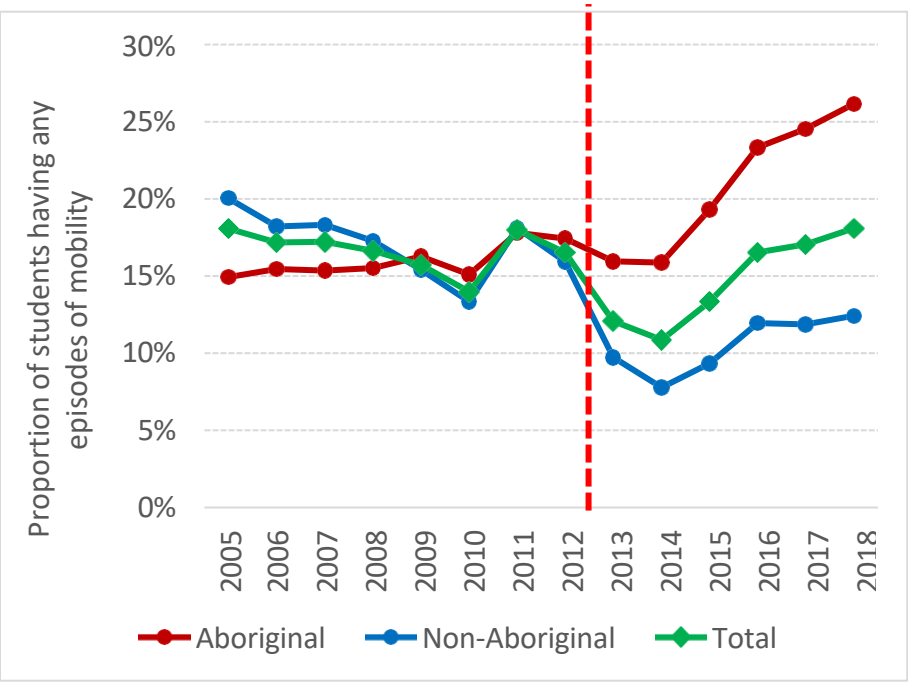


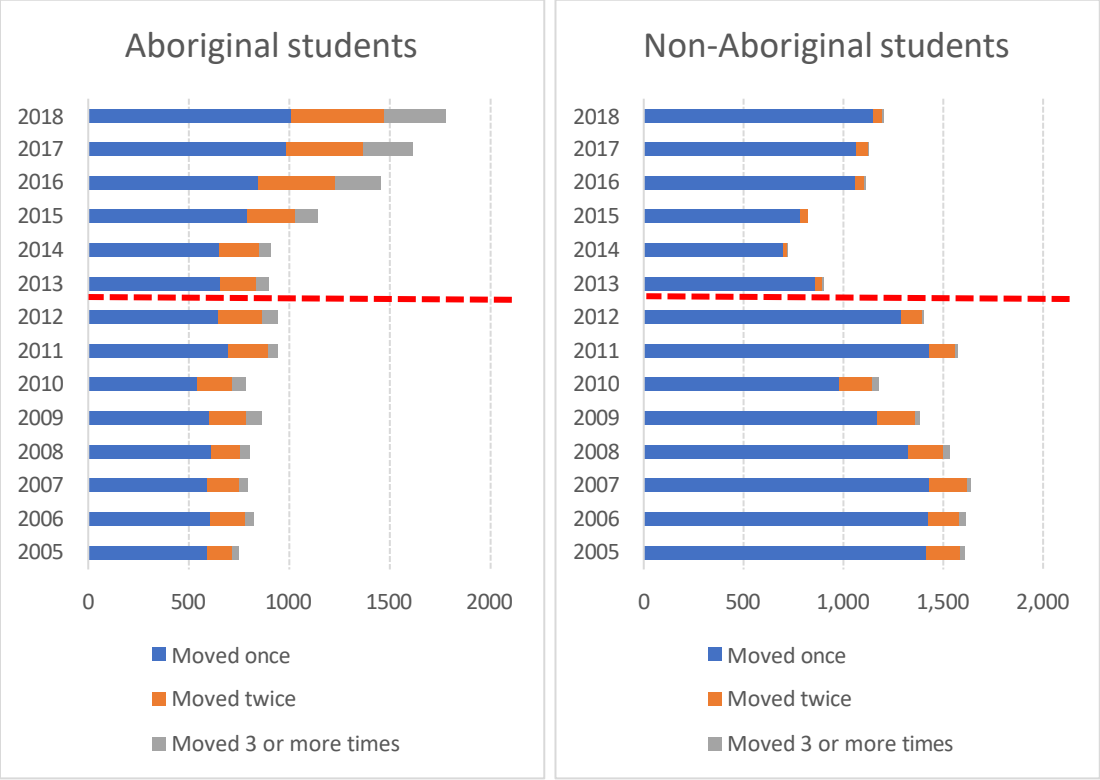
Figure 3.2: Proportion of students enrolled in NTG schools who had any episode of mobility, for Aboriginal, non-Aboriginal and total students, Northern Territory, 2005–2018



3.2.2 Levels of student mobility

The results for the frequency (or level) of episodes of mobility for individual students within a calendar year are presented in Figure 3.3. A majority of students who moved only moved once in the same calendar year for both Aboriginal and non-Aboriginal students throughout the study period. However, the number of students who moved 2 and 3 or more times in a calendar year were both consistently higher among Aboriginal students than non-Aboriginal students. Noticeably, the number of Aboriginal students who moved 3 or more times increased considerably in the last 4 years of the study period (2015–2018) compared with previous years. There were very few non-Aboriginal students who moved 3 or more times in a calendar year (fewer than 10 since 2012). Further, in Period 2, there was an increasing trend in the total number of Aboriginal students with any level of mobility. By contrast, among non-Aboriginal students, the number of students with any level of mobility increased markedly from 2015 to 2016 and then increased only slightly through 2016 to 2018.

Figure 3.3: Number of students and level of mobility, by year, for Aboriginal and non-Aboriginal students, Northern Territory, 2005–2018

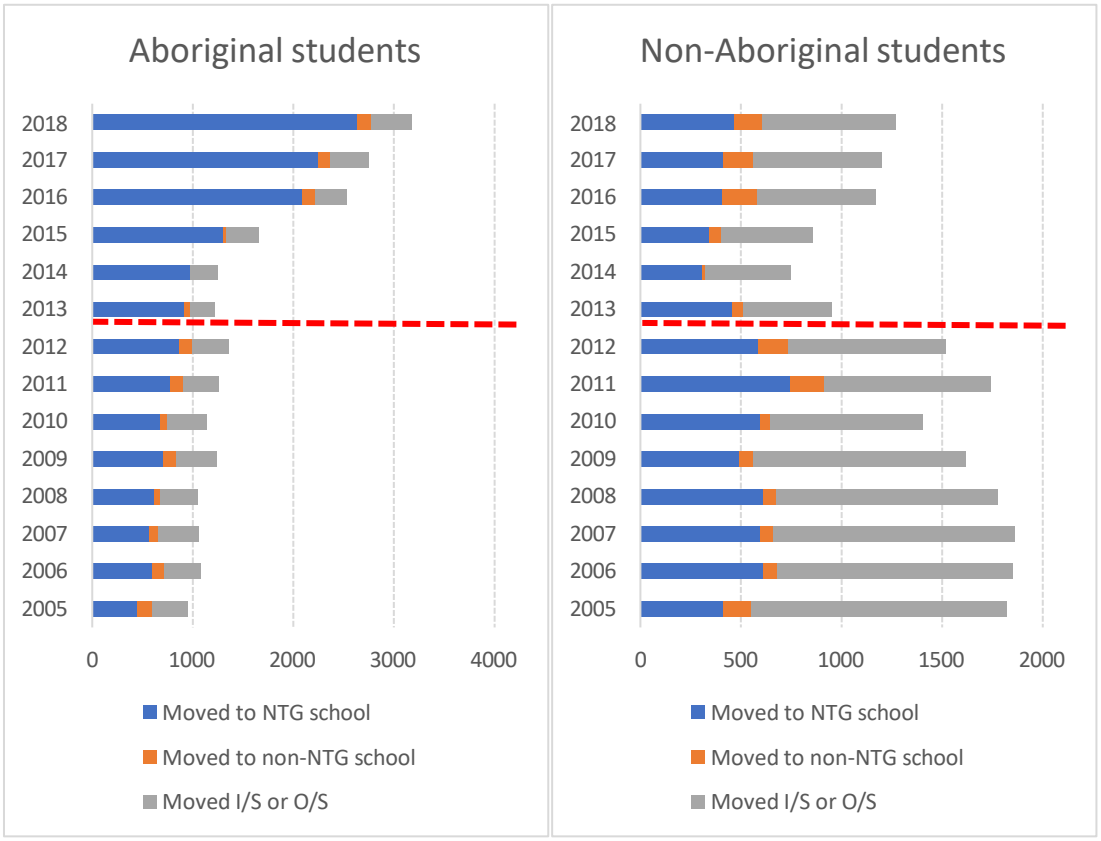


3.2.3 Categories of student mobility

In the analysis of the patterns of student mobility by mobility categories, we first excluded enrolment records that involved no record of an episode of mobility or were classified as 'Other or unknown', and then examined the remaining records (Figure 3.4).

Among Aboriginal students, the dominant category of mobility was 'moved to NTG school' across the whole study period. The total annual number of episodes of mobility increased substantially from 2005 to 2018, and the greatest increase occurred in the category of 'Moving to NTG school'. By contrast, among non-Aboriginal students, the dominant category was consistently 'Moved interstate or overseas' throughout the whole period. The total number of mobility episodes by category, for non-Aboriginal students, appeared to have decreased moderately from Period 1 to Period 2. The number of episodes for the category 'Moved to NTG school' did not show any evident trend over time. The category 'Moved to non-NTG school' only represented a small proportion in both groups of students. The number of episodes of 'Moved interstate or overseas' was substantially greater in non-Aboriginal students than in Aboriginal students throughout the period. In summary, among students who left NTG primary schools, Aboriginal students were more likely to move to another NTG school while non-Aboriginal students were more likely to move interstate or overseas.

Figure 3.4: Number of episodes of mobility for students and category of mobility, by year, for Aboriginal and non-Aboriginal students, Northern Territory, 2005–2018



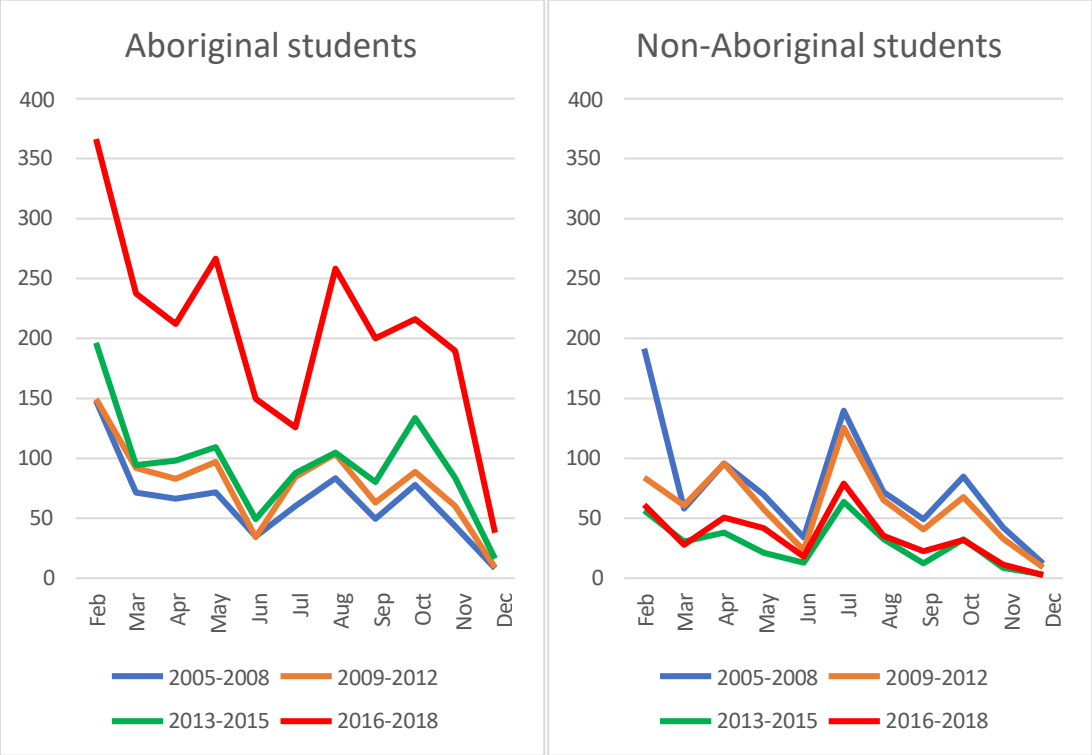
Note: I/S – interstate, O/S - overseas

3.2.4 Timing of student mobility

The timing of the episodes of mobility was examined by the average number of episodes by calendar month. To facilitate interpretation, we divided the study period of 14 years into 4 shorter periods, with 2 periods before 2013 and 2 from 2013 to 2018. The 4 periods were 2005–2008, 2009–2012, 2013–2015 and 2016–2018. The average number of episodes of mobility for these periods by calendar month are presented in Figure 3.5.

The average numbers of episodes of mobility were consistently highest in January and February which is consistent with movement of families to new locations at the start of each year. For presentation purposes the large average number of episodes of mobility in January are not presented in Figure 3.5. For Aboriginal students, after excluding January and February, the months with higher average numbers of mobility episodes were May, August and October. For non-Aboriginal students, the months with highest student mobility were July, April and October.

Figure 3.5: Average number of episodes of student mobility, by month, for 4 time periods (2005–2008, 2009–2012, 2013–2015 and 2016–2018) for Aboriginal and non-Aboriginal students, Northern Territory

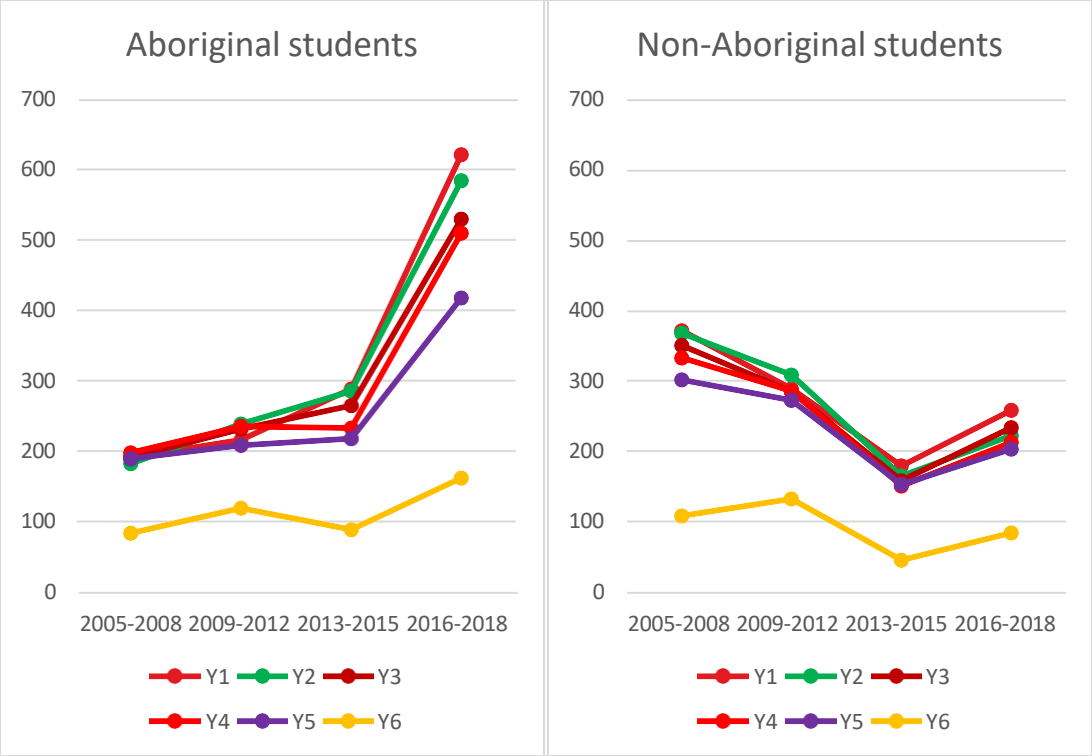


3.2.5 Frequency of student mobility by year level

We examined the distribution of mobility episodes by year levels of primary school and present the averages for the 4 periods (2005–2008, 2009–2012, 2013–2015 and 2016–2018) in Figure 3.6. Among Aboriginal students, there was a substantial increase in the average episodes of mobility for all primary school years in the period 2016–2018. Across the first 3 time periods, mobility was similar across Years 1 to 5 and lower in Year 6. In the period from 2016 to 2018, there appears to be a gradient across all school years with the highest average number of episodes of mobility in Year 1 and lowest average in Year 6.

Among non-Aboriginal students, there was a decrease in annual mobility episodes, for all year levels, from 2009–2012 to 2013–2015, followed by a small increase in 2016–2018. Across the 4 time periods, mobility was similar for Year 1 to Year 5 and lower for Year 6 students.

Figure 3.6: Average numbers of episodes of student mobility, by year level, for 4 time periods (2005–2008, 2009–2012, 2013–2015 and 2016–2018) for Aboriginal and non-Aboriginal students, Northern Territory



3.3 Network analysis with Gephi

In this analysis, all episodes of mobility were used, including those determined using enrolment records and the long absences. For students with dual enrolments (or, overlapping enrolment records), we checked their attendance records and eliminated short spells of attendance (shorter than 10 consecutive school days) before determining their mobility status. As the focus for this part of the study was on the destination locations of student mobility, we excluded episodes of mobility where the destination was the same location as the original school (which is consistent with a student not attending a school but not leaving the community or suburb where they lived).

In the process of network analysis, we used degree ranges to filter out localities (nodes) with low numbers of episodes of mobility (edges) to facilitate the detection of clusters of localities while keeping the proportion of episodes visible in the visualisation at a high level (we set the target at 80%). This was followed by the modularity analysis to detect clusters of localities.

3.3.1 Aboriginal students

In the analysis for Aboriginal students, we first filtered out localities with low numbers of mobility episodes using the degree range of 37–158. This means that the maximal number of episodes of mobility linked to a locality was 158, and that localities with fewer than 37 episodes of mobility were hidden from the visualisation and excluded from modularity analysis. This degree range allowed 80.6% of edges and 57.1% of nodes to be included in the visualisation. The average weighted degree was 311.1, which means, on average, there were 311.1 episodes of mobility linked to an individual locality included in the analysis.

We started the modularity analysis with the default value of resolution (1.0) and adjusted the resolution to optimise the cluster detection process taking into consideration practicability of clusters detected and the value of modularity score (value close to 1 indicates strong community structure). The final resolution adopted was 0.7, which yielded a modularity score of 0.164 and detected 7 clusters (Figure 3.7). The 7 clusters have been named to align with the corresponding NT regions or location: Barkly, Borroloola-Robinson River, Darwin-Top End, Big Rivers West, Arnhem Land, Big Rivers East and Central.

Table 3.1 provides a summary of mobility episodes by source and target clusters. Overall, Central, Arnhem Land and Darwin-Top End clusters were the top 3 clusters both as source clusters and target clusters. These 3 clusters also recorded the highest number of mobility episodes occurring within the same cluster. Detailed statistics on inflows, outflows and within-cluster flows are presented for each cluster below.

Figure 3.7: Clusters of localities detected with modularity analysis in Gephi, Aboriginal students, Northern Territory, 2005–2018

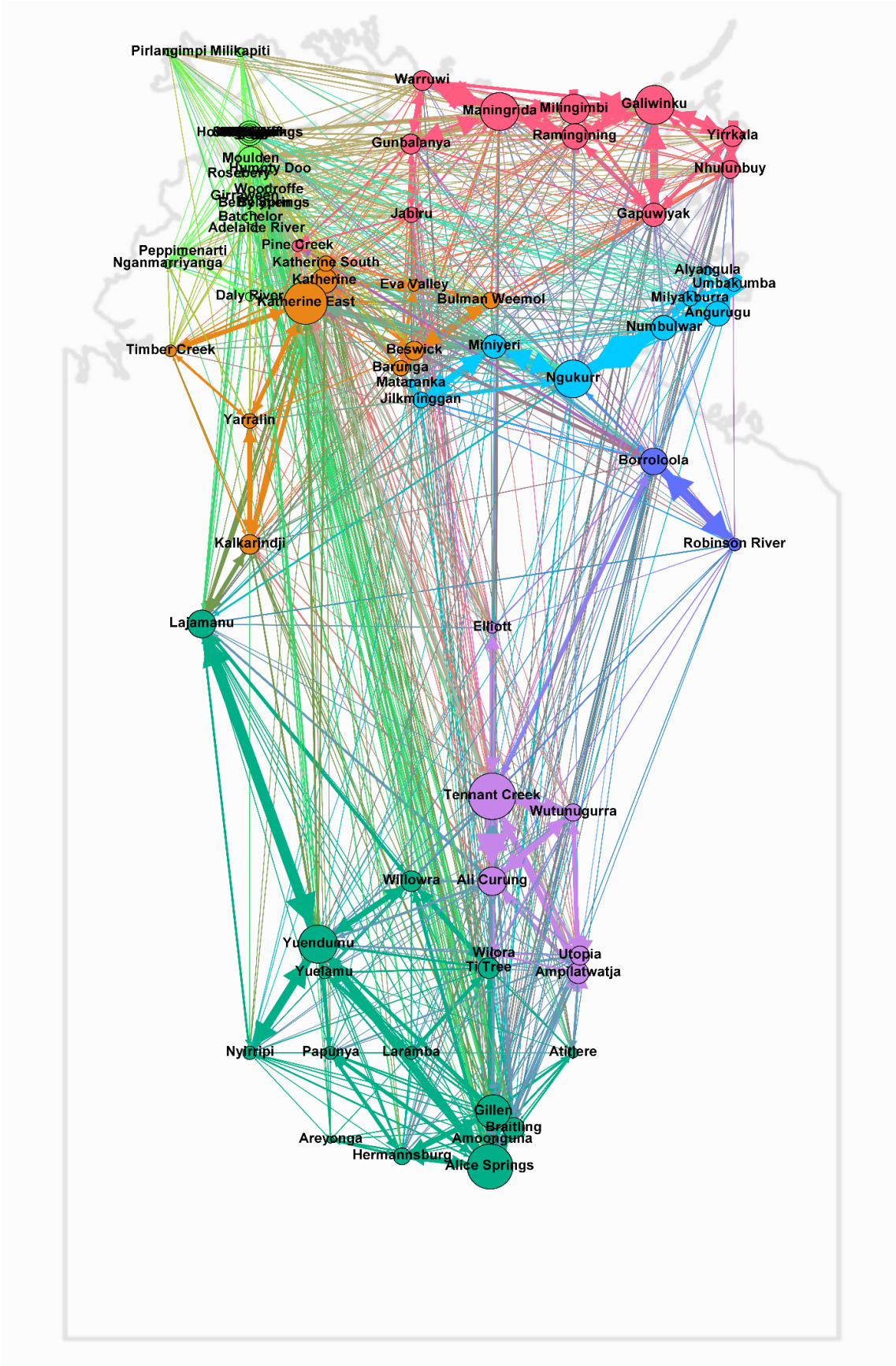


Table 3.1: Summary of the number of episodes of mobility, by source and target cluster, Aboriginal students, Northern Territory, 2005–2018

Source cluster	Target cluster							Total	%
	Barkly	Borroloola-Robinson River	Darwin-Top End	Big Rivers West	Arnhem Land	Big Rivers East	Central		
Barkly	1,902	90	147	168	36	19	695	3,057	11.0%
Borroloola-Robinson River	70	312	90	97	57	99	41	766	2.8%
Darwin-Top End	151	91	3,252	423	866	212	371	5,366	19.4%
Big Rivers West	144	89	483	2,039	281	417	292	3,745	13.5%
Arnhem Land	38	48	912	293	3,922	167	91	5,471	19.8%
Big Rivers East	13	103	220	399	185	2,385	59	3,364	12.1%
Central	680	42	363	289	94	56	4,395	5,919	21.4%
Total	2,998	775	5,467	3,708	5,441	3,355	5,944	27,688	
%	10.8%	2.8%	19.7%	13.4%	19.7%	12.1%	21.5%		

A. Darwin-Top End cluster (light green nodes)

This cluster consisted of suburbs of Darwin and Palmerston, towns within Litchfield Shire (Berry Springs, Girraween, Howard Springs and Humpty Doo) and a number of remote communities located in the northern and western part of the Top End region (Adelaide River, Batchelor, Belyuen, Daly River, Milikapiti, Nganmarriyanga, Peppimenarti and Pirlangimpi). As shown in Table 3.2, a large proportion of the total mobility episodes were within-cluster type (42.9%). Arnhem Land, Big Rivers West and Central clusters were the top 3 clusters for both outflows and inflows.

Table 3.2: Number of episodes of inflow and outflow between clusters and within-cluster mobility, Aboriginal students, Darwin-Top End cluster, 2005–2018

Mobility type	Source / Target cluster						Total	%
	Barkly	Borroloola-Robinson River	Big Rivers West	Arnhem Land	Big Rivers East	Central		
Outflows	151	91	423	866	212	371	2,114	27.9%
Inflows	147	90	483	912	220	363	2,215	29.2%
Within-cluster							3,252	42.9%
Total	298	181	906	1,778	432	734	7,581	
% (total of inflows and outflows)	6.9%	4.2%	20.9%	41.1%	10.0%	17.0%		

B. Arnhem Land cluster (red nodes)

This cluster centred on localities in West and East Arnhem Land and included Galiwinku, Gapuwiyak, Gunbalanya, Jabiru, Maningrida, Milingimbi, Nhulunbuy, Pine Creek, Ramingining, Warruwi and Yirrkala. As shown in Table 3.3, more than half of the overall mobility episodes occurred within the cluster (56.1%). Darwin-Top End cluster recorded by far the highest numbers of inflows to and outflow from this cluster. It was followed by Big Rivers West and Big Rivers East clusters in both outflows and inflows.

Table 3.3: Number of episodes of inflow and outflow between clusters and within-cluster mobility, Aboriginal students, Arnhem Land cluster, 2005–2018

Mobility type	Source / Target cluster						Total	%
	Barkly	Borroloola-Robinson River	Darwin-Top End	Big Rivers West	Big Rivers East	Central		
Outflows	38	48	912	293	167	91	1,549	22.2%
Inflows	36	57	866	281	185	94	1,519	21.7%
Within-cluster							3,922	56.1%
Total	74	105	1,778	574	352	185	6,990	
% (total of inflows and outflows)	2.4%	3.4%	58.0%	18.7%	11.5%	6.0%		

C. Big Rivers West cluster (brown nodes)

Located in the western part of the Big Rivers region, this cluster contained the service centre of Katherine, and the following localities: Barunga, Beswick, Bulman-Weemol, Eva Valley, Kalkarindji, Timber Creek and Yarralin. As shown in Table 3.4, overall, episodes of mobility distributed relatively evenly across the 3 types of mobility with the within-cluster type accounting for the highest proportion at 37.7%. Darwin-Top End and Big Rivers East clusters were the dominant clusters for both outflows and inflows, followed by Arnhem Land and Central clusters.

Table 3.4: Number of episodes of inflow and outflow between clusters and within-cluster mobility, Aboriginal students, Big Rivers West cluster, 2005–2018

Mobility type	Source / Target cluster						Total	%
	Barkly	Borroloola-Robinson River	Darwin-Top End	Arnhem Land	Big Rivers East	Central		
Outflows	144	89	483	281	417	292	1,706	31.5%
Inflows	168	97	423	293	399	289	1,669	30.8%
Within-cluster							2,039	37.7%
Total	312	186	906	574	816	581	5,414	
% (total of inflows and outflows)	9.2%	5.5%	26.8%	17.0%	24.2%	17.2%		

D. Big Rivers East cluster (light blue nodes)

This cluster consisted of localities in the eastern part of the Big Rivers region, namely, Jilkminggan, Mataranka, Miniyeri, Ngukurr and Numbulwar. It also extended to Groote Eylandt and Bickerton Island in the East Arnhem region to include the following localities: Alyangula, Angurugu, Umbakumba and Milyakburra. Over half (55.0%, Table 3.5) of mobility episodes occurred within the cluster with the balance equally distributed between the other 2 types: inflows (22.4%) and outflows (22.6%). Big Rivers West cluster was the dominant cluster for both outflows and inflows, followed by Darwin-Top End and Arnhem Land clusters.

Table 3.5: Number of episodes of inflow and outflow between clusters and within-cluster mobility, Aboriginal students, Big Rivers East cluster, 2005–2018

Mobility type	Source / Target cluster						Total	%
	Barkly	Borroloola-Robinson River	Darwin-Top End	Big Rivers West	Arnhem Land	Central		
Outflows	13	103	220	399	185	59	979	22.6%
Inflows	19	99	212	417	167	56	970	22.4%
Within-cluster							2,385	55.0%
Total	32	202	432	816	352	115	4,334	
% (total of inflows and outflows)	1.6%	10.4%	22.2%	41.9%	18.1%	5.9%		

E. Borroloola-Robinson River cluster (blue nodes)

This was a small cluster containing 2 localities: Borroloola and Robinson River. Only a quarter of mobility episodes occurred within the cluster (25.4%, Table 3.6), with

approximately equal proportions of inflows (37.7%) and outflows (36.9%). The top 3 clusters for both inflows and outflows were Big Rivers East, Big Rivers West and Darwin-Top End.

Table 3.6: Number of episodes of inflow and outflow between clusters and within-cluster mobility, Aboriginal students, Borroloola-Robinson River cluster, 2005–2018

Mobility type	Source / Target cluster						Total	%
	Barkly	Darwin-Top End	Big Rivers West	Arnhem Land	Big Rivers East	Central		
Outflows	70	90	97	57	99	41	454	36.9%
Inflows	90	91	89	48	103	42	463	37.7%
Within-cluster							312	25.4%
Total	160	181	186	105	202	83	1,229	
% (total of inflows and outflows)	17.4%	19.7%	20.3%	11.5%	22.0%	9.1%		

F. Central cluster (green nodes)

This cluster consisted of suburbs of Alice Springs and remote communities in Central Australia including: Amoonguna, Areyonga, Atitjere, Braitling, Gillen, Hermannsburg, Laramba, Nyirripi, Papunya, Ti Tree, Willowra, Yuelamu and Yuendumu, as well as Lajamanu in the Big Rivers region. As shown in Table 3.7, nearly 60% of all mobility episodes belonged to the within-cluster type (58.9%) with about 20% belonging to each of the other 2 types. The Barkly cluster was the closest related cluster to the Central cluster, accounting for 44.7% of its total of inflows and outflows, followed by Darwin-Top End (23.9%) and Big Rivers West clusters (18.9%).

Table 3.7: Number of episodes of inflow and outflow between clusters and within-cluster mobility, Aboriginal students, Central cluster, 2005–2018

Mobility type	Source / Target cluster						Total	%
	Barkly	Borroloola-Robinson River	Darwin-Top End	Big Rivers West	Arnhem Land	Big Rivers East		
Outflows	680	42	363	289	94	56	1,524	20.4%
Inflows	695	41	371	292	91	59	1,549	20.7%
Within-cluster							4,395	58.9%
Total	1,375	83	734	581	185	115	7,468	
% (total of inflows and outflows)	44.7%	2.7%	23.9%	18.9%	6.0%	3.7%		

G. Barkly cluster (purple nodes)

This cluster was located in the Barkly region, including localities of Ali Curung, Ampilatwatja, Elliott, Tennant Creek, Utopia and Wutunugurra, and also a remote community of the Central region, Wilora. As shown in Table 3.8, a large proportion of episodes of mobility occurred within the cluster (45.8%) with the rest evenly split between outflows (27.8%) and inflows (26.4%). Of the total of inflows and outflows, Central cluster was by far the most closely connected cluster, representing 61.1%, followed by Big Rivers West cluster (13.9%) and Darwin-Top End cluster (13.2%).

Table 3.8: Number of episodes of inflow and outflow between clusters and within-cluster mobility, Aboriginal students, Barkly cluster, 2005–2018

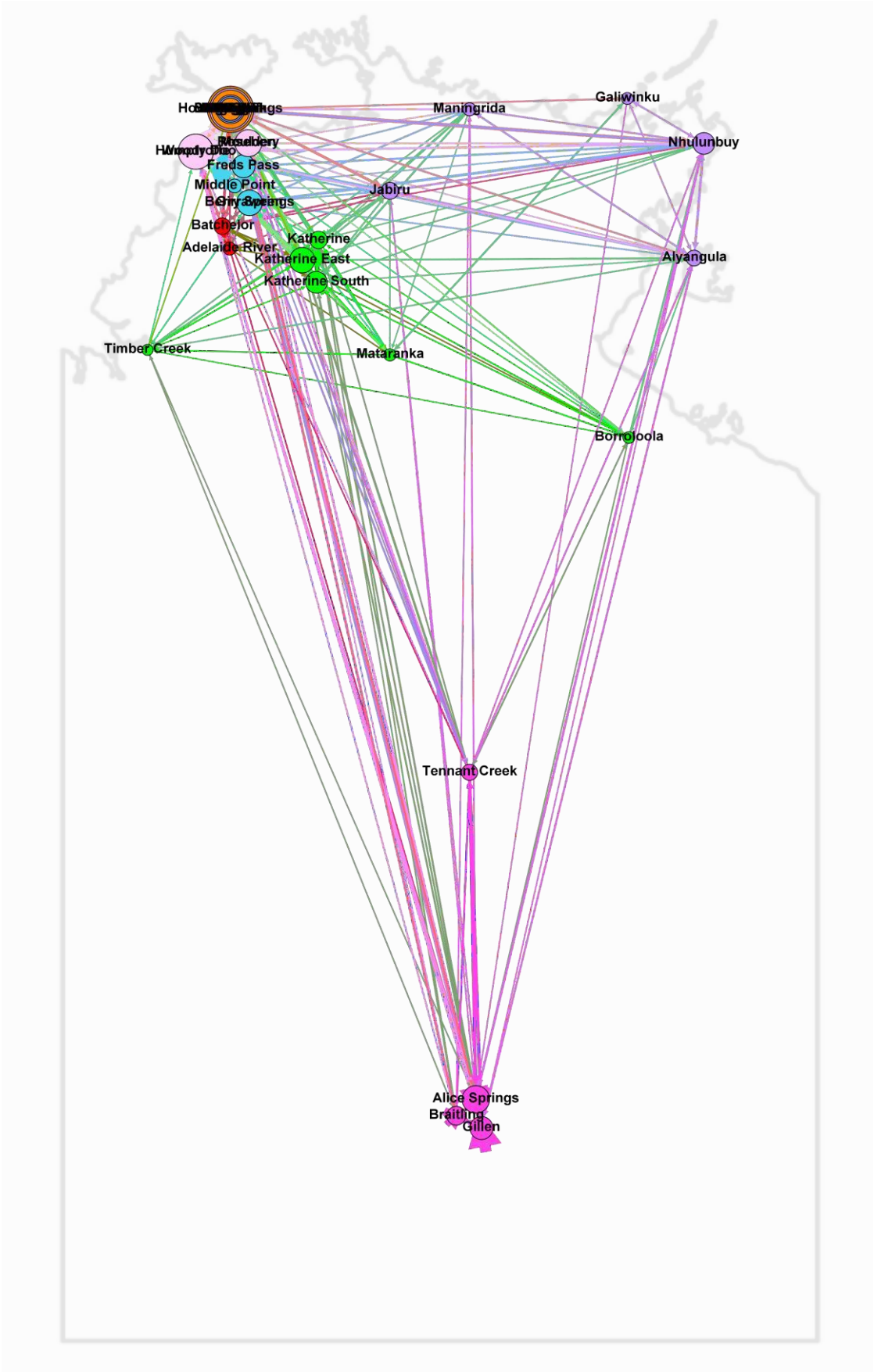
Mobility type	Source / Target cluster						Total	%
	Borroloola-Robinson River	Darwin-Top End	Big Rivers West	Arnhem Land	Big Rivers East	Central		
Outflows	90	147	168	36	19	695	1,155	27.8%
Inflows	70	151	144	38	13	680	1,096	26.4%
Within-cluster							1,902	45.8%
Total	160	298	312	74	32	1,375	4,153	
% (total of inflows and outflows)	7.1%	13.2%	13.9%	3.3%	1.4%	61.1%		

3.3.2 Non-Aboriginal students

The same network analysis processes described in the last section were used to analyse the mobility data for non-Aboriginal students. The degree range used to filter out localities with a low number of mobility episodes was 26–92, which allowed 76.9% of edges and 30.1% of nodes to be included in modularity analysis and be visible in the visualisation. The average weighted degree was 141.1. The modularity analysis using the default value of resolution (1.0) produced a negative modularity score. We tested a number of resolutions and adopted the value of 0.58, which yielded a modularity score of 0.01. This low score indicates that the network structure of the clusters of localities detected was not strong. With these parameters, the modularity analysis detected 9 clusters of localities (Figure 3.8). As 3 of the 9 clusters consisted exclusively of Darwin suburbs, for reason of practicality, we combined them into a single Darwin cluster. The 7 remaining clusters were named to align with the corresponding NT regions or locations: Darwin, Palmerston, Litchfield, Batchelor-Adelaide River, Arnhem Land, Big Rivers and Central-Barkly.

A summary of mobility episodes by source and target clusters is provided in Table 3.9. Darwin (44.8%), Palmerston (20.5%) and Litchfield (12.3%) were the top 3 clusters both

Figure 3.8: Clusters of localities detected with modularity analysis in Gephi, non-Aboriginal students, Northern Territory, 2005–2018



as source clusters and target clusters. These 3 clusters also recorded the highest number of mobility episodes occurring within the same cluster. We describe detailed statistics on inflows, outflows and within-cluster flows for each cluster below.

Table 3.9: Summary of mobility statistics by source and target clusters, non-Aboriginal students, Northern Territory, 2005–2018

Source cluster	Target cluster							Total	%
	Batchelor-Adelaide River	Central-Barkly	Litchfield	Big Rivers	Arnhem Land	Palmerston	Darwin		
Batchelor-Adelaide River	18	2	21	7	6	26	27	107	1.6%
Central-Barkly	1	258	24	19	19	74	92	487	7.3%
Litchfield	23	23	320	22	48	214	166	816	12.3%
Big Rivers	5	26	41	176	28	79	102	457	6.9%
Arnhem Land	3	18	53	31	71	82	173	431	6.5%
Palmerston	19	54	266	49	61	566	347	1,362	20.5%
Darwin	24	55	217	51	138	504	1,982	2,971	44.8%
Total	93	436	942	355	371	1,545	2,889	6,631	
%	1.4%	6.6%	14.2%	5.4%	5.6%	23.3%	43.6%	100.0%	

A. Darwin cluster (orange nodes)

The Darwin cluster included suburbs of Darwin and was by far the largest cluster in terms of episodes of mobility, recording a total of 3,878 episodes (Table 3.10). Just over half (51.1%) of these episodes occurred within the same cluster. Of the total of outflows and inflows, the clusters with highest numbers of mobility episodes linked to the Darwin cluster were Palmerston and Litchfield clusters, accounting for 44.9% and 20.2% respectively.

Table 3.10: Number of episodes of inflow and outflow between clusters and within-cluster mobility, non-Aboriginal students, Darwin cluster, 2005–2018

Mobility type	Source / Target cluster						Total	%
	Batchelor	Central-Barkly	Litchfield	Big Rivers	Arnhem Land	Palmerston		
Outflows	24	55	217	51	138	504	989	25.5%
Inflows	27	92	166	102	173	347	907	23.4%
Within-cluster							1,982	51.1%
Total	51	147	383	153	311	851	3,878	
% (total of inflows and outflows)	2.7%	7.8%	20.2%	8.1%	16.4%	44.9%		

B. Litchfield cluster (pink nodes)

This cluster consisted of localities within the Litchfield Shire including Berry Springs, Freds Pass, Girraween, Howard Springs and Humpty Doo. Additionally, Middle Point, in the Top End region, was also categorised under this cluster. Notably, the dominant mobility type was inflows, accounting for 43.3% of all episodes of mobility, followed by outflows (34.5%) shown in Table 3.11. The within-cluster type only accounted for 22.3% of episodes. Of the total of inflows and outflows, Palmerston (42.9%) and Darwin (34.3%) clusters contributed the highest proportions.

Table 3.11: Number of episodes of inflow and outflow between clusters and within-cluster mobility, non-Aboriginal students, Litchfield cluster, 2005–2018

Mobility type	Source / Target cluster						Total	%
	Batchelor	Central-Barkly	Big Rivers	Arnhem Land	Palmerston	Darwin		
Outflows	23	23	22	48	214	166	496	34.5%
Inflows	21	24	41	53	266	217	622	43.3%
Within-cluster							320	22.3%
Total	44	47	63	101	480	383	1,438	
% (total of inflows and outflows)	3.9%	4.2%	5.6%	9.0%	42.9%	34.3%		

C. Palmerston cluster (light blue nodes)

All localities in this cluster were suburbs of Palmerston. As with Litchfield cluster, inflows were the dominant mobility type, accounting for 41.8% of overall mobility episodes, followed by outflows (34.0%) shown in Table 3.12. The within-cluster type accounted for the smallest proportion of all mobility episodes (24.2%). Of the total of inflows and outflows, the highest proportions were recorded by Darwin (47.9%) and Litchfield (27.0%) clusters.

Table 3.12: Number of episodes of inflow and outflow between clusters and within-cluster mobility, non-Aboriginal students, Palmerston cluster, 2005–2018

Mobility type	Source / Target cluster						Total	%
	Batchelor	Central-Barkly	Litchfield	Big Rivers	Arnhem Land	Darwin		
Outflows	19	54	266	49	61	347	796	34.0%
Inflows	26	74	214	79	82	504	979	41.8%
Within-cluster							566	24.2%
Total	45	128	480	128	143	851	2,341	
% (total of inflows and outflows)	2.5%	7.2%	27.0%	7.2%	8.1%	47.9%		

D. Batchelor-Adelaide River cluster (red nodes)

This was the smallest cluster, consisting of 2 localities: Batchelor and Adelaide River. A total of 182 episodes of mobility were recorded of which 48.9% were outflows, 41.2% inflows and 9.9% within-cluster episodes (Table 3.13). Of the total of inflows and outflows, high proportions were recorded by Darwin (28.0%), Palmerston (24.7%) and Litchfield (24.2%) clusters.

Table 3.13: Number of episodes of inflow and outflow between clusters and within-cluster mobility, non-Aboriginal students, Batchelor-Adelaide River cluster, 2005–2018

Mobility type	Source / Target cluster						Total	%
	Central-Barkly	Litchfield	Big Rivers	Arnhem Land	Palmerston	Darwin		
Outflows	2	21	7	6	26	27	89	48.9%
Inflows	1	23	5	3	19	24	75	41.2%
Within-cluster							18	9.9%
Total	3	44	12	9	45	51	182	
% (total of inflows and outflows)	1.8%	26.8%	7.3%	5.5%	27.4%	31.1%		

E. Big Rivers cluster (light green nodes)

Localities within this cluster were all located in the Big Rivers region including the service centre of Katherine and 3 remote communities: Borroloola, Mataranka and Timber Creek. The dominant mobility type was outflows, representing 44.2% of all mobility episodes, followed by inflows (28.1%) and the within-cluster type (9.7%) shown in Table 3.14. Leading clusters with highest sum of inflows and outflows were Darwin (33.3%), Palmerston (27.8%) and Litchfield (13.7%).

Table 3.14: Number of episodes of inflow and outflow between clusters and within-cluster mobility, non-Aboriginal students, Big Rivers cluster, 2005–2018

Mobility type	Source / Target cluster						Total	%
	Batchelor	Central-Barkly	Litchfield	Arnhem Land	Palmerston	Darwin		
Outflows	5	26	41	28	79	102	281	44.2%
Inflows	7	19	22	31	49	51	179	28.1%
Within-cluster							176	27.7%
Total	12	45	63	59	128	153	636	
% (total of inflows and outflows)	2.6%	9.8%	13.7%	12.8%	27.8%	33.3%		

F. Arnhem Land cluster (blue nodes)

This cluster consisted of localities in the Top End region (Jabiru and Maningrida) and the East Arnhem region (Alyangula, Galiwinku and Nhulunbuy) as well as Jingili, which is a suburb in Darwin. Nearly half of all mobility episodes were outflows (49.2%), followed by inflows (41.0%) as demonstrated in Table 3.15. The within-cluster type only accounted for 9.7%. The clusters with the greatest sum of inflows and outflows were Darwin (47.1%), Palmerston (21.7%) and Litchfield (15.3%).

Table 3.15: Number of episodes of inflow and outflow between clusters and within-cluster mobility, non-Aboriginal students, Arnhem Land cluster, 2005–2018

Mobility type	Source / Target cluster						Total	%
	Batchelor	Central-Barkly	Litchfield	Big Rivers	Palmerston	Darwin		
Outflows	3	18	53	31	82	173	360	49.2%
Inflows	6	19	48	28	61	138	300	41.0%
Within-cluster							71	9.7%
Total	9	37	101	59	143	311	731	
% (total of inflows and outflows)	1.4%	5.6%	15.3%	8.9%	21.7%	47.1%		

G. Central-Barkly cluster (pink nodes)

This cluster consisted of suburbs within Alice Springs and Tennant Creek in the Barkly region. Table 3.16 shows the dominant mobility type was the within-cluster type, representing 38.8% of all mobility episodes, followed by outflows (34.4%) and inflows (26.8%). Other clusters with highest total of inflows and outflows were Darwin (36.1%) and Palmerston (31.4%).

Table 3.16: Number of episodes of inflow and outflow between clusters and within-cluster mobility, non-Aboriginal students, Central-Barkly cluster, 2005–2018

Mobility type	Source / Target cluster						Total	%
	Batchelor	Litchfield	Big Rivers	Arnhem Lands	Palmerston	Darwin		
Outflows	1	24	19	19	74	92	229	34.4%
Inflows	2	23	26	18	54	55	178	26.8%
Within-cluster							258	38.8%
Total	3	47	45	37	128	147	665	
% (total of inflows and outflows)	0.7%	11.5%	11.1%	9.1%	31.4%	36.1%		

3.4 Latent class analysis

As described in section 2.4.3, for latent class analysis (LCA) we used the annual Year 1 cohorts from 2009 to 2012 as the study cohort. We applied the following inclusion criteria to select the study cohort:

1. A student's first enrolment record was Year 1 in the years from 2009 to 2012
2. A student's first enrolment record was in an NT Government school
3. The age of the student at first enrolment was between 5 and 7 years.

All records of enrolment and attendance from Year 1 to Year 6 of the selected students were included in the analysis. We first performed univariate analysis with chi-squared analysis on demographic and mobility-related variables to assess the differences between Aboriginal and non-Aboriginal students.

3.4.1 Univariate analysis

Results of univariate analysis are presented in Table 3.17. The study cohort consisted of 3,631 Aboriginal students (36.8%) and 6,240 non-Aboriginal students (63.2%). With the exception of sex, there was evidence of a difference between Aboriginal and non-Aboriginal students for all the variables examined. Aboriginal students were more likely to have mobility than non-Aboriginal students (50.8% vs 42.3%). Aboriginal students were also more likely to record more than one episode of mobility (31.5% vs 10.2%). With regard to mobility category, Aboriginal students were more likely to have 'only urban to remote or remote to urban' mobility (11.0% vs 2.1%). Non-Aboriginal students were more likely to ever move to non-NTG schools (1.9% vs 1.4%) and were almost 2 times more likely to move interstate or overseas (13.2% vs 6.3%). We also examined the distribution of mobility episodes by source region (i.e. the region where the mobility episode originated from) and found evidence of a difference between the 2 groups of students: for Aboriginal students the distribution ranged from 11.0% for the Barkly region to 22.9% for Central region, while for non-Aboriginal students a markedly higher proportion of episodes originated from Darwin (36.4%) and Top End (39.4%) regions.

Comparing other variables, Aboriginal students were more likely to speak English as a second language (65.5% vs 38.8%). Aboriginal students were more likely than non-Aboriginal students to be absent for both Year 3 and Year 5 NAPLAN (3.9% vs 0.3%) but less likely to have ≥80% attendance rate for preschool (16.3% vs 23.1%) and Year 3 (39.2% vs 85.0%). With regard to the calendar month of mobility, for Aboriginal students, mobility was most likely to occur in August, October, May and March, after excluding January and February. For non-Aboriginal students, 63.2% of mobility occurred in January. Among other months, July, February and April recorded the highest amount of mobility.

Given the multiple differences between the 2 groups of students, we conducted separate LCA for Aboriginal and non-Aboriginal students.

Table 3.17: Demographic and mobility-related characteristics of Year 1 students enrolled in NTG primary schools in 2009–2012, by Aboriginal status, Northern Territory

Variable	Aboriginal	Non-Aboriginal	All	p-value
n =	3,631	6,240	9,871	-
%	36.8	63.2		
Sex				0.506
Female	48.2	48.9		
Male	51.8	51.1		
English as a second language				<0.0005
No	34.5	61.2		
Yes	65.5	38.8		
Attending NAPLAN Y3 & Y5				<0.0005
Not absent	86.3	77.3		
Both absent	3.9	0.3		
Missing data	9.8	22.4		
Preschool attendance				<0.0005
<60%	48.5	25.2		
60-79%	15.4	25.4		
≥80%	16.3	23.1		
Missing data	19.8	26.3		
Region (for the originating locality, proportion of total mobility episodes)				<0.0005
Barkly	11.0	1.5		
Big Rivers	20.9	6.9		
Central	22.9	9.4		
Darwin	11.7	36.4		
East Arnhem	12.2	6.3		
Top End	19.7	39.4		
Missing data	1.5	0.1		
Year 3 attendance				<0.0005
<60%	32.4	6.1		
60-79%	27.9	8.6		
≥80%	39.2	85.0		
Missing data	0.4	0.3		
Calendar month (proportion of total mobility episodes)				<0.0005
Jan	23.2	63.2		
Feb	13.6	4.9		
Mar	7.5	3.9		
Apr	7.3	4.9		
May	7.9	2.7		
Jun	3.6	1.6		
Jul	6.0	6.8		
Aug	9.1	3.7		
Sep	6.1	2.0		
Oct	8.5	3.7		

Nov	6.3	2.2	
Dec	1.1	0.5	
Year level at first mobility episode			<0.0005
Year 1	31.1	37.7	
Year 2	21.2	25.1	
Year 3	16.9	15.8	
Year 4	12.7	10.9	
Year 5	12.1	7.7	
Year 6	6.2	2.9	
Number of mobility episodes			<0.0005
0	49.2	57.7	
1	19.3	32.1	
2	12.7	6.9	
3–4	8.7	2.7	
5+	10.1	0.6	
Mobility category			<0.0005
Not moved	49.2	57.7	
Only remote to remote	22.9	21.7	
Only urban to urban	16.5	18.5	
Only urban to remote or remote to urban	11.0	2.1	
Mixed	0.3	0.1	
Ever moved to non-NTG schools			0.03
No	98.7	98.1	
Yes	1.4	1.9	
Ever moved interstate or overseas			0.002
No	93.7	86.8	
Yes	6.3	13.2	

3.4.2 Aboriginal students

A total of 3,631 Aboriginal students were included for the LCA. The process used for LCA is described in Chapter 2. We considered the results and model fit testing as well as the interpretability and selected a 5-class model. Details of model testing results and the model selection process are provided in Appendix 1, Section A.1 and Table Appendix 1.

The 5 groups identified were named according to their mobility characteristics (Table 3.18): Once-off Movers (n = 153, representing 4.2% of Aboriginal students), Occasional Movers (n = 252, 6.9%), Frequent Movers (n = 69, 1.9%), Intrastate Movers (n = 1,371, 37.8%) and Stayers (n = 1,786, 49.2%). Students in the first 4 groups recorded different levels and types of mobility while the Stayers group did not record any mobility. Further details of the characteristics of the groups of students are presented in Table 3.19.

Table 3.18: Results of latent class analysis of mobility-related characteristics of students enrolled in Year 1 in 2009–2012, Aboriginal students, Northern Territory

Variable	Once-off Movers		Occasional Movers		Frequent Movers		Intrastate Movers		Stayers
n =	153		252		69		1,371		1,786
% (of total 3,631)	4.2		6.9		1.9		37.8		49.2
	Probability	(95% CI)	Probability	(95% CI)	Probability		Probability		Probability
Number of episodes of mobility									
0	0.0	(0.0~0.0)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	100.0
1	94.6	(89.6~99.6)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	33.4	(30.1~36.7)	0.0
2	1.0	(0.0~2.8)	97.3	(87.9~100.0)	0.0	(0.0~0.0)	24.1	(20.8~27.4)	0.0
3–4	0.0	(0.0~0.0)	0.0	(0.0~0.0)	79.0	(67.2~90.8)	16.7	(13.9~19.5)	0.0
5+	4.5	(0.0~8.9)	2.7	(0.0~12.1)	21.0	(9.2~32.8)	25.9	(23.1~28.6)	0.0
Mobility category									
Not moved	0.0	(0.0~0.0)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	100.0
Only remote to remote	100.0	(100.0~100.0)	0.0	(0.0~0.0)	4.2	(0.0~9.8)	42.1	(38.4~45.9)	0.0
Only urban to urban	0.0	(0.0~0.0)	97.2	(91.6~102.8)	27.1	(15.5~38.7)	32.5	(29.2~35.8)	0.0
Only urban to remote or remote to urban	0.0	(0.0~0.0)	2.8	(0.0~8.4)	68.7	(56.6~80.8)	24.4	(21.5~27.3)	0.0
Mixed	0.0	(0.0~0.0)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	1.0	(0.4~1.5)	0.0
Ever moved to non-NTG schools									
No	88.7	(85.0~92.4)	96.5	(93.5~99.5)	95.3	(91.4~99.2)	99.8	(99.1~100.5)	100.0
Yes	11.3	(7.6~15.0)	3.5	(0.5~6.5)	4.7	(0.8~8.6)	0.2	(0.0~0.9)	0.0
Ever moved interstate or overseas									
No	61.4	(54.2~68.6)	68.4	(58.4~78.4)	56.1	(43.1~69.2)	100.0	(100.0~100.0)	100.0
Yes	38.6	(31.4~45.8)	31.6	(21.6~41.6)	43.9	(30.8~56.9)	0.0	(0.0~0.0)	0.0

Notes: Probabilities are presented as percentages. Some estimates for confidence intervals were either negative or greater than 100% and are presented in the table as 0.0% and 100.0% respectively.

Table 3.19: Results of post-hoc analysis, after latent class analysis, of the characteristics of 5 classes of students enrolled in Year 1 in 2009–2012, Aboriginal students, Northern Territory

Variables used in post-hoc analysis	Once-off Movers	Occasional Movers	Frequent Movers	Intrastate Movers	Stayers
	(n = 153)	(n = 252)	(n = 69)	(n = 1,371)	(n = 1,786)
Sex					
Female	52.9	49.6	47.8	49.7	46.4
Male	47.1	50.4	52.2	50.3	53.6
English as a second language					
No	53.6	57.9	30.4	29.7	33.5
Yes	46.4	42.1	69.6	70.3	66.5
Preschool attendance**					
<60%	30.7	45.2	50.7	51.7	47.9
60–79%	16.3	13.9	8.7	13.0	17.6
≥80%	7.8	15.5	5.8	13.9	19.4
Missing data	45.1	25.4	34.8	21.4	15.1
Year 3 attendance***					
<60%	33.3	25.4	60.9	37.5	28.4
60–79%	19.0	26.2	21.7	31.8	26.2
≥80%	46.4	47.6	17.4	30.3	45.1
Missing data	1.3	0.8	0.0	0.4	0.3
Attending NAPLAN Y3 & Y5***					
Not absent	33.3	75.0	49.3	88.4	92.2
Both absent	1.3	1.6	5.8	4.5	3.9
Missing data	65.4	23.4	44.9	7.1	3.9
Calendar month of mobility (proportion of all episodes of mobility)***					
Jan	58.8	44.1	35.6	18.5	
Feb	6.6	13.7	13.7	13.9	
Mar	5.2	3.8	10.3	7.6	
Apr	1.9	4.8	5.1	8.0	
May	7.1	4.2	5.8	8.6	
Jun	3.3	2.2	4.5	3.7	
Jul	2.4	7.2	6.2	6.0	
Aug	3.8	6.8	5.8	9.9	
Sep	5.7	3.0	4.8	6.4	
Oct	1.4	6.6	5.5	9.1	
Nov	2.8	3.2	2.7	7.1	
Dec	1.0	0.2	0.0	1.2	
Year level at first mobility episode***					
Year 1	67.3	38.0	54.1	18.26	
Year 2	13.3	26.5	29.7	18.76	
Year 3	7.3	18.7	10.8	18.76	
Year 4	4.0	7.8	2.7	15.77	
Year 5	4.0	8.4	0.0	18.46	
Year 6	4.0	0.6	2.7	9.98	

* $p < 0.05$; ** $p < 0.005$; *** $p < 0.0005$

Among Once-off Movers, 94.6% only moved once, though a small proportion moved either 2 times (1.0%) or 5+ times (4.5%). All students in this group moved exclusively from remote to remote regions and they were more likely than the other groups, with mobility, to move to a non-NTG school (11.3%). More than one-third of this group ever moved interstate or overseas (38.6%). By contrast, Occasional Movers predominantly moved 2 times (97.3%) and from urban to urban regions (97.2%). Few Occasional Movers ever moved to a non-NTG school (3.5%) but close to one-third (31.6%) had ever moved interstate or overseas. All Frequent Movers moved 3 or more times and were the most likely to move only from urban to remote or from remote to urban localities (68.7%). Few students in this group ever moved to a non-NTG school (4.7%). Intrastate Movers could record from one-to-many episodes of mobility; 42.1% of them only moved from remote to remote regions and only a small proportion moved to a non-NTG school. No Intrastate Movers were recorded moving interstate or overseas.

Post-hoc analysis with chi-squared test was performed to further characterise the identified groups (Table 3.19). There was no evidence for a difference between the 5 groups of students for sex but there was evidence of a difference in the variable 'English as a second language', with Frequent Movers and Intrastate Movers recording higher probabilities (both about 70%). The high levels of missing data made the results for preschool attendance and 'attending NAPLAN Year 3 & Year 5' unreliable. However, missing data were at low levels for Year 3 attendance, and there was evidence of a difference among the 5 groups for this variable. Once-off and Occasional Movers had much higher probability of recording 80% or higher attendance in Year 3 than Frequent Movers (46.4% and 47.6% vs 17.4%, respectively); and the probabilities were similar to Stayers (45.1%).

There was evidence of a difference in 'year level at first mobility episode' among the 4 groups with mobility. The majority of Once-off Movers moved in Year 1 (67.3%), followed by Year 2 (13.3%). For Occasional Movers and Frequent Movers, although the highest probability was also recorded in Year 1 (38.0% and 54.1% respectively), the probabilities spread more evenly between Year 1 and Year 3. The distribution of probabilities was more evenly distributed across year levels for Intrastate Movers.

3.4.3 Non-Aboriginal students

A total of 6,240 non-Aboriginal students were included in LCA. We tested 2-class to 7-class models. After considering the results of model details and model fit testing as well as the interpretability of the models, we selected the 6-class model. Details of the results for model testing and the model selection process are provided in section A.2 and Table Appendix I-2 in Appendix I.

The 6 groups identified in LCA for non-Aboriginal students were termed: Once-off Remote Intrastate Movers (n = 103, representing 1.7% of non-Aboriginal students), Once-off Interstate Movers (n = 1,230, 19.7%), Once-off Urban Intrastate Movers (n = 812, 13.0%),

Occasional Movers (n = 440, 7.1%), Frequent Movers (n = 54, 0.9%) and Stayers (n = 3,601, 57.7%, Table 3.20). The large majority of students in the first 3 groups moved only once; Occasional Movers predominantly moved twice (89.4%), while 91.8% of Frequent Movers moved 3–4 times. Once-off Remote Intrastate Movers and Once-off Interstate Movers exclusively moved from remote to remote regions, Once-off Urban Intrastate Movers and Occasional Movers were more likely to move only from urban to urban regions, while Frequent Movers were most likely to move 'only urban to remote or remote to urban' localities. All Once-off Remote Intrastate Movers had ever moved to non-NTG schools but none of them had ever moved interstate or overseas. Once-off Interstate Movers and Frequent Movers were more likely than other groups to have moved interstate or overseas (56.2% and 69.3% respectively).

Results of post-hoc analysis are presented in Table 3.21. Only one variable, sex, showed no evidence of a difference between groups (p = 0.770). Analysis showed evidence of a difference for other variables included. Notably, Stayers and Once-off Urban Intrastate Movers recorded much higher probabilities of having 80% or higher attendance rates (90.0% and 81.5% respectively).

There was evidence of a difference in the distribution of mobility episodes across calendar months among the 5 groups with mobility. There were very high probabilities of moving in January in Once-off Remote Intrastate Movers and Once-off Interstate Movers (87.9% and 89.4% respectively) while in the other 3 groups, there was a mid-year peak in July (between 8% and 10%).

Table 3.20: Results of latent class analysis of mobility-related characteristics of students enrolled in Year 1 in 2009–2012, non-Aboriginal students, Northern Territory

Variable	Once-off Remote Intrastate Movers		Once-off Interstate Movers		Once-off Urban Intrastate Movers		Occasional Movers		Frequent Movers		Stayers
n =	103		1,230		812		440		54		3,601
%	1.7		19.7		13.0		7.1		0.9		57.7
	Prob.	(95% CI)	Prob.	(95% CI)	Prob.	(95% CI)	Prob.	(95% CI)	Prob.	(95% CI)	Prob.
Number of episodes of mobility											
0	0.0	(0.0~0.0)	0	(0.0~0.0)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	100.0
1	99.0	(97.1~100.0)	99.8	(99.5~100.2)	85.9	(81.3~90.4)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	0.0
2	0.0	(0.0~0.0)	0.2	(0.0~0.5)	2.5	(0.0~5.5)	89.4	(84.6~94.2)	0.0	(0.0~0.0)	0.0
3–4	0.0	(0.0~0.0)	0	(0.0~0.0)	8.5	(5.8~11.3)	9.3	(4.9~13.8)	91.8	(83.1~100.0)	0.0
5+	1.0	(0.0~2.9)	0	(0.0~0.0)	3.1	(1.7~4.4)	1.3	(0.0~3.0)	8.2	(0.0~16.9)	0.0
Mobility category											
Not moved	0.0	(0.0~0.0)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	100.0
Only remote to remote	100.0	(100.0~100.0)	100.0	(100.0~100.0)	15.3	(8.1~22.5)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	0.0
Only urban to urban	0.0	(0.0~0.0)	0.0	(0.0~0.0)	79.0	(72.1~85.8)	93.6	(91.1~96.1)	0.0	(0.0~0.0)	0.0
Only urban to remote or remote to urban	0.0	(0.0~0.0)	0.0	(0.0~0.0)	5.8	(4.1~7.4)	6.4	(3.9~8.9)	93.9	(87.2~100.0)	0.0
Mixed	0.0	(0.0~0.0)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	6.1	(0.0~12.8)	0.0
Ever moved to non-NTG schools											
No	0.0	(0.0~0.0)	100.0	(100.0~100.0)	100.0	(100.0~100.0)	96.2	(94.4~97.9)	98.5	(94.4~100.0)	100.0
Yes	100.0	(100.0~100.0)	0.0	(0.0~0.0)	0.0	(0.0~0.0)	3.8	(2.1~5.6)	1.5	(0.0~5.6)	0.0
Ever moved interstate or overseas											
No	100.0	(100.0~100.0)	43.8	(39.2~48.5)	100.0	(100.0~100.0)	63.6	(58.3~69.0)	30.7	(15.9~45.4)	100.0
Yes	0.0	(0.0~0.0)	56.2	(51.5~60.8)	0.0	(0.0~0.0)	36.4	(31.0~41.7)	69.3	(54.6~84.1)	0.0

Notes: Probabilities are presented as percentages. Some estimates for confidence intervals were either negative or greater than 100% and are presented in the table as 0.0% and 100.0% respectively. Prob: Probability

Table 3.21: Results of post-hoc analysis, after latent class analysis, of the characteristics of 6 classes of students enrolled in Year 1 in 2009–2012, non-Aboriginal students, Northern Territory

Variables used in post-hoc analysis	Once-off Remote Intrastate Movers	Once-off Interstate Movers	Once-off Urban Intrastate Movers	Occasional Movers	Frequent Movers	Stayers
	(n = 103)	(n = 1,230)	(n = 812)	(n = 440)	(n = 54)	(n = 3,601)
Sex						
Female	50.5	48.3	49.0	52.1	44.4	48.7
Male	49.5	51.7	51.0	48.0	55.6	51.4
English as a second language						
No	51.5	64.4	51.9	61.4	61.1	62.5
Yes	48.5	35.6	48.2	38.6	38.9	37.6
Preschool attendance**						
<60%	17.5	24.8	27.6	27.3	16.7	24.9
60–79%	28.2	21.8	23.0	20.2	14.8	27.8
≥80%	29.1	15.1	18.0	15.9	16.7	27.8
Missing data	25.2	38.3	31.4	36.6	51.9	19.5
Year 3 attendance***						
<60%	20.4	11.0	5.8	12.3	16.7	3.1
60–79%	7.8	9.5	12.7	12.7	11.1	6.8
≥80%	71.8	78.6	81.5	74.1	68.5	90.0
Missing data	0.0	0.9	0.0	0.9	3.7	0.1
Attending NAPLAN Y3 & Y5***						
Not absent	74.8	42.0	91.3	62.5	40.7	88.6
Both absent	0.0	0.6	0.5	0.5	1.9	0.2
Missing data	25.2	57.4	8.3	37.1	57.4	11.2
Calendar month of mobility (proportion out of all episodes of mobility)***						
Jan	87.9	89.4	45.1	53.2	40.9	
Feb	1.9	2.0	6.5	6.2	11.1	

Mar	0.9	1.5	6.3	4.7	2.8
Apr	1.9	1.1	7.2	6.4	8.8
May	1.9	0.9	3.3	3.7	6.6
Jun	0.0	0.5	2.4	1.8	3.3
Jul	1.9	2.4	10.4	8.3	8.8
Aug	0.0	0.9	5.4	5.5	3.9
Sep	1.9	0.8	3.1	2.0	2.2
Oct	0.9	0.4	6.3	4.4	6.1
Nov	0.9	0.1	3.7	3.2	2.2
Dec	0.0	0.1	0.4	0.7	3.3
Year level at first mobility episode* **					
Year 1	68.9	36.2	22.6	51.0	70.97
Year 2	7.8	22.6	29.1	29.5	25.81
Year 3	10.7	15.0	21.9	10.6	0
Year 4	2.9	11.5	16.0	4.5	3.23
Year 5	6.8	9.1	10.0	3.8	0
Year 6	2.9	5.6	0.5	0.7	0

* $p < 0.05$; ** $p < 0.005$; *** $p < 0.0005$

Chapter 4 Student mobility in the East Arnhem region

Key findings

Descriptive statistics

- The average annual number of Aboriginal students enrolled in public primary schools in East Arnhem was consistently higher than non-Aboriginal students during the study period.
- The proportion of students who moved each year increased after 2013 and in 2018 was 22.7% for Aboriginal students and 19.4% for non-Aboriginal students.
- The majority of Aboriginal and non-Aboriginal students who moved each year, moved only once. The proportion of students who moved 2 or more times in a year was higher among Aboriginal students.
- Among Aboriginal students, the annual number of episodes of mobility increased substantially from 2015 to 2018 with the majority of the increase occurring in the category of 'Moving to an NTG school'. Among non-Aboriginal students, the major category was 'Moved interstate or overseas'.

Network analysis

- For Aboriginal students, 3 clusters of localities were identified: West Arnhem (major localities included Gapuwiyak, Galiwinku and Ramingining); Nhulunbuy-Yirrkala (major localities included Nhulunbuy and Yirrkala); and East Arnhem South (major localities included Angurugu, Umbakumba and Milyakburra).
- Clusters of localities were not evident for non-Aboriginal students due to widely varied source and destination locations for mobility episodes.

Latent class analysis

- Grouping of students with different characteristics of mobility was assessed for the annual Year 1 cohorts from 2009 to 2012, with 527 Aboriginal students (59.1%) and 364 non-Aboriginal students (40.9%) in the analysis.
- For Aboriginal students, 2 groups were identified: **Movers** (190 students, 36.1%) and **Stayers** (337 students, 63.9%). The Movers largely moved within the NT and between NTG schools and tended to move from one remote location to another remote location.
- For non-Aboriginal students, 3 groups were identified: **Intrastate Movers**, **Interstate Movers** and **Occasional Movers** (with 19, 52 and 293 students respectively).

4.1 Overview of chapter

This chapter presents a deep-dive analysis of student mobility in the East Arnhem region. As in the deep-dive for the other 2 regions, we excluded enrolment records for students which were: related to distance education; not relevant to primary school years; and, for students who had died. Schools included in this deep-dive are listed in Table Appendix 9. Section 4.2 provides descriptive information for students enrolled in primary schools across all years of available data from 2005 to 2018. The section includes information on the number of student enrolments each year, the number and proportion of students who moved during each year in the region, including information on average annual enrolment, the number of times students moved, categories of movement and the month of movement. Geographic patterns of movement are presented in section 4.3, including the number of episodes of mobility between regions and between communities. This section includes information presented as visualisations which highlight clusters of localities between which episodes of mobility are more common. Section 4.4 describes the characteristics of children with different patterns of mobility, including those children who remained at the same primary school and those children who moved once or many times. For this section, the information is based on children who commenced Year 1 of primary school between 2009 and 2012 with analysis for up to 6 years to Year 6 of primary school education.

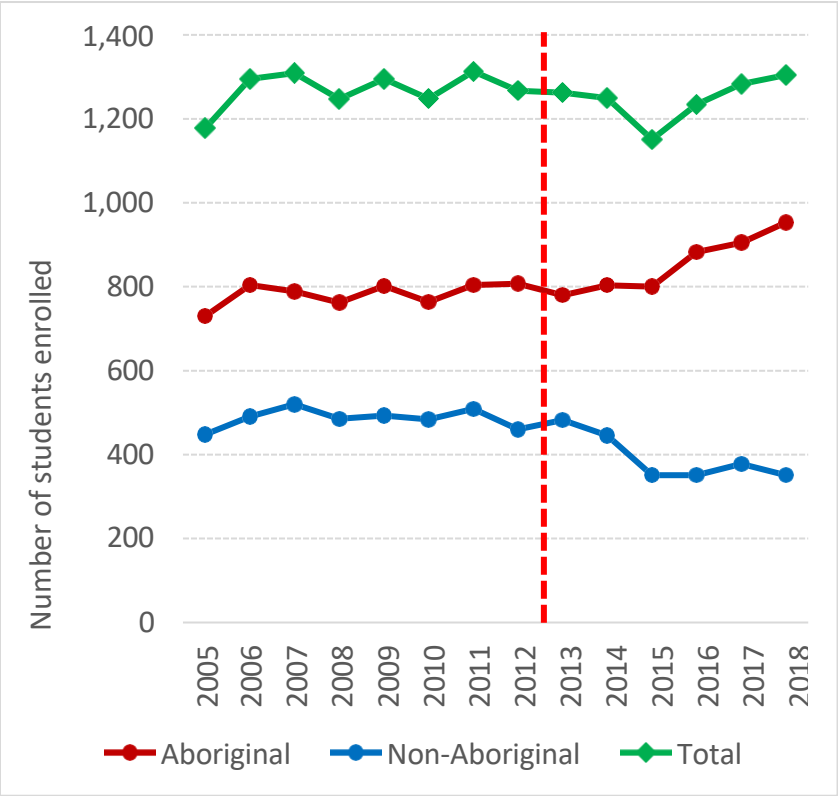
4.2 Descriptive statistics

This section provides descriptive information about students who enrolled in an NT Government primary school in the East Arnhem region from 2005 to 2018. All enrolment and attendance records from NT Government primary schools in the East Arnhem region of this period were included for analysis. To recognise changes from 2013 in departmental procedures for recording enrolment and attendance (see section 2.2), we present the results for the period prior to the change (2005–2012, referred to as Period 1) and after the change (2013–2018, referred to as Period 2) separately, and indicate the division of the whole study period into these 2 periods with a red line in the relevant figures.

4.2.1 Annual student enrolment and mobility

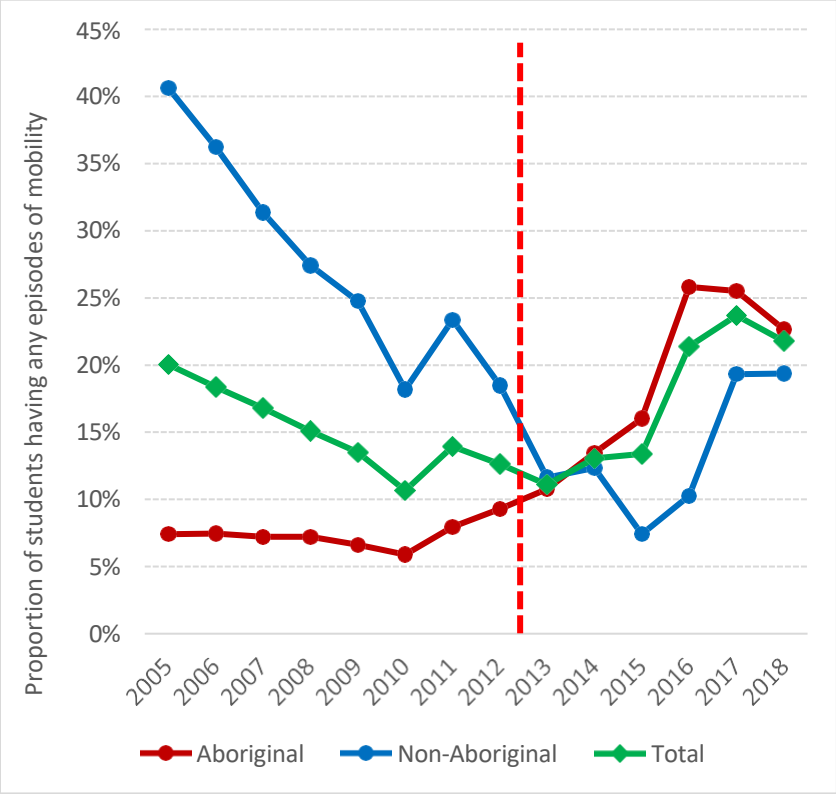
In East Arnhem, each year there were on average 1,260 students (813 Aboriginal and 446 non-Aboriginal students) enrolled in public primary schools between 2005 and 2018. In Period 1, the annual number of students ever enrolled did not change significantly in both Aboriginal (fluctuated between 750 and 800) and non-Aboriginal students (fluctuated between 450 and 520, Figure 4.1). However, in Period 2, the annual number of enrolled Aboriginal students increased consistently from 780 in 2013 to 953 in 2018, a 22.2% increase. The trend was different in non-Aboriginal students: the annual number of enrolled students decreased from 2013 to 2015 but then remained at around 350 up to 2018.

Figure 4.1: Number of students ever enrolled in NTG schools in a calendar year, for Aboriginal, non-Aboriginal and total students, East Arnhem region, 2005–2018



In Period 1, the proportion of Aboriginal students who had any episode of mobility in a calendar year remained between 6% and 7% from 2005 to 2010 and then increased from 5.9% in 2010 to 9.3% in 2012 (Figure 4.2). The increasing trend appeared to continue into Period 2 up to 2016 when the proportion reached a peak at 25.8%. After that, it decreased to reach 21.8% in 2018. Among non-Aboriginal students, there was a rapid decrease in this proportion of students with an episode of mobility in Period 1, falling from 40.6% in 2005 to 18.2% in 2010. The proportion then fluctuated between 2010 and 2012. In Period 2, the proportion of non-Aboriginal students having any mobility decreased from 2013 to 2015, after which it increased sharply to reach 19.4% in 2018.

Figure 4.2: Proportion of students enrolled in NTG schools who had any episode of mobility for Aboriginal, non-Aboriginal and total students, East Arnhem region, 2005–2018



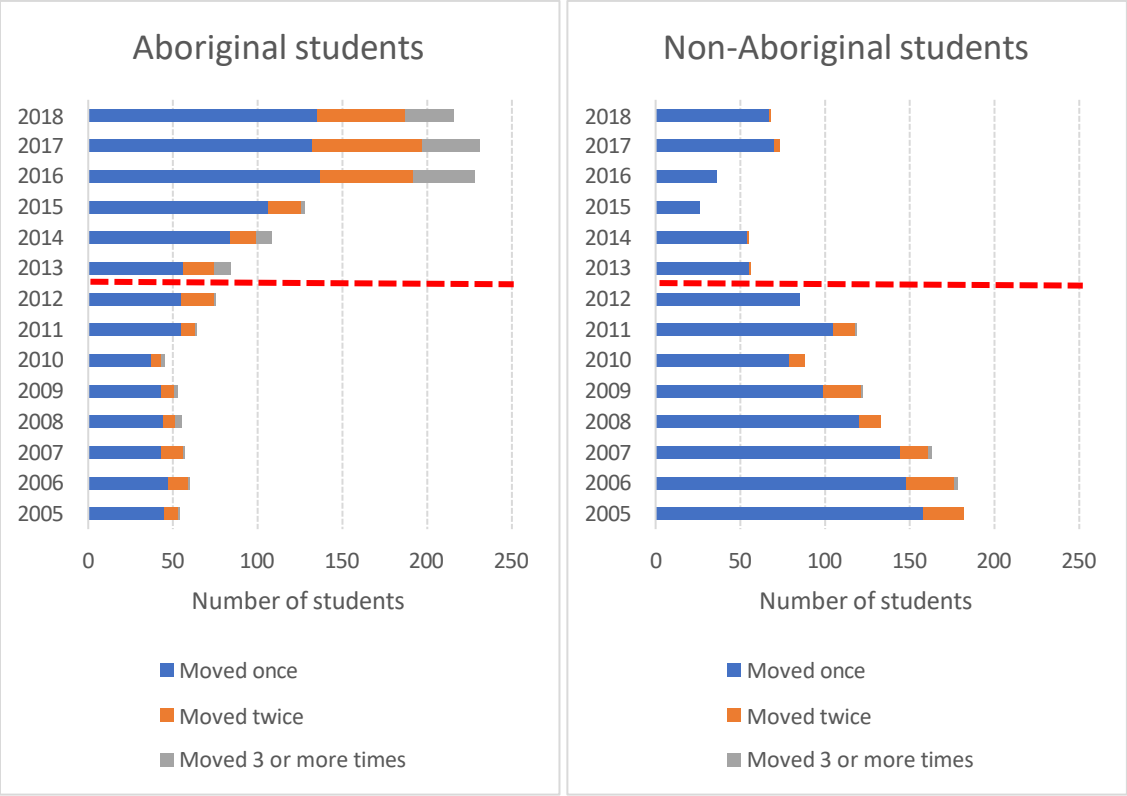
4.2.2 Levels of student mobility

The number of students with any level of mobility in a calendar year is presented in Figure 4.3. The majority of both Aboriginal and non-Aboriginal students who moved within a calendar year moved only once throughout the study period.

Among Aboriginal students, in Period 1, the trend and pattern were largely unchanged in 2005–2011 and the proportion of students moving twice increased slightly in 2012. In Period 2, the proportion of students moving once increased between 2013 and 2016 and then remained at the same level in the last 2 years. Notably, the proportion for those moving twice increased from 2015 to 2016 and remained at the same level in 2016–2018. A similar pattern of increase also occurred within the category of 'moved 3 or more times' during the same time period.

For non-Aboriginal students, the numbers in 'moved once' and 'moved twice' categories were considerably higher than Aboriginal students, but the pattern reversed in Period 2, when the numbers of both categories decreased substantially and were lower than those in Aboriginal students.

Figure 4.3: Number of students and level of mobility, by year, for Aboriginal and non-Aboriginal students, East Arnhem region, 2005–2018



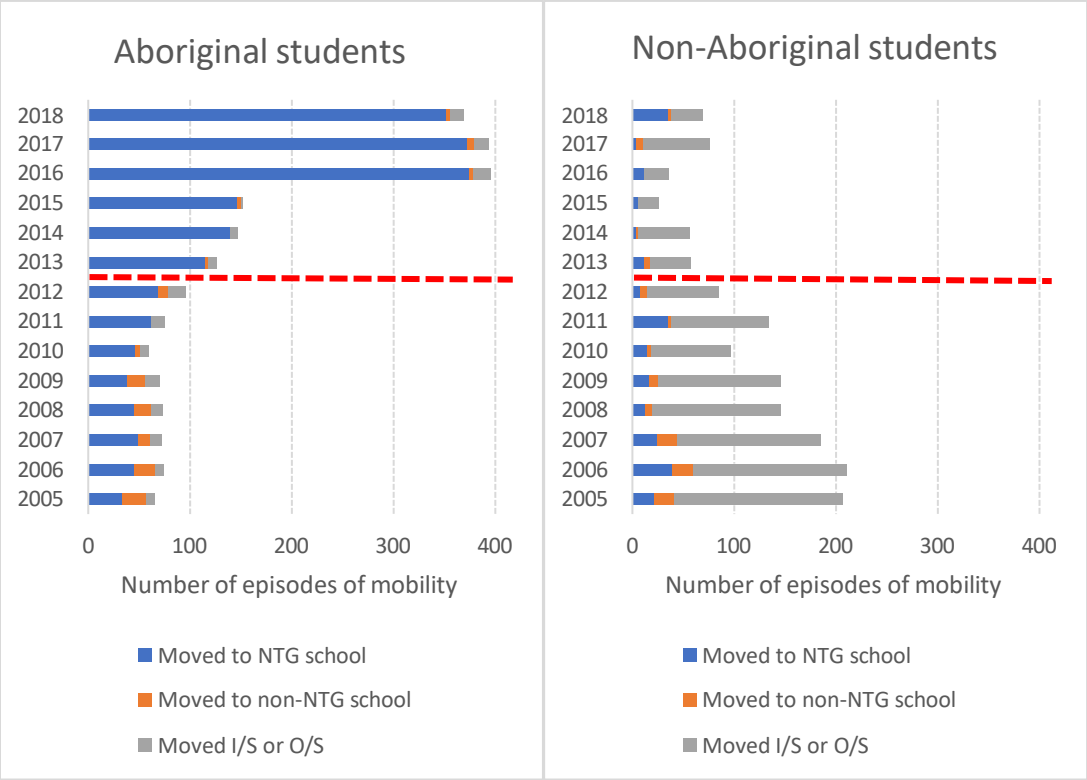
4.2.3 Destination categories for episodes of student mobility

This section presents the annual number of episodes of student mobility by destination categories. In this analysis, we excluded enrolment records that involved no mobility or were classified as 'Other or unknown', and then examined the remaining records. As shown in Figure 4.4 the dominant category among Aboriginal students was consistently 'moved to NTG school' while among non-Aboriginal students, it was consistently 'moved interstate or overseas'.

For Aboriginal students, the annual number of episodes of mobility remained relatively unchanged in Period 1, but the proportion of 'moved to non-NTG school' decreased substantially. In Period 2, the dominant category was 'moved to NTG school', while 'moved to non-NTG school' continued to represent only a very small proportion of episodes. In the most recent 3 years (2016–2018), the category 'moved interstate or overseas' increased slightly.

Among non-Aboriginal students, the large majority of mobility episodes were in the category 'moved interstate or overseas'. While this category remained dominant in Period 2, the numbers of mobility episodes in each category all decreased substantially.

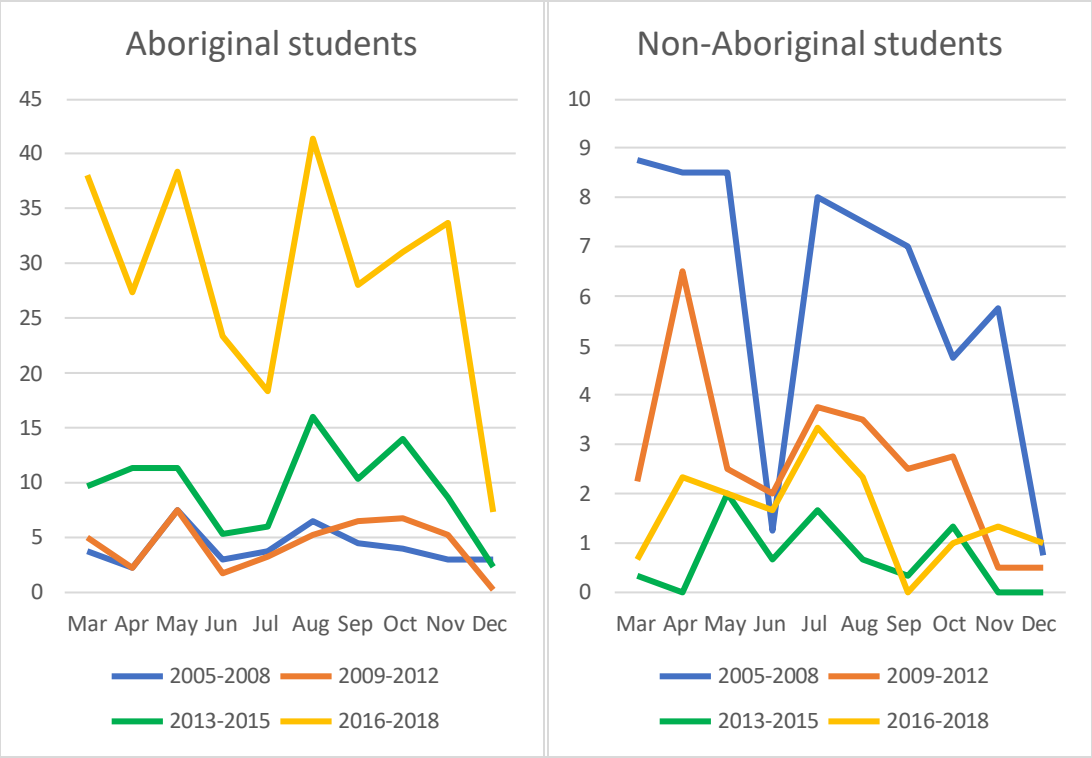
Figure 4.4: Number of episodes of mobility for students and category of mobility, by year, for Aboriginal and non-Aboriginal students, East Arnhem region, 2005-–018



4.2.4 Timing of student mobility

This section presents the analysis results on the timing of mobility across a calendar year. We examined the timing of mobility by analysing the month of the year in which episodes of mobility occurred and calculated the average number for 4 time periods, 2005–2008, 2009–2012, 2013–2015 and 2016–2018 (Figure 4.5). There were a much greater number of episodes in January and February, corresponding to the period when many families move at the start of a calendar year. As the numbers for Aboriginal students were substantially higher in the most recent period (2016–2018) than in previous periods, we focused on this period in our analysis. Excluding January and February, the number of mobility episodes was highest in August, May and March. Among non-Aboriginal students, the numbers were highest in July, April and August.

Figure 4.5: Average number of episodes of student mobility, by month, for 4 time periods (2005–2008, 2009–2012, 2013–2015, 2016–2018) for Aboriginal and non-Aboriginal students, East Arnhem region



4.3 Network analysis with Gephi

This section presents the result of network analysis with the Gephi software program for the East Arnhem region. The study cohort for this analysis was the same cohort used for descriptive analysis in section 4.2, which was all students enrolled in NTG primary schools in the East Arnhem region in the period from 2005 to 2018. As this analysis focused on the patterns of student mobility, only records representing episodes of mobility were included. We used localities for the nodes in the Gephi network analysis and not schools, as explained in section 2.4.2. In this section, we refer to episodes of mobility leaving a locality as departing moves and those going into it as incoming moves, to avoid confusion with the terms of outflows and inflows used to refer to episodes of mobility leaving and coming into a region. Further, in the results tables for a single community or locality, cells containing values smaller than 10 were suppressed and replaced with 'NR' (not reportable) to protect confidentiality. Where there is only one category with a small value, we suppressed the value in a related cell to prevent calculation of suppressed values. Given the different patterns and characteristics of mobility between Aboriginal and non-Aboriginal students already shown in section 4.2, we conducted the network analysis for the 2 groups of students separately.

4.3.1 Aboriginal students

Parameters and results of network analysis with Gephi are presented in Table 4.1. As for the other network analyses presented in this report, to facilitate the detection of significant networks of student mobility we performed a filtering process to exclude localities with a low number of episodes of mobility using the degree range of 10 to 91. This meant that all localities that recorded less than 10 episodes of mobility were excluded from the visualisation while the upper bound of 91 was the maximum number of episodes between communities. This filtering process allowed 60.3% of all mobility routes (367 out of 609) and 19.9% of all localities (31 out of 156) to be presented in the visualisation, including all 11 East Arnhem localities. This indicates that there was a high proportion of localities in this region which recorded fewer than 10 episodes of mobility over the study period.

The average weight degree was 185.4 which was calculated by dividing the total of 5,746 episodes of mobility between the 31 localities included in the visualisation. This value means, on average, each locality in the visualisation recorded 185 episodes of mobility during the study period, which was substantially lower than the value calculated for the Aboriginal students of the NT (311.1, see section 3.4.1).

Table 4.1: Parameters and results of network analysis with Gephi, Aboriginal students, East Arnhem region, 2005–2018

Parameters / statistics	Values
Degree range	10–91
Nodes visible	19.9%
Edges visible	60.3%
Modularity score	0.052
Number of modularity communities identified	4
Average weighted degree	185.4

As the modularity analysis with the default resolution (1.0) produced a negative modularity score, we applied a number of lower resolutions to improve cluster detection and adopted the value of 0.8. The modularity analysis yielded a modularity score of 0.052 and detected 4 clusters (Figure 4.6):

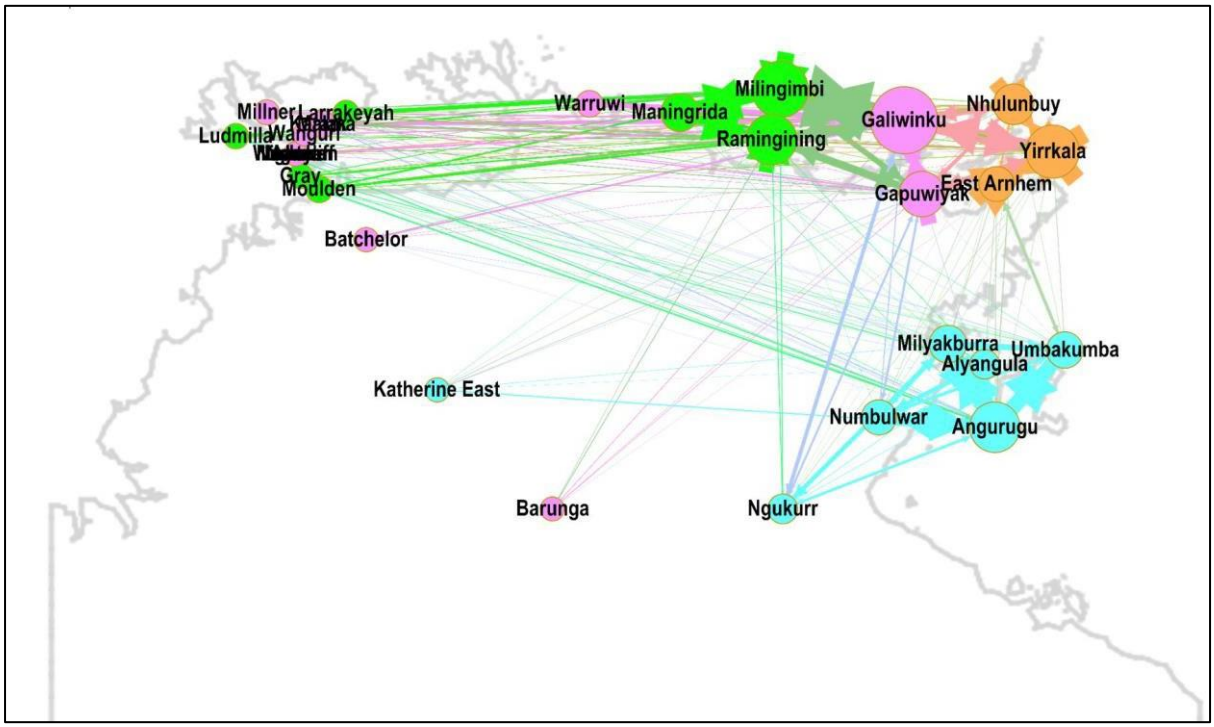
A. West Arnhem cluster (light green nodes)

B. Galiwinku-Gapuwiyak cluster (pink nodes)

C. Nhulunbuy-Yirrkala cluster (orange nodes)

D. East Arnhem South cluster (light blue nodes).

Figure 4.6: Clusters of localities detected with modularity analysis in Gephi, Aboriginal students, East Arnhem region, 2005–2018



There are 5,746 episodes of mobility, visible in Figure 4.6, which were included in network analysis for Aboriginal students in the East Arnhem region (Table 4.2). The majority of mobility episodes occurred within the region (58.0%), with outflows and inflows accounting for approximately the same proportions of all episodes of mobility (20.6% and 21.3% respectively). Of the total of outflows and inflows, the Top End region (38.8%) recorded the highest proportion followed by Big Rivers (31.1%) and Darwin (30.1%) regions.

Table 4.2: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, East Arnhem region, 2005–2018

Mobility type	Source / Target region			Total	%
	Big Rivers	Darwin	Top End		
Outflows	379	360	447	1,186	20.6%
Inflows	372	365	488	1,225	21.3%
Within-region				3,335	58.0%
Total	751	725	935	5,746	
% (total of inflows and outflows)	31.1%	30.1%	38.8%		

Details of the detected clusters are described below.

A. West Arnhem cluster (light green nodes):

This cluster is located in the western part of the East Arnhem region and consists of 2 localities: Ramingining and Milingimbi. It also extends to the eastern part of the Top End region (specifically, Maningrida) and a number of suburbs in the Darwin region. This cluster recorded a total of 1,601 episodes of mobility, of which 42.7% occurred within the East Arnhem region, 26.8% were outflows and 30.5% inflows (Table 4.3). The majority of inflows and outflows related to the Top End region (74.9%) indicating the West Arnhem cluster's close connection with the Top End region.

Table 4.3: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, West Arnhem cluster, East Arnhem region, 2005–2018

Mobility type	Source / Target region			Total	%
	Big Rivers	Darwin	Top End		
Outflows	21	119	289	429	26.8%
Inflows	0	90	398	488	30.5%
Within-region				684	42.7%
Total	21	209	687	1,601	
% (total of inflows and outflows)	2.3%	22.8%	74.9%		

We describe the mobility statistics for the 2 major localities below.

- **Ramingining:**

A total of 1,015 episodes of mobility were recorded for Ramingining, including 493 departing moves (48.6%) and 522 incoming moves (51.4%). Of all mobility episodes (including both departing and incoming moves), 58.1% occurred within the East Arnhem region and 29.6% were to or from the Top End region. Milingimbi, Maningrida and Galiwinku were the top 3 destination and source localities for departing and incoming moves respectively (Table 4.4).

Table 4.4: Leading destination and source localities for episodes of mobility, Aboriginal students, Ramingining, West Arnhem cluster, East Arnhem region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Milingimbi	126	25.6	Milingimbi	143	27.4
Maningrida	109	22.1	Maningrida	120	23.0
Galiwinku	73	14.8	Galiwinku	82	15.7
Gapuwiyak	67	13.6	Gapuwiyak	63	12.1
Malak	18	3.7	Malak	18	3.5
Moulden	15	3.0	Moulden	16	3.1

- **Milingimbi**

Milingimbi recorded a total of 1,221 episodes of mobility, including 620 departing moves (50.8%) and 601 incoming moves (49.2%). Together, 62.7% of departing and incoming moves occurred within the East Arnhem region and a further 24.7% were to or from the Top End region. Galiwinku, Ramingining and Maningrida recorded the highest numbers of departing and incoming moves (Table 4.5).

Table 4.5: Leading destination and source localities for episodes of mobility, Aboriginal students, Milingimbi, West Arnhem cluster, East Arnhem region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Galiwinku	186	30.0	Galiwinku	173	28.8
Ramingining	143	23.1	Maningrida	131	21.8
Maningrida	116	18.7	Ramingining	126	21.0
Gapuwiyak	48	7.7	Gapuwiyak	42	7.0
Larrakeyah	29	4.7	Larrakeyah	33	5.5
Yirrkala	17	2.7	Yirrkala	21	3.5

B. Galiwinku-Gapuwiyak cluster (pink nodes):

This cluster is located in the centre of the East Arnhem region and includes 2 major localities, Galiwinku and Gapuwiyak, and extends to a number of localities in the Top End, Darwin and Big Rivers regions. A total of 1,574 episodes of mobility were recorded during the study period for this cluster. Of these, more than half (56.2%) occurred within the East Arnhem region, 20.5% were outflows and 23.3% inflows (Table 4.6). Of the total inflows and outflows, Darwin and Top End regions recorded the highest proportions of mobility episodes (58.5% and 28.4% respectively).

Table 4.6: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, Galiwinku-Gapuwiyak cluster, East Arnhem region, 2005–2018

Mobility type	Source / Target region			Total	%
	Big Rivers	Darwin	Top End		
Outflows	77	139	106	322	20.5%
Inflows	13	264	90	367	23.3%
Within-region				885	56.2%
Total	90	403	196	1,574	
% (total of inflows and outflows)	13.1%	58.5%	28.4%		

The mobility statistics for the 2 major localities are described below.

- **Gapuwiyak:**

Gapuwiyak recorded a total of 815 episodes of mobility, including 410 departing moves (50.7%) and 405 incoming moves (49.7%). Of the sum of departing and incoming moves, 81.2% occurred within the East Arnhem region and 9.1% were to or from the Big Rivers region. Galiwinku, Ramingining and Yirrkala recorded the highest numbers of departing and incoming moves (Table 4.7).

Table 4.7: Leading destination and source localities for episodes of mobility, Aboriginal students, Gapuwiyak, Galiwinku-Gapuwiyak cluster, East Arnhem region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Galiwinku	134	32.7	Galiwinku	131	32.4
Ramingining	63	15.4	Ramingining	67	16.5
Yirrkala	53	12.9	Yirrkala	51	12.6
Milingimbi	42	10.2	Milingimbi	48	11.9
Nhulunbuy	31	7.6	Nhulunbuy	27	6.7
Numbulwar	18	4.4	Ngukurr	17	4.2

- **Galiwinku:**

A total of 1,613 episodes of mobility were recorded for Galiwinku, including 797 departing moves (49.4%) and 816 incoming moves (50.6%). Of all mobility episodes, 69.0% occurred within the East Arnhem region; 14.1% and 11.7% were to or from Darwin and Top End regions respectively.

Table 4.8: Leading destination and source localities for episodes of mobility, Aboriginal students, Galiwinku, Galiwinku-Gapuwiyak cluster, East Arnhem region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Milingimbi	173	21.7	Milingimbi	186	22.8
Gapuwiyak	131	16.4	Gapuwiyak	134	16.4
Yirrkala	113	14.2	Yirrkala	114	14.0
Ramingining	82	10.3	Ramingining	73	9.0
Nhulunbuy	56	7.0	Nhulunbuy	50	6.1
Warruwi	40	5.0	Warruwi	46	5.6

C. Nhulunbuy-Yirrkala cluster (orange nodes):

This cluster is located in the eastern part of the East Arnhem region and includes the regional centre of Nhulunbuy and Yirrkala. A total of 1,534 episodes of mobility were connected to this cluster of which a great majority (87.5%) occurred within the East Arnhem

region. As the location information from one of the linked datasets we used to track students' mobility was based on SA2, not localities, for this cluster, there were some mobility episodes categorised under the ABS SA2 name of 'East Arnhem' (440 episodes of mobility, including 213 departing moves and 227 incoming ones). Of the total of outflows and inflows, the Darwin region accounted for 55.5%, followed by the Top End region (28.8%).

Table 4.9: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, Nhulunbuy-Yirrkala cluster, East Arnhem region, 2005–2018

Mobility type	Source / Target cluster			Total	%
	Big Rivers	Darwin	Top End		
Outflows	17	58	22	97	6.3%
Inflows	13	48	33	94	6.1%
Within-region				1,343	87.5%
Total	30	106	55	1,534	
% (total of inflows and outflows)	15.7%	55.5%	28.8%		

The mobility statistics for the 2 larger localities are described below.

- **Nhulunbuy**

Nhulunbuy recorded a total of 636 episodes of mobility, including 297 departing moves (46.7%) and 339 incoming ones (53.3%) as shown in Table 4.10. Of all episodes of mobility, 84.7% occurred within the East Arnhem region and 8.6% were to or from the Darwin region. The 3 leading destination and source localities were Yirrkala, Galiwinku and Gapuwiyak.

Table 4.10: Leading destination and source localities for episodes of mobility, Aboriginal students, Nhulunbuy, Nhulunbuy-Yirrkala cluster, East Arnhem region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Yirrkala	138	46.5	Yirrkala	168	49.6
Galiwinku	50	16.8	Galiwinku	56	16.5
Gapuwiyak	27	9.1	Gapuwiyak	31	9.1
East Arnhem	14	4.7	East Arnhem	13	3.8

- **Yirrkala**

A total of 1,100 episodes of mobility were recorded for Yirrkala, including 571 departing moves and 529 incoming moves. Of the total of departing and incoming moves, 93.2% occurred within the East Arnhem region. The 3 leading destination and source localities were Nhulunbuy, East Arnhem SA2 and Galiwinku (Table 4.11).

Table 4.11: Leading destination and source localities for episodes of mobility, Aboriginal students, Yirrkala, Nhulunbuy-Yirrkala cluster, East Arnhem region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Nhulunbuy	168	29.4	East Arnhem	156	29.5
East Arnhem	167	29.3	Nhulunbuy	138	26.1
Galiwinku	114	20.0	Galiwinku	113	21.4
Gapuwiyak	51	8.9	Gapuwiyak	53	10.0
Milingimbi	21	3.7	Milingimbi	17	3.2

D. East Arnhem South (light blue nodes):

This cluster is located in the southern part of the East Arnhem region and includes Groote Eylandt. Major localities of the East Arnhem South cluster were Angurugu, Umbakumba, Alyangula and Milyakburra. Two remote communities in the east part of Big Rivers region, Numbulwar and Ngukurr, as well as the regional centre of Katherine, were also included in this cluster.

This cluster recorded a total of 1,724 episodes of mobility, of which 48.0% occurred within the East Arnhem region, in addition to 25.8% outflows and 26.3% inflows related to other regions. The Big Rivers region accounted for 80.4% of the total of outflows and inflows, followed by the Darwin region (12.4%).

Table 4.12: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, East Arnhem South cluster, East Arnhem region, 2005–2018

Mobility type	Source / Target cluster			Total	%
	Big Rivers	Darwin	Top End		
Outflows	362	52	30	444	25.8%
Inflows	359	59	35	453	26.3%
Within-region				827	48.0%
Total	721	111	65	1,724	
% (total of inflows and outflows)	80.4%	12.4%	7.2%		

We described the mobility statistics of the major localities below.

- **Angurugu**

Angurugu recorded a total of 1,001 episodes of mobility, of which 503 were departing moves (50.2%) and 498 incoming ones (49.8%). Of all mobility episodes, 62.3% occurred within the East Arnhem region, followed by Big Rivers region (27.0%). The 3 leading destination and source localities were Umbakumba, Milyakburra and Numbulwar. Major destination and source localities in the Big Rivers region were Numbulwar and Ngukurr.

Table 4.13: Leading destination and source localities for episodes of mobility, Aboriginal students, Angurugu, East Arnhem South cluster, East Arnhem region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Umbakumba	131	26.3	Milyakburra	134	26.6
Milyakburra	125	25.1	Umbakumba	124	24.7
Numbulwar	106	21.3	Numbulwar	110	21.9
Alyangula	49	9.8	Alyangula	32	6.4
Ngukurr	16	3.2	Ngukurr	22	4.4
Ludmilla	10	2.0	Moulden	13	2.6

- **Umbakumba**

Umbakumba recorded 241 departing moves and 246 incoming ones, each representing about half of the total of 487 episodes of mobility. Of the total of all mobility episodes, 84.8% occurred within the East Arnhem region, and 11.7% were connected with the Big Rivers region. The 3 leading destination and source localities were Umbakumba, Milyakburra and Numbulwar.

- **Alyangula**

Alyangula recorded 115 incoming moves and 114 departing ones. Overall, 52.4% of all mobility episodes occurred within the East Arnhem region, with 32.8% connected with the Big Rivers region. Angurugu and Milyakburra were the leading localities for both departing and incoming moves.

- **Milyakburra**

A total of 524 episodes of mobility were recorded for Milyakburra, including 267 departing moves and 257 incoming moves. Of all mobility episodes, 73.3% occurred within the East Arnhem region and 23.3% were connected with the Big Rivers region. The 3 leading localities for both departing and incoming moves were Angurugu, Umbakumba and Ngukurr.

4.3.2 Non-Aboriginal students

We trialled network analysis with Gephi for non-Aboriginal students. Our analysis found widely varied source and destination locations for these mobility episodes. We applied Gephi network analysis with varying combinations of degree range and resolution but the modularity scores were consistently negative. As modularity measures the number of edges within the community and the number of edges going outside the community, negative modularity scores indicate there were more edges connecting with nodes outside the cluster than those connecting with nodes inside a cluster. In other words, the clusters detected with Gephi for non-Aboriginal students of the East Arnhem region did not have strong connections. As a result, visualisation of network analysis for this group of students is not presented.

A total of 6,375 episodes of mobility were recorded for non-Aboriginal students in the East Arnhem region during the study period (Table 4.14). Overall, 52.3% of mobility episodes occurred within the East Arnhem region, while 23.7% were outflows to other regions and 24.0% inflows from other regions. Of the total of outflows and inflows, regions contributing the highest proportions of mobility episodes were Top End (37.7%), Big Rivers (32.7%) and Darwin (26.3%). The 3 leading localities for departing and incoming moves were Galiwinku, Yirrkala and Milingimbi.

Table 4.14: Number of episodes of inflow and outflow between regions and within-region mobility, non-Aboriginal students, East Arnhem region, 2005–2018

Mobility type	Source / Target region					Total	%
	Barkly	Big Rivers	Central	Darwin	Top End		
Outflows	3	505	48	403	551	1,510	23.7%
Inflows	4	488	49	395	594	1,530	24.0%
Within-region						3,335	52.3%
Total	7	993	97	798	1,145	6,375	
% (of total of outflows and inflows)	0.2%	32.7%	3.2%	26.3%	37.7%		

Table 4.15: Leading destination and source localities within the East Arnhem region for episodes of mobility, non-Aboriginal students, East Arnhem region, 2005–2018

Destination localities	Number of episodes of mobility	%	Source localities	Number of episodes of mobility	%
Galiwinku	557	11.5	Galiwinku	556	11.4
Yirrkala	491	10.1	Yirrkala	534	11.0
Milingimbi	367	7.6	Milingimbi	398	8.2
Gapuwiyak	333	6.9	Gapuwiyak	329	6.8
Angurugu	305	6.3	Angurugu	319	6.6
Ramingining	304	6.3	Maningrida	288	5.9
Nhulunbuy	292	6.0	Ramingining	286	5.9
Maningrida	258	5.3	Nhulunbuy	247	5.1
East Arnhem	224	4.6	Numbulwar	217	4.5
Numbulwar	221	4.6	East Arnhem	211	4.3
Umbakumba	209	4.3	Umbakumba	204	4.2
Milyakburra	186	3.8	Milyakburra	198	4.1
Ngukurr	118	2.4	Ngukurr	126	2.59

4.4 Latent class analysis

This section presents the results of the analysis of the characteristics of students in relation to mobility. LCA was performed to identify subsets of students who shared similar characteristics. We used the annual cohorts of 2009–2012 for this analysis for 2 reasons: first to reduce the effects of the inconsistency in recording of enrolment and attendance in the early part of the study period (reported in Chapter 2); and, secondly to optimise the length of follow-up from Year 1 to Year 6. The cohort selection was carried out by applying the following inclusion criteria:

1. A student's first enrolment record was Year 1 in the years from 2009 to 2012
2. A student's first enrolment record was in an NT Government school in the East Arnhem region
3. The age of the student at first enrolment was between 5 and 7 years.

All records of enrolment and attendance of the selected students, from Year 1 to Year 6, were included in the analysis.

4.4.1 Univariate analysis

We first performed univariate analysis with chi-squared analysis on demographic and mobility-related variables to assess for differences between Aboriginal and non-Aboriginal students. A total of 891 students were selected in the study cohort, including 527 Aboriginal students (59.1%) and 364 non-Aboriginal students (40.9%). Results of univariate analysis are presented in Table 4.16. There was strong statistical evidence for differences between these

2 groups of students in all variables analysed except sex and 'ever moved to non-NTG schools'. Aboriginal students were more likely than non-Aboriginal students to: speak English as a second language (92.2% vs 12.4%); miss both Year 3 and Year 5 NAPLAN (9.1% vs 0.8%); and have higher preschool attendance but lower Year 3 attendance (comparing the proportion with ≥80% attendance). Non-Aboriginal students were more likely to ever move to non-NTG schools (2.5% vs 1.0%) and ever move interstate or overseas (14.3% vs 1.0%). Non-Aboriginal students who ever moved were more likely to move in early years of primary school (e.g. 37% vs 17.2% in Year 1; and 25% vs 19.5% in Year 2). There was a higher proportion of students who never moved among Aboriginal students (64.5% vs 49.5%). The great majority of mobility episodes of non-Aboriginal students occurred in January (78.0% vs 12.9% for Aboriginal students). A substantial proportion of episodes of student mobility of Aboriginal students occurred in February (15.4%), August (12.1%) and October (11.1%).

Given the differences between the 2 groups of students, we performed separate latent class analysis for the 2 groups.

Table 4.16: Demographic and mobility-related characteristics of Year 1 students enrolled in NTG primary schools in 2009–2012, by Aboriginal status, East Arnhem region

Variable	Aboriginal	Non-Aboriginal	All	p-value
n =	527	364	891	
%	59.1	40.9		
Sex				0.677
Female	46.1	47.5		
Male	53.9	52.5		
English as a second language				<0.0005
No	7.8	87.6		
Yes	92.2	12.4		
Attending NAPLAN Y3 & Y5				<0.0005
Not absent	84.3	61.8		
Both absent	9.1	0.8		
Missing data	6.6	37.4		
Preschool attendance				<0.0005
<60%	56.7	21.2		
60–79%	14.4	42.6		
≥80%	17.5	9.3		
Missing data	11.4	26.9		
Year 3 attendance				<0.0005
<60%	62.2	10.4		
60–79%	24.5	9.1		
≥80%	13.3	80.5		
Calendar month (proportion of total mobility episodes)				<0.0005
Jan	12.9	78.0		
Feb	15.4	4.4		

Mar	7.0	1.3	
Apr	6.8	3.5	
May	8.2	2.6	
Jun	3.7	0.0	
Jul	4.6	2.2	
Aug	12.1	1.8	
Sep	8.5	2.2	
Oct	11.1	1.8	
Nov	8.1	2.2	
Dec	1.6	0.0	
Year level at first mobility episode			<0.0005
Year 1	17.2	37.0	
Year 2	19.5	25.0	
Year 3	16.0	16.9	
Year 4	18.3	12.5	
Year 5	16.0	4.9	
Year 6	13.0	3.8	
Number of mobility episodes			<0.0005
0	64.5	49.5	
1	10.4	42.0	
2	8.7	6.0	
3–4	6.1	2.5	
5+	10.3	0.0	
Mobility category			<0.0005
Not moved	64.5	49.5	
Only remote to remote	22.0	38.5	
Only urban to urban	4.4	8.8	
Only urban to remote or remote to urban	8.7	3.3	
Mixed	0.4	0.0	
Ever moved to non-NTG schools			0.072
No	99.1	97.5	
Yes	1.0	2.5	
Ever moved interstate or overseas			0.002
No	99.1	85.7	
Yes	1.0	14.3	

4.4.2 Aboriginal students

A total of 527 Aboriginal students were included in the LCA. The processes for conducting the LCA, including testing for model fit and determining the best fit model are described in Chapter 2. Note that the variable 'mobility category' was not included in the covariates for LCA model building due to its high level of correlation with the variable 'number of episodes of mobility'. However, it was included in the post-hoc analysis. We considered the testing results on model fit and the interpretability of the models with a number of latent classes

and determined the 2-class model to be most appropriate. Details of the model testing results and the model selection process are provided in section B.1 and Table Appendix 3 in Appendix 1.

The 2 groups detected in the LCA (Table 4.17) were named according to their characteristics in mobility: Movers (n = 190, 36.1% of Aboriginal students) and Stayers (n = 337, 63.9%). In the Movers group, students were equally likely to move only 1 time and to move 5 times or more (30.7% and 30.4% respectively), compared with Stayers who had a high probability of not moving (93.7%). There was no evidence for a difference between the 2 groups for the other 2 variables examined. The probability was low for Movers to ever move to non-NTG schools (3.0%) or interstate or overseas (3.0%). This means the Movers would largely move either within the NT or between NTG schools.

Results of post-hoc analysis are presented in Table 4.18. There was evidence of a difference between the 2 groups of students for sex ($p = 0.015$) and speaking English as a second language ($p < 0.0005$). There was a higher proportion of male students in the Stayers group (57.9% vs 46.8%). Stayers were more likely to speak English as a second language (95.6% vs 86.3%). There was no evidence of a difference in other variables examined, including preschool and Year 3 attendance and attending NAPLAN Year 3 & Year 5.

With regard to the distribution of mobility episodes across calendar months in the Movers group, except January and February, the months recording higher proportions of total mobility episodes were August (12.1%) and October (11.1%). In terms of 'year level at first mobility episodes', there were higher proportions of mobility episodes in early and middle years (Year 1 to Year 4) than in late years (Years 5 and 6). We also examined the mobility categories: Movers were most likely to move only from remote to remote areas (61.1%), although about 1 in 4 of them only moved from urban to remote or remote to urban areas (25.8%).

Table 4.17: Results of latent class analysis for mobility-related characteristics of students enrolled in Year 1 2009–2012, Aboriginal students, East Arnhem region

Variable	Movers		Stayers	
n =	190		337	
%	36.1		63.9	
	Probability	(95% CI)	Probability	(95% CI)
Number of episodes of mobility				
0	0.0	(0.0~0.0)	93.7	(30.4~100.0)
1	30.7	(0.8~60.6)	1.0	(0.0~29.5)
2	26.9	(0.0~66.6)	0.0	(0.0~0.0)
3–4	12.1	(0.0~44.5)	2.7	(0.0~23.0)
5+	30.4	(8.9~51.8)	2.6	(0.0~24.2)
Ever moved to non-NTG schools		(0.0~0.0)		(0.0~0.0)
No	97.0	(92.1~100.0)	100.0	(100.0~100.0)
Yes	3.0	(0.0~7.9)	0.0	(0.0~0.0)

Ever moved interstate or overseas			(0.0~0.0)		(0.0~0.0)
	No	97.0	(91.7~100.0)	100.0	(100.0~100.0)
	Yes	3.0	(0.0~8.3)	0.0	(0.0~0.0)

Notes: Probabilities are presented as percentages. Some estimates for confidence intervals were either negative or greater than 100% and are presented in the table as 0.0% and 100.0% respectively.

Table 4.18: Results of post-hoc analysis, after latent class analysis, of the characteristics of 2 classes of students enrolled in Year 1 in 2009–2012, Aboriginal students, East Arnhem region

Variables used in post-hoc analysis	Movers (n = 190)	Stayers (n = 337)
Sex*		
Female	53.2	42.1
Male	46.8	57.9
English as a second language***		
No	13.7	4.5
Yes	86.3	95.6
Preschool attendance		
<60%	56.8	56.7
60–79%	14.2	14.5
≥80%	19.5	16.3
Missing data	9.5	12.5
Year 3 attendance		
<60%	65.8	60.2
60–79%	20.0	27.0
≥80%	14.2	12.8
Missing data	0.0	0.0
Attending NAPLAN Y3 & Y5		
Not absent	81.6	85.8
Both absent	9.0	9.2
Missing data	9.5	5.0
Calendar month of mobility (proportion out of all episodes of mobility)***		
Jan	12.9	-
Feb	15.4	-
Mar	7.0	-
Apr	6.8	-
May	8.2	-
Jun	3.7	-
Jul	4.6	-
Aug	12.1	-
Sep	8.5	-
Oct	11.1	-
Nov	8.1	-

Dec	1.6	-
Year level at first mobility episode		
Year 1	17.3	-
Year 2	19.5	-
Year 3	16.2	-
Year 4	19.5	-
Year 5	15.7	-
Year 6	11.9	-
Mobility category		
Not moved	0	-
Only remote to remote	61.1	-
Only urban to urban	12.1	-
Only urban to remote or remote to urban	25.8	-
Mixed	1.1	-

Notes: Figures are presented as percentages. * $p < 0.05$; ** $p < 0.005$; *** $p < 0.0005$

4.4.3 Non-Aboriginal students

There were 364 non-Aboriginal students included in the LCA. We followed the same processes conducted for Aboriginal students, described above, and adopted the 3-class model. The 3 groups identified were named according to their mobility characteristics: Intrastate Movers (n = 19, 5.2%), Interstate Movers (n = 52, 14.3%) and Occasional Movers (n = 293, 80.5%) as shown in Table 41.

While students in all 3 groups were likely to have mobility during primary school years, Occasional Movers only had a probability of 37.1% to move and moved once, compared with the probability of 100% to move in the other 2 groups. The majority of Interstate Movers only moved once (69.2%) and had 98.9% probability of moving interstate or overseas, while the other 2 groups only moved within the NT. Intrastate Movers differed from the other 2 groups by having a high probability of moving 3–4 times (22.1% vs 5.8% and 0.0% in Interstate Movers and Occasional Movers respectively). Intrastate Movers were also the only group that had ever moved to non-NTG schools (33.4% vs 0% in the other 2 groups).

Post-hoc analysis revealed further differences in the characteristics and patterns of mobility among the 3 groups (Table 4.18). No evidence of difference was found between the 3 groups in sex, speaking English as a second language and preschool attendance (high levels of missing data were noted for this variable). However, there was evidence of a difference in Year 3 attendance: Occasional Movers had the highest probability of having 80% or higher attendance (82.6%) and Intrastate Movers (the groups that moved most frequently among the 3) recorded the lowest probability of 80% or higher attendance (63.2%).

With regard to the timing of mobility, the less frequently moved groups (Interstate Movers and Occasional Movers) were more likely to have the highest proportion of mobility occurring in January (76.1% and 91.2% respectively) while there were comparatively greater proportions of Intrastate Movers who moved in other months; February (11.6%), November (11.6%) and April (9.3%) being the top 3 months.

In terms of 'year level at first mobility episodes', notably all Interstate Movers moved in Year 1. This was also the year level that recorded the highest proportion of all mobility episodes for Intrastate Movers (63.2%), while the proportion was much lower among Occasional Movers (3.5%). For Occasional Movers, if they moved, they were more likely to move in Year 2 to Year 4 (in total, 82.3%). With regards to mobility category, Intrastate Movers were more likely to only move from urban to urban areas (63.2%) while Interstate Movers and Occasional Movers (when they moved) were more likely to move only from remote to remote areas (69.2% and 34.1%).

Table 4.19: Results of latent class analysis for mobility-related characteristics for students enrolled in Year 1 in 2009–2012, non-Aboriginal students, East Arnhem region

Variable		Intrastate Movers		Interstate Movers		Occasional Movers	
	n =	19		52		293	
	%	5.2		14.3		80.5	
		Probability (95% CI)		Probability (95% CI)		Probability (95% CI)	
Number of episodes of mobility							
	0	0.0	(0.0~0.0)	0.0	(0.0~0.0)	62.9	(56.5~69.4)
	1	45.0	(12.3~77.7)	69.2	(56.7~81.8)	37.1	(30.6~43.5)
	2	32.9	(8.7~57.0)	25.0	(13.2~36.8)	0.0	(0.0~0.0)
	3–4	22.1	(2.8~41.5)	5.8	(0.0~12.1)	0.0	(0.0~0.0)
	5+	0.0	(0.0~0.0)	0.0	(0.0~0.0)	0.0	(0.0~0.0)
Ever moved to non-NTG schools							
	No	66.6	(40.6~92.7)	100.0	(100.0~100.0)	100.0	(100.0~100.0)
	Yes	33.4	(7.3~59.4)	0.0	(0.0~0.0)	0.0	(0.0~0.0)
Ever moved interstate or overseas							
	No	100.0	(100.0~100.0)	1.1	(0.0~27.4)	100.0	(100.0~100.0)
	Yes	0.0	(0.0~0.0)	98.9	(72.6~100.0)	0.0	(0.0~0.0)

Notes: Probabilities are presented as percentages. Some estimates for confidence intervals were either negative or greater than 100% and are presented in the table as 0.0% and 100.0% respectively.

Table 4.20: Results of post-hoc analysis, after latent class analysis, of the characteristics of 3 classes of students enrolled in Year 1 in 2009–2012, non-Aboriginal students, East Arnhem region

Variables used in post-hoc analysis	Intrastate Movers	Interstate Movers	Occasional Movers
	(n = 19)	(n = 52)	(n = 293)
Sex			
Female	36.8	44.2	48.8
Male	63.2	55.8	51.2
English as a second language			
No	79.0	82.7	89.1
Yes	21.1	17.3	10.9
Preschool attendance			
<60%	31.6	25.0	19.8
60–79%	31.6	32.7	45.1
≥80%	15.8	3.9	9.9
Missing data	21.1	38.5	25.3
Year 3 attendance**			
<60%	31.6	5.8	9.9
60–79%	5.3	19.2	7.5
≥80%	63.2	75.0	82.6
Missing data	0.0	0.0	0.0
Attending NAPLAN Y3 & Y5***			
Not absent	52.6	5.8	72.4
Both absent	5.3	0.0	0.7
Missing data	42.1	94.2	27.0
Calendar month of mobility (proportion out of all episodes of mobility)***			
Jan	46.5	76.1	91.2
Feb	11.6	7.0	0.0
Mar	0.0	2.8	0.9
Apr	9.3	4.2	0.9
May	7.0	2.8	0.9
Jun	0.0	0.0	0.0
Jul	2.3	1.4	2.7
Aug	0.0	2.8	1.8
Sep	4.7	2.8	0.9
Oct	7.0	0.0	0.9
Nov	11.6	0.0	0.0
Dec	0.0	0.0	0.0
Year level at first mobility episode***			
Year 1	63.2	100.0	3.5
Year 2	15.8	0.0	38.1
Year 3	21.1	0.0	23.9
Year 4	0.0	0.0	20.4
Year 5	0.0	0.0	8.0
Year 6	0.0	0.0	6.2

Mobility category* **			
Not moved	0.0	0.0	61.1
Only remote to remote	26.3	69.2	34.1
Only urban to urban	63.2	25.0	2.4
Only urban to remote or remote to urban	10.5	5.8	2.4
Mixed	0.0	0.0	0.0

* $p < 0.05$; ** $p < 0.005$; *** $p < 0.0005$

Chapter 5 Student mobility in the Central region

Key findings

Descriptive statistics

- The number of Aboriginal students enrolled each year was consistently higher than non-Aboriginal students and the difference increased across the study period.
- Among Aboriginal students, there was a trend of an increasing proportion of students recording any mobility in a calendar year during the period of 2013–2018, starting from around 20% in 2013 and 2014 to 37.6% in 2018, an increase of around 88%. For non-Aboriginal students, the proportion of students who moved dropped sharply from around 20% in 2005–2012 to around 10% in 2013–2017, with an increase in 2018 (14.2%).
- The majority of both Aboriginal and non-Aboriginal students, who moved, moved only once in the same calendar year.
- For Aboriginal students there was a trend of increase in the number of students who moved for all 3 levels of mobility (once, twice and 3 or more times), in the period from 2013 to 2018. For non-Aboriginal students the major category of mobility was 'Move interstate or overseas'.

Network analysis

- For Aboriginal students, 7 clusters of localities were identified: Alice Springs, Finke-Titjikala, Central East, Yuendumu-Nyirripi, Central South, Central West and Central North. The average weighted degree was 231.5, which was lower than the 311.1 for Aboriginal students for the NT overall.
- Clusters of mobility were not evident for non-Aboriginal students due to widely varied source and destination locations for the mobility episodes.

Latent class analysis

- Grouping of students with different characteristic of mobility was assessed for the annual Year 1 cohorts from 2009 to 2012, with 669 Aboriginal students (53.4%) and 584 non-Aboriginal students (46.6%).
- For Aboriginal students, 4 groups were identified: Frequent Movers (30 students, representing 4.5% of the cohort), Intrastate Movers (261, 39.0%), Once-off Movers (99, 14.8%) and Stayers (279, 41.7%).
    - **Frequent Movers** tended to have 2 or more episodes of mobility, only move from urban to remote or from remote to urban areas and move interstate or overseas. **Intrastate movers** could move from once to more than 5 times, tended to move from remote to remote areas or from urban to urban areas, rarely moved to non-NTG schools and never moved interstate or overseas. **Once-off Movers** tended to move only once, moved between remote areas

and were more likely to move to non-NTG schools or out of the NT than Intrastate Movers.
    - Post-hoc analysis found that Year 3 attendance decreased as the frequency of mobility increased across the 3 groups with mobility.
- For non-Aboriginal students, 4 groups were identified: Frequent Movers (54 students, representing 9.2% of the study cohort), Occasional Movers (155, 26.5%), Once-off Movers (56, 9.6%) and Stayers (319, 54.6%).
    - **Frequent Movers** tended to move twice and move only from urban to urban areas, were moderately likely to move out of the NT but rarely moved to non-NTG schools. **Occasional Movers** tended to move only once and only move either from urban to urban areas or from remote to remote areas, but rarely moved to non-NTG schools and never moved interstate or overseas. **Once-off Movers** only ever moved once and all these moves were interstate or overseas and from remote to remote areas.
    - Post-hoc analysis found that the proportion of students with 80% or higher Year 3 attendance decreased, among the 3 groups with mobility, as the frequency of mobility increased.

5.1 Overview of chapter

This chapter presents a deep-dive analysis of student mobility in the Central region. As in the deep-dive for the other 2 regions, we excluded enrolment records for students which were: related to distance education, not relevant to primary school years, and for students who had died. Schools included in this deep-dive are listed in Appendix 2, Appendix Table 10. Section 5.2 provides descriptive information for students enrolled in primary schools across all years of available data from 2005 to 2018. The section includes information on the number of student enrolments each year; the number and proportion of students who moved during each year in the region, including information on average annual enrolment; the number of times students moved; categories of movement; and the month of movement. Geographic patterns of movement are presented in section 5.3, including the number of episodes of mobility between regions and between communities. This section includes information presented as visualisations which highlight clusters of localities between which episodes of mobility are more common. Section 5.4 describes the characteristics of children with different patterns of mobility, including those children who remained at the same primary school and those children who moved once or many times. For this section, the information is based on children who commenced Year 1 of primary school between 2009 and 2012 with analysis for up to 6 years to Year 6 of primary school education.

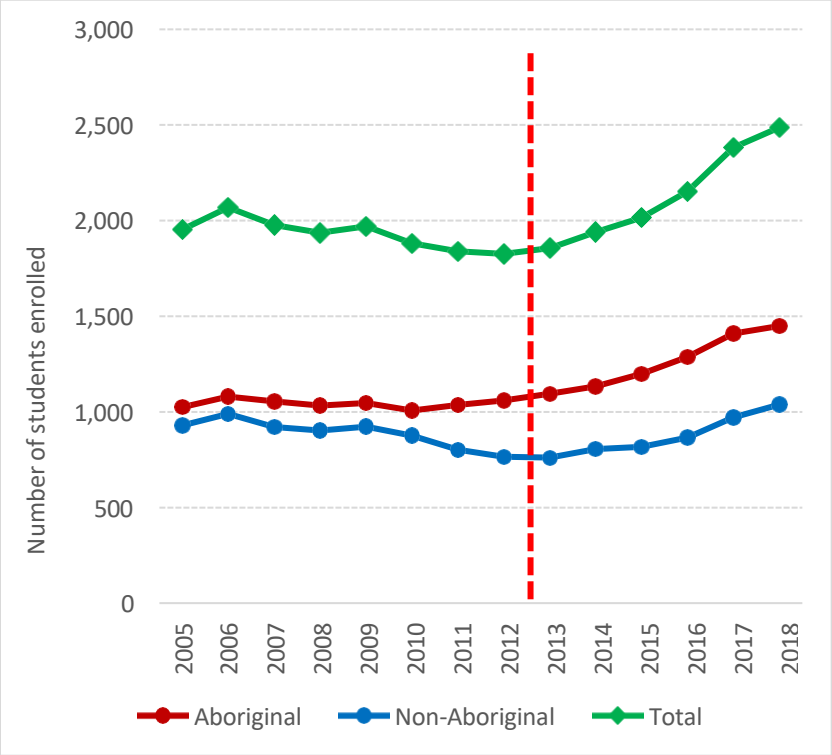
5.2 Descriptive statistics

This section provides descriptive information about students who enrolled in an NT Government primary school in the Central region from 2005 to 2018. All enrolment and attendance records from NT Government primary schools in the Central region of this period were included for analysis. To recognise changes introduced in 2013 in departmental procedures for recording enrolment and attendance (see section 2.2), we present the results for the period prior to the change (2005–2012, referred to as Period 1) and after the change (2013–2018, referred to as Period 2) separately, and indicate the division of the whole study period into these 2 periods with a red line in the relevant figures.

5.2.1 Annual student enrolment and mobility

During the period 2005–2018, there was an average of 2,020 students enrolled per year in public primary schools in the Central region (1,137 Aboriginal and 883 non-Aboriginal students). The number of Aboriginal students enrolled each year was consistently higher than non-Aboriginal students and the difference increased across the study period. The number of Aboriginal students enrolled each year was relatively stable during Period 1 (between 1,000 and 1,100); in Period 2, the number consistently increased each year from 1,095 students in 2013 to 1,449 students in 2018 (Figure 5.1).

Figure 5.1: Number of students ever enrolled in NTG schools in a calendar year, for Aboriginal, non-Aboriginal and total students, Central region, 2005–2018

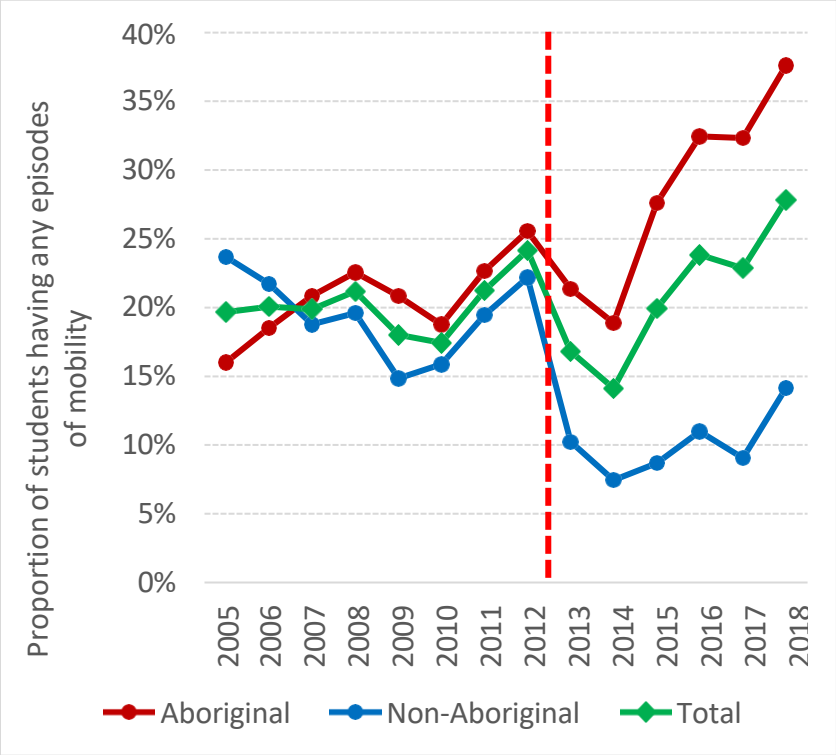


The number of non-Aboriginal students enrolled each year declined between 2006 and 2012 in Period 1 (from 929 to 766); in Period 2, the number trended upwards from 761 in 2013 to 1,038 students in 2018.

The proportion of students with a record of moving schools each year is presented in Figure 5.2. Among Aboriginal students, in Period 1, there was some variation between years but with an overall increase in the proportion of students who ever moved. After an apparent fall in 2013 and 2014, the trend of increasing mobility continued from around 20% of students in 2013 and 2014 to 37.6% in 2018, an increase of around 88% for that period.

Among non-Aboriginal students, in Period 1, the proportion of students having an episode of mobility each year varied between 15% and 23% with no apparent trend of increase or decrease. In Period 2, there was a markedly lower proportion of non-Aboriginal students who moved each year, than recorded in Period 1, with the lowest proportion in 2014 (7.4%) followed by evidence of an increasing trend to 14.2% of students in 2018.

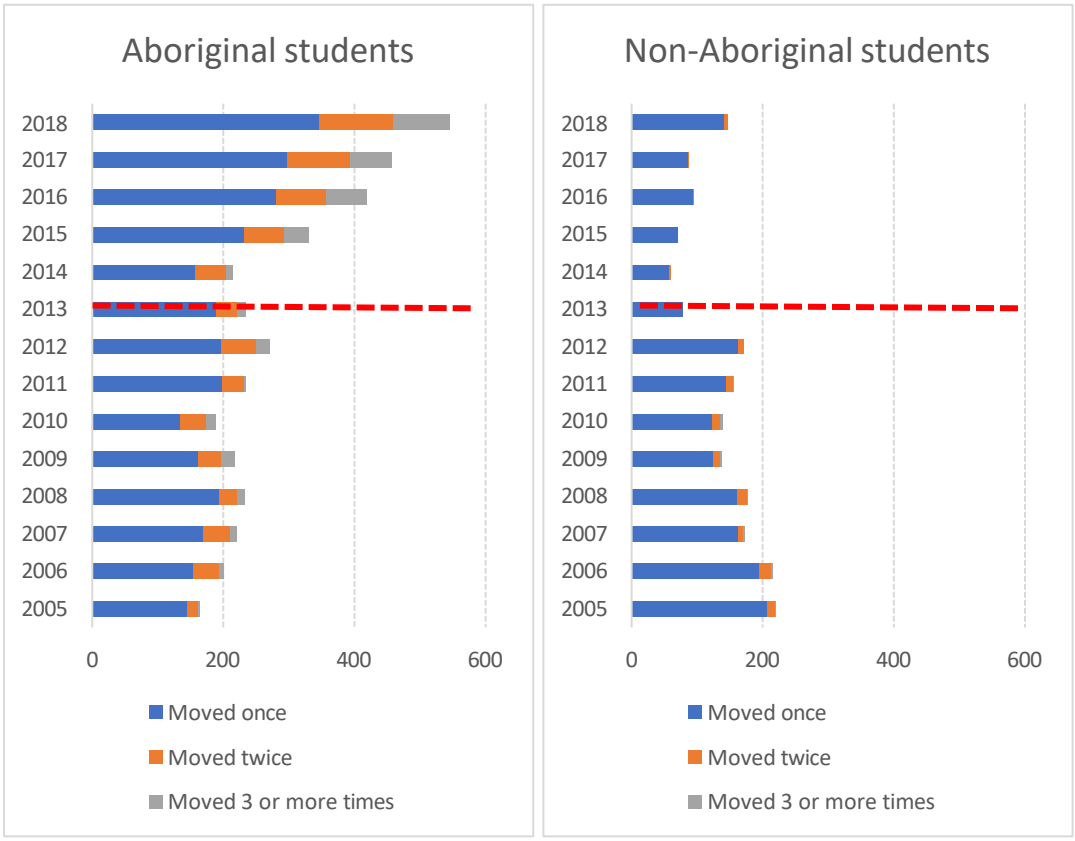
Figure 5.2: Proportion of students in NTG schools who had any episode of mobility, for Aboriginal, non-Aboriginal and total students, Central region, 2005–2018



5.2.2 Levels of student mobility

Analysis results for the number of students who moved in each calendar year and the level of mobility are presented in Figure 5.3. The majority of both Aboriginal and non-Aboriginal students who moved, only moved once in the same calendar year. Among Aboriginal students, the proportion of students for each of the 3 levels of mobility (once, twice or 3 or more times) remained relatively stable in Period 1; however, across Period 2 there is a trend of an increasing number of students who moved for all 3 levels of mobility. Among non-Aboriginal students, the number of students who moved more than once was less than 20 students each year across Period 1. In Period 2, there was no apparent trend in the number of students who moved each year, with only 5 or less students moving more than once.

Figure 5.3: Number of students and level of mobility, by year, for Aboriginal and non-Aboriginal students, Central region, 2005–2018

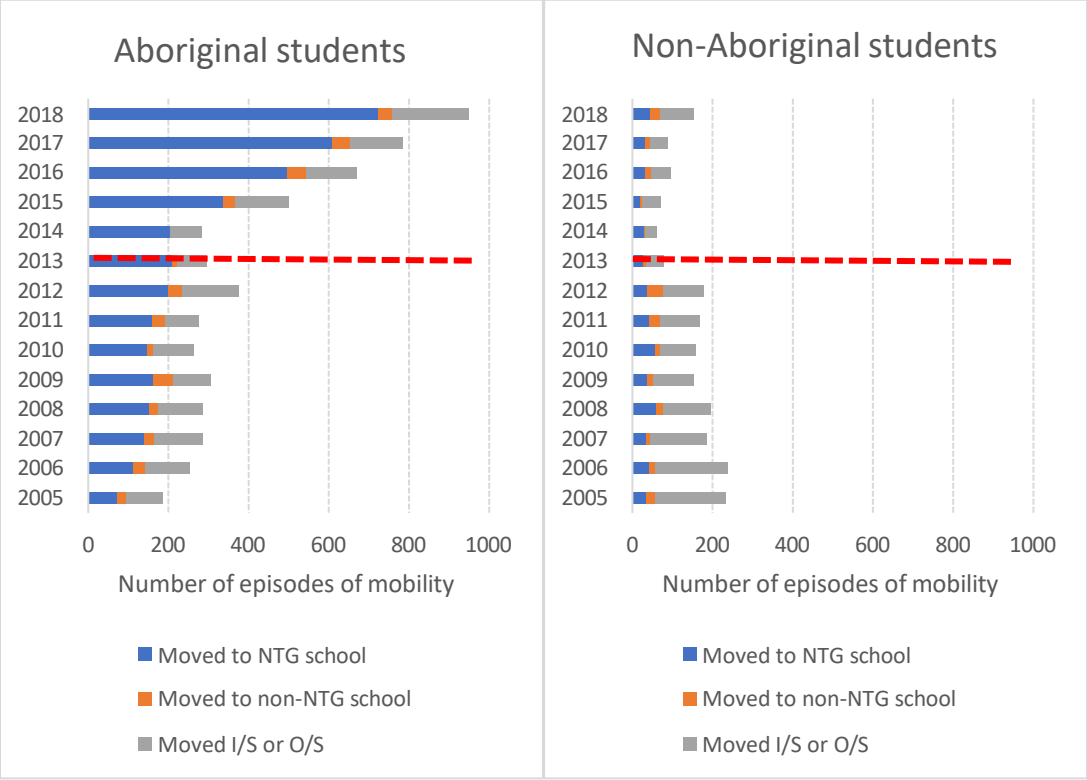


5.2.3 Categories of student mobility

This section examined the annual number of episodes of student mobility by destination category, for those students for whom a destination could be determined (Figure 5.4). Among Aboriginal students, the dominant destination category was 'Moved to NTG school'. In Period 1, the number of episodes of mobility varied around 200 each year; however, in Period 2, the number of episodes of mobility increased substantially. For the category 'Moved to NTG school' the number of episodes increased from 211 to 723, and the number of episodes of 'Moved interstate or overseas' increased from 73 to 191. The number of episodes of mobility in the category 'Moved to non-NTG-school' increased from 10 episodes in 2013 to 34 episodes in 2018.

Among non-Aboriginal students, the dominant category was 'Moved interstate or overseas'. In Period 1, there were between 89 and 181 episodes of mobility in this category, while in Period 2 (between 2013 and 2017) there were less than 50 episodes each year and in 2018 this increased to 84 episodes.

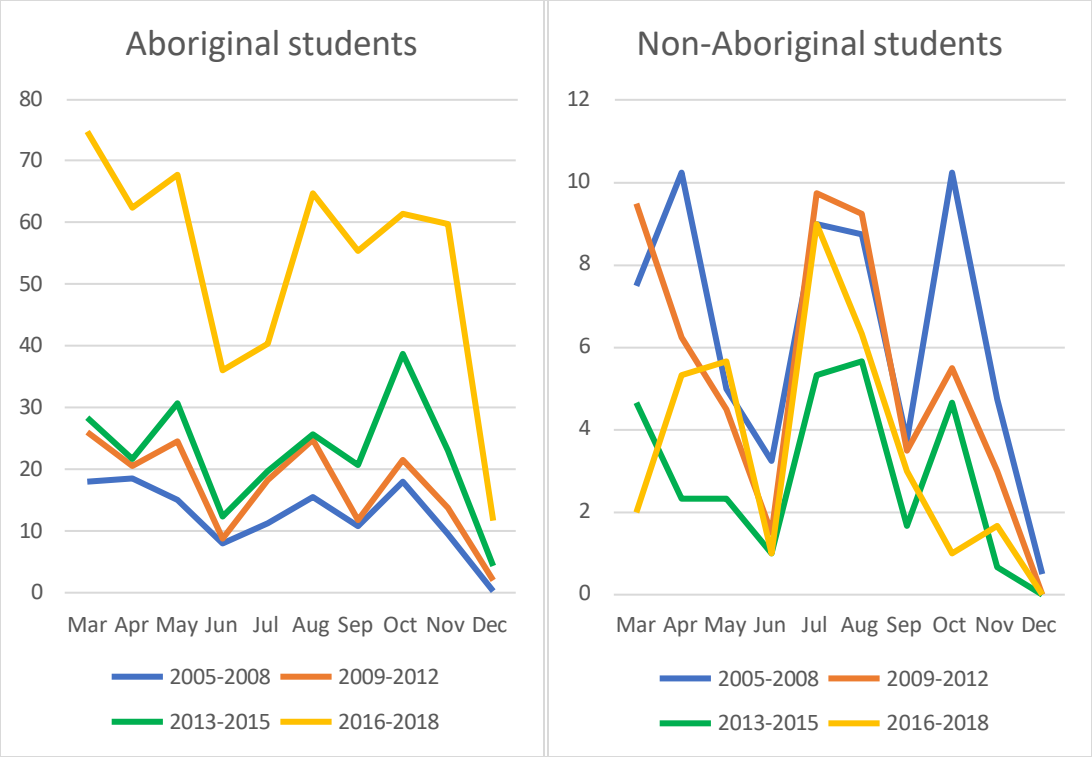
Figure 5.4: Number of episodes of mobility for students and category of mobility, by year, for Aboriginal and non-Aboriginal students, Central region, 2005–2018



5.2.4 Timing of student mobility

In this section, we analysed the number of episodes of mobility by calendar month. The results are presented as the average for the 4 time periods, 2005–2008, 2009–2012, 2013–2015 and 2016–2018 (Figure 5.5). Similar to the results for East Arnhem region (Chapter 4) and Big Rivers region (Chapter 6), the average number of episodes of mobility each month was greatest for the most recent 2016–2018 period. The highest average movement in each time period was in January and February at the start of the school year. Excluding these 2 months, the highest number of episodes of mobility for Aboriginal students was around the start of school terms in March, May, August and October. There was only a small average number of movements during the school year for non-Aboriginal students. After excluding January and February, the number of mobility episodes appeared to be greatest in July, August and October with a less clear peak earlier in the year between March and May but varying with the time period.

Figure 5.5: Average number of episodes of student mobility, by month, for 4 time periods (2005–2008, 2009–2012, 2013–2015, 2016–2018) for Aboriginal and non-Aboriginal students, Central region



5.3 Network analysis with Gephi

This section presents the results of network analysis with the Gephi software program for the Central region. For network analysis we included all episodes of mobility including movements into and out of the region and within the region, named inflows, outflows and within-region mobility respectively. When reporting results for an individual locality, we referred to movements into and out of a locality as incoming and departing moves, respectively. To assist interpretation of the results and to protect confidentiality, the analysis excluded patterns of mobility with less than 10 episodes. This is important particularly considering the small sizes of population of some remote communities and their even smaller sizes of primary school student population.

5.3.1 Aboriginal students

Parameters and results of network analysis with Gephi are presented in Table 5.1. To facilitate the detection of significant networks of student mobility, we excluded nodes involving low numbers of episodes of mobility (which indicated that they were unconnected with other localities in a network). The degree range used in this filtering process was 15 to 158 episodes. This meant that all localities that recorded less than 15 episodes of mobility were excluded from the visualisation while the upper bound of 158 is the maximum number of episodes connected to localities. This filtering process allowed 66.3% of all mobility

routes (709 out of 1070) and 65.9% of Central region localities (29 out of 44) to be visible in the visualisation. By dividing the total of 9,953 episodes of mobility by 43 localities (including localities outside the Central region) applied in the visualisation, we obtained the average weighted degree of 231.5. This value means, on average, each locality included in the visualisation recorded 231 episodes of mobility during the study period. Modularity analysis conducted with a resolution of 0.6 detected 7 clusters of localities with a modularity value of 0.065. The modularity score is low, which meant the detected cluster structure was not strong and that there is a high level of movement to other localities outside of these clusters. The modularity analysis detected 7 clusters of localities for the Central region, as presented in Figure 21 and described below: Alice Springs, Finke-Titjikala, Central East, Yuendumu-Nyirripi, Central South, Central West and Central North. The visualisation of the network analysis is presented in Figure 5.6.

Table 5.1: Parameters and results of network analysis with Gephi, Aboriginal students, Central region, 2005–2018

Item	Values and results
Degree range	15–158
Central region localities visible (% of the total of 44)	29 (65.9%)
Nodes visible (% of all NT nodes)	43 (27.6%)
Edges visible (% of all edges)	709 (66.3%)
Modularity score	0.065
Number of modularity communities identified	7
Average weighted degree	231.5

Details on the numbers of inflows, outflows and within-region mobility episodes are presented in Table 5.2. The dominant type of mobility was within-region, which accounted for 73.0% of all mobility episodes in the visualisation. There were slightly more inflows than outflows (15.9% vs 11.0%). Other regions which contributed the majority of inflows and outflows were Barkly and Big River regions. No episodes of mobility involving East Arnhem or Top End regions were included in the visualisation. This shows that localities of these 2 regions only contributed low numbers of mobility episodes. Details of episodes of mobility for each of the clusters are presented below.

Figure 5.6: Clusters of localities detected with modularity analysis in Gephi, Aboriginal students, Central region, 2005–2018

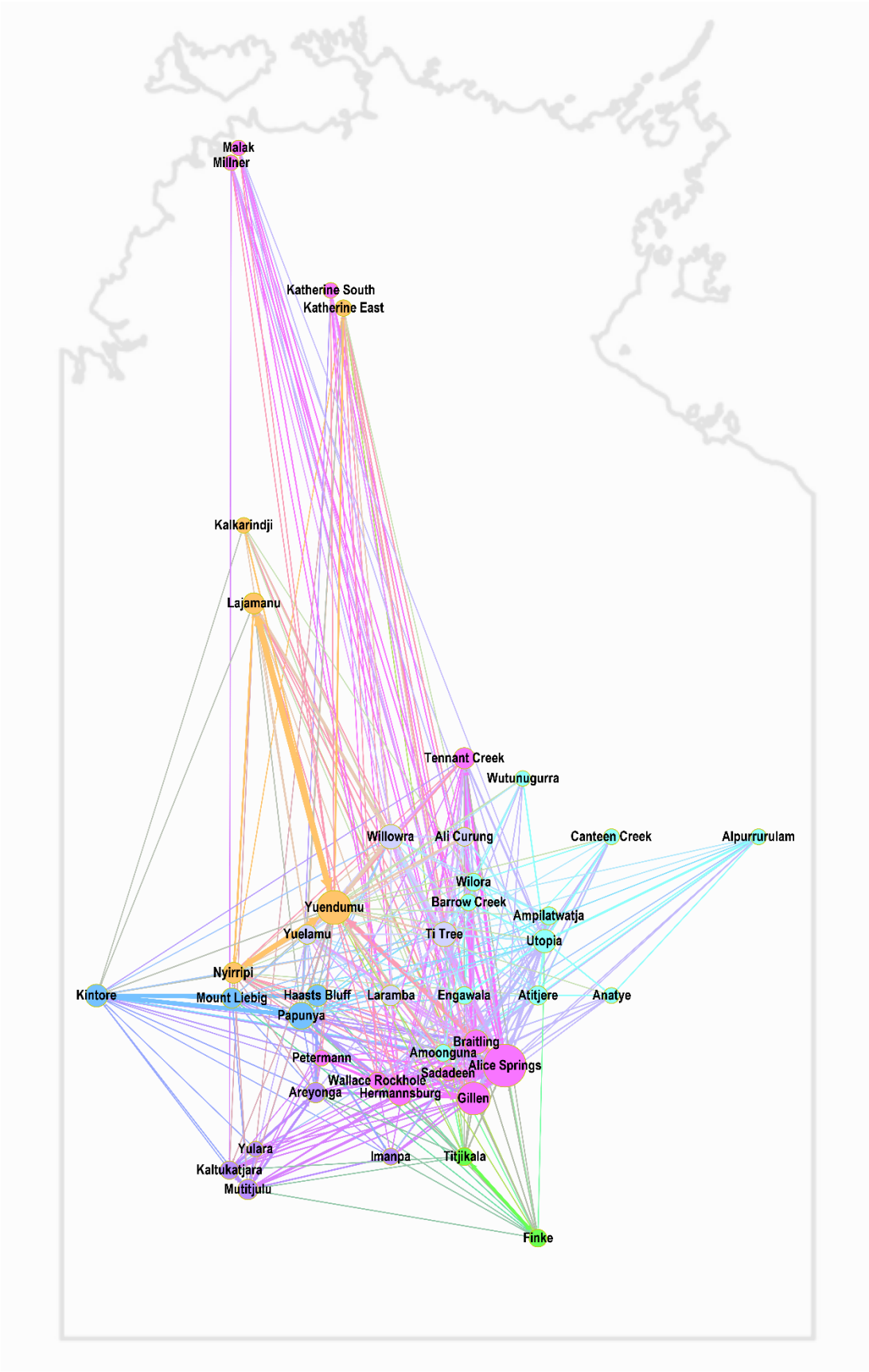


Table 5.2: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, Central region, 2005–2018

Mobility type	Barkly	Big Rivers	East Arnhem	Darwin	Top End	Total	% of total: 9,953
Outflows	636	409	0	53	0	1,098	11.0%
Inflows	1134	394	0	59	0	1,587	15.9%
Within-region	-	-	-	-	-	7,268	73.0%
Total	1770	803	0	112	0	9,953	
% (of total of inflows and outflows: 2,685)	65.9%	29.9%	0.0%	4.2%	0.0%		

Cluster A – Alice Springs (pink nodes):

This was the largest cluster among the 7 Central region clusters. It consisted of the town of Alice Springs including a number of suburbs and some surrounding remote localities including Hermannsburg, Wallace Rockhole and Petermann (a locality which contains the communities of Kaltukatjara, Mutitjulu and Yulara). Beyond the Central region, this cluster also extended its mobility connections to some Darwin suburbs, Katherine and a number of remote communities in Barkly and Big Rivers regions. Summary statistics on mobility are provided in Table 5.3. Of the total of 3,400 episodes of mobility for the Alice Springs cluster, more than three-quarters (76.6%) occurred within the Central region with similar proportions of outflows and inflows. Among regions, the Barkly region contributed the highest numbers of mobility connections. Mobility details for selected localities are described below.

Table 5.3: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, Alice Springs cluster, Central region, 2005–2018

Mobility type	Barkly	Big Rivers	Darwin	Total	% of total
Outflows	272	97	39	408	12.0%
Inflows	298	32	59	389	11.4%
Within-region	-	-	-	2,603	76.6%
Total	570	129	98	3,400	

- ***Alice Springs*** (the urban centre with its suburbs, Braitling, Sadadeen and Gillen):

A total of 2,909 episodes of mobility (representing 85.6% of the mobility episodes for the cluster) were classified under the urban centre of Alice Springs. As the total number of episodes was relatively large, we analysed these episodes in relation to the Central region. The vast majority (80.7%) of mobility episodes occurred within the Central region (Table 5.4). The proportion for outflows to other regions (12.7%) was almost twice the proportion of inflows from other regions (6.6%). Destination localities with highest numbers of departing moves from Alice Springs were Yuendumu, Hermannsburg and Tennant Creek. Source localities contributing the highest numbers of incoming moves were Hermannsburg, Tennant Creek and Wallace Rockhole (Table 5.5).

Table 5.4: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, Alice Springs, Alice Springs cluster, Central region, 2005–2018

Mobility type	Barkly	Big Rivers	Darwin	Total	% of total
Outflows	253	89	27	369	12.7%
Inflows	133	27	32	192	6.6%
Within-region	-	-	-	2,348	80.7%
Total	386	116	59	2,909	

Table 5.5: Leading destination and source localities for episodes of mobility, Aboriginal students, Alice Springs, Alice Springs cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Yuendumu	207	11.7	Hermannsburg	166	36.1
Hermannsburg	165	9.3	Tennant Creek	133	28.9
Tennant Creek	140	7.9	Wallace Rockhole	70	15.2
Ti Tree	89	5.0	Petermann	32	7.0
Papunya	86	4.9	Katherine South	27	5.9
Utopia	77	4.4	Millner	17	3.7

- ***Hermannsburg:***

A total of 595 episodes of mobility were recorded for Hermannsburg. They included 381 departing moves (64.0%) and 214 incoming moves (36.0%). The majority of departing moves (43.6%) and incoming moves (77.1%) were to and from Alice Springs (Table 5.6). Most other

destination and source localities for mobility episodes of Hermannsburg were remote communities in Central, Barkly and Big Rivers regions.

Table 5.6: Leading destination and source localities for episodes of mobility, Aboriginal students, Hermannsburg, Alice Springs cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Alice Springs	166	43.6	Alice Springs	165	77.1
Papunya	35	9.2	Wallace Rockhole	30	14.0
Wallace Rockhole	31	8.1	Malak	10	4.7
Areyonga	25	6.6			
Laramba	13	3.4			
Mount Liebig	13	3.4			

- ***Petermann:***

Petermann recorded 105 episodes of mobility with 53 being departing moves and 52 incoming ones, all occurring within the Central region. Of these, 60.4% of departing moves and 67.3% of incoming moves went to and from Alice Springs. In addition, Wallace Rockhole contributed 17.0% of departing moves and 19.2% of incoming moves. Other localities recorded low numbers of episodes of mobility.

- ***Wallace Rockhole:***

This locality recorded 234 episodes of mobility, 128 (54.7%) of which were departing moves and 106 (45.3%) incoming ones. The main localities for departing moves were Alice Springs (54.7%), Hermannsburg (23.4%) and Petermann (7.8%), while the majority of incoming moves came from Alice Springs (61.3%) and Hermannsburg (29.3%), all being localities in the same cluster.

Cluster B – Finke-Titjikala (light green nodes):

This was a small cluster containing 2 localities, Finke and Titjikala, with a total of 266 episodes of mobility, of which 262 (98.4%) occurred within the Central region.

- ***Finke:***

There were 132 departing moves from Finke, with 51.5% to Titjikala and 30.0% to Alice Springs. All 70 recorded incoming moves came from Titjikala.

- ***Titjikala:***

This locality recorded 134 departing moves, with 52.2% of them to Finke and 23.9% to Alice Springs. All 68 incoming moves came from Finke.

Cluster C – Central East (light blue nodes):

This cluster was located in the north-eastern part of the region. A total of 1,252 episodes of mobility were recorded for this cluster, including 153 outflows (12.2%) and 654 inflows (52.2%) to and from other regions and 445 within-region episodes (35.5%). Of mobility episodes to and from other regions, 92.2% of outflows went to the Barkly region and all inflows came from the Barkly region. The localities included in this cluster with higher numbers of mobility episodes were Utopia, Ampilatwatja, Atitjere, Engawala, Wilora and Amoonguna with details of movement in the following tables. Other localities within this cluster with lower number of episodes of movement were Barrow Creek, Alpurrurulam, Anatye, Canteen Creek and Wutunugurra.

- ***Utopia:***

Utopia recorded 214 outflows and 296 inflows. All departing moves occurred within the Central region while 76.4% of incoming moves came from the Barkly region and 23.7% from the Central region. The top destination for departing moves was Alice Springs while Ampilatwatja was the most important source locality for incoming moves (Table 5.7).

Table 5.7: Leading destination and source localities for episodes of mobility, Aboriginal students, Utopia, Central East cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Alice Springs	78	36.5	Ampilatwatja	122	41.2
Atitjere	30	14.0	Alpurrurulam	40	13.5
Engawala	25	11.7	Barrow Creek	27	9.1
Ti Tree	23	10.8	Engawala	26	8.8
Papunya	19	8.9	Atitjere	22	7.4
Wilora	11	5.1	Canteen Creek	21	7.1

- ***Ampilatwatja:***

There were 195 outflows and 35 inflows recorded for Ampilatwatja; all occurred within the Central region. Utopia and Wilora were the most important destination and source localities for departing and incoming moves, respectively (Table 5.8).

Table 5.8: Leading destination and source localities for episodes of mobility, Aboriginal students, Ampilatwatja, Central East cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Utopia	122	62.6	Wilora	24	68.6
Alice Springs	30	15.4	Atitjere	11	31.4
Wilora	20	10.3			
Atitjere	11	5.6			

- ***Atitjere:***

Atitjere recorded a total of 300 episodes of mobility, of which 182 were departing moves and 118 incoming ones. Of departing moves, 76.4% remained in the Central region while 23.6% went to the Barkly region. For incoming moves, half went to the Barkly region and half were from the Central region. The most important destination for departing moves was Alice Springs (24.7%), while the source locality that contributed the highest number of incoming moves was Utopia (25.4%) as shown in Table 5.9.

Table 5.9: Leading destination and source localities for episodes of mobility, Aboriginal students, Atitjere, Central East cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Alice Springs	45	24.7	Utopia	30	25.4
Engawala	22	12.1	Amoonguna	24	20.3
Utopia	22	12.1	Engawala	21	17.8
Amoonguna	21	11.5	Anatye	14	11.9
Ti Tree	14	7.7	Canteen Creek	12	10.2
Canteen Creek	13	7.1	Ampilatwatja	11	9.3

- ***Engawala:***

A total of 180 episodes of mobility were recorded for this locality, of which, 147 (81.7%) occurred within the Central region. Alice Springs received the highest number of departing moves from Engawala (29.0%) while Utopia (51.0%) and Atitjere (44.9%) were the sources for the highest numbers of incoming moves (Table 5.10).

Table 5.10: Leading destination and source localities for episodes of mobility, Aboriginal students, Engawala, Central East cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Alice Springs	38	29.0	Utopia	25	51.0
Utopia	26	19.9	Atitjere	22	44.9
Atitjere	21	16.0			
Ti Tree	15	11.5			
Willowra	11	8.4			

- ***Wilora:***

Wilora recorded 200 episodes of mobility. There were 125 departing moves, of which 67.2% went to the Barkly region and 29.6% remained in the Central region. Almost all (98.7%) of the 75 incoming moves came from the Barkly region (Table 5.11).

Table 5.11: Leading destination and source localities for episodes of mobility, Aboriginal students, Wilora, Central East cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Ampilatwatja	24	19.2	Barrow Creek	29	38.7
Barrow Creek	24	19.2	Ampilatwatja	20	26.7
Tennant Creek	23	18.4	Utopia	11	14.7
Alice Springs	12	9.6	Wutunugurra	10	13.3
Utopia	10	8.0			

- ***Amoonguna:***

This locality recorded 135 episodes of mobility; 108 departing moves and 27 incoming ones. Of departing moves, 88.0% went to other Central region localities and 7.4% went to Barkly region. Of incoming moves, 25 (92.6%) came from other Central region localities. Further details of destination and source localities are provided in Table 5.12. Alice Springs, Atitjere and Titjikala were the major destinations for departing moves, while Atitjere was the dominant source locality for incoming moves.

Table 5.12: Leading destination and source localities for episodes of mobility, Aboriginal students, Amoonguna, Central East cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Alice Springs	38	35.2	Atitjere	21	77.8
Atitjere	24	22.2			
Titjikala	13	12.0			

Cluster D – Yuendumu-Nyirripi (orange nodes):

This cluster largely consisted of 2 remote localities, Yuendumu and Nyirripi, and extended its connections with southern localities in Big Rivers region, namely, Kalkarindji, Lajamanu, and with some further connections to Katherine East.

A total of 1,419 episodes of mobility were recorded, including 283 outflows (19.9%), 362 inflows (25.5%) and 774 within-region episodes (54.5%) as shown in Table 5.13. All inflows came from the Big Rivers region, which was also the dominant region for destinations of outflows. There were some outflows to the Barkly region (18.0%) and a small proportion to the Darwin region (2.1%). Mobility details of the 2 major localities are described below.

Table 5.13: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, Yuendumu-Nyirripi cluster, Central region, 2005–2018

Mobility type	Barkly	Big Rivers	Darwin	Total	% of total
Outflows	51	226	6	283	19.9%
Inflows	0	362	0	362	25.5%
Within-region	-	-	-	774	54.5%
Total	51	588	6	1,419	

- ***Yuendumu:***

Yuendumu recorded 1,149 episodes of mobility, of which 794 were departing moves and 355 were incoming ones. Alice Springs, Lajamanu, Nyirripi and Willowra were the major destination localities for departing moves (Table 5.14). The source localities for incoming moves included the 3 Big Rivers localities of Lajamanu, Kalkarindji and Katherine East plus Nyirripi.

Table 5.14: Leading destination and source localities for episodes of mobility, Aboriginal students, Yuendumu, Yuendumu-Nyirripi cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Alice Springs	171	21.5	Lajamanu	177	49.9
Lajamanu	160	20.2	Nyirripi	141	39.7
Nyirripi	132	16.6	Katherine East	24	6.8
Willowra	88	11.1	Kalkarindji	13	3.7
Papunya	38	4.8			
Ali Curung	32	4.0			
Ti Tree	27	3.4			
Katherine East	23	2.9			
Kalkarindji	16	2.0			
Yuelamu	16	2.0			

- ***Nyirripi:***

Compared with Yuendumu, Nyirripi recorded a much smaller total of 422 episodes of mobility. Major destinations for the 263 departing moves were Yuendumu (53.6%), Alice Springs (11.8%), Kintore (9.1%) and Lajamanu (8.4%). There were 2 source localities for the 159 incoming moves, namely Yuendumu (83.0%) and Lajamanu (17.0%).

Cluster E – Central South (orange nodes):

This cluster was located in the south and south-west parts of Central region. Central region localities included in this cluster were: Areyonga, Imanpa, Kaltukatjara, Mutitjulu and Yulara. Almost all of the 763 episodes of mobility recorded under this cluster moved within the Central region (759, 99.5%).

- ***Areyonga:***

Areyonga recorded 225 departing moves and 102 incoming ones. Almost 1 in 4 departing moves from Areyonga went to Haasts Bluff (24.9%), making it the most important destination locality (Table 5.15). Kaltukatjara and Mutitjulu were the most important source localities for incoming moves, contributing 52.9% and 45.1%, respectively.

Table 5.15: Leading destination and source localities for episodes of mobility, Aboriginal students, Areyonga, Central South cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Haasts Bluff	56	24.9	Kaltukatjara	54	52.9
Kaltukatjara	42	18.7	Mutitjulu	46	45.1
Alice Springs	35	15.6			
Mutitjulu	34	15.1			
Hermannsburg	30	13.3			

- ***Imanpa:***

Imanpa recorded 94 departing moves and 19 incoming ones with almost all occurring within the Central region (Table 5.16). Alice Springs received 41.5% of departing moves, followed by Papunya (28.7%) and Mutitjulu (20.2%). Mutitjulu was the dominant source locality contributing 89.5% of incoming moves.

Table 5.16: Leading destination and source localities for episodes of mobility, Aboriginal students, Imanpa, Central South cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Alice Springs	39	41.5	Mutitjulu	17	89.5
Papunya	27	28.7			
Mutitjulu	19	20.2			

- ***Kaltukatjara:***

This locality recorded a total of 271 episodes of mobility; 173 departing moves and 98 incoming ones. All but 2 of these episodes occurred within the Central region. Mutitjulu and Areyonga were the leading localities for both departing moves and incoming moves (Table 5.17).

Table 5.17: Leading destination and source localities for episodes of mobility, Aboriginal students, Kaltukatjara, Central South cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Mutitjulu	71	41.0	Mutitjulu	56	57.1
Areyonga	54	31.2	Areyonga	42	42.9
Alice Springs	37	21.4			

- ***Mutitjulu:***

Mutitjulu recorded 243 outflows and 140 inflows, a total of 383 episodes of mobility, all occurring within the Central region. Alice Springs received 28.0% of departing moves, followed by Kaltukatjara and Areyonga (Table 5.18). The leading source localities for incoming moves were Kaltukatjara and Areyonga.

Table 5.18: Leading destination and source localities for episodes of mobility, Aboriginal students, Mutitjulu, Central South cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Alice Springs	68	28.0	Kaltukatjara	71	50.7
Kaltukatjara	56	23.1	Areyonga	34	24.3
Areyonga	46	18.9	Imanpa	19	13.6
Imanpa	17	7.0	Yulara	16	11.4
Yulara	13	5.4			

- ***Yulara:***

Yulara recorded 41 episodes of mobility; 28 departing moves and 13 incoming ones. Mutitjulu received 57.1% of departing moves and contributed 100% of incoming moves. Other leading destination localities for departing moves were Alice Springs, Kintore and Katherine East.

Cluster F – Central West (blue nodes):

The Central West cluster was located in the western part of the Central region and localities within this cluster included: Haasts Bluff, Kintore, Mount Liebig and Papunya. A total of 1,389 episodes of mobility were recorded for this cluster, of which a large majority (98.3%)

occurred within the Central region and most were between localities within the Central West cluster.

- ***Haasts Bluff:***

A total of 482 episodes of mobility were recorded for this locality, all occurring within the Central region. Kintore and Papunya were the leading destination and source localities for departing and incoming moves (Table 5.19).

Table 5.19: Leading destination and source localities for episodes of mobility, Aboriginal students, Haasts Bluff, Central West cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Kintore	87	28.7	Kintore	81	45.3
Papunya	58	19.1	Papunya	52	29.1
Areyonga	56	18.5	Mount Liebig	46	25.7
Mount Liebig	54	17.8			
Laramba	17	5.6			
Alice Springs	16	5.3			

- ***Kintore:***

There were 579 episodes of mobility recorded for this locality, including 342 departing moves and 237 incoming ones. Almost all of these episodes occurred within the Central region (99.1%), with Papunya and Haasts Bluff being both the highest ranked destination and source localities (Table 5.20).

Table 5.20: Leading destination and source localities for episodes of mobility, Aboriginal students, Kintore, Central West cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Papunya	108	31.6	Papunya	106	44.7
Haasts Bluff	81	23.7	Haasts Bluff	87	36.7
Alice Springs	57	16.7	Mount Liebig	44	18.57
Mount Liebig	49	14.33			
Nyirripi	23	6.73			

- ***Mount Liebig:***

This locality recorded 409 episodes of mobility, all of which occurred within the Central region. As shown in Table 5.21, Papunya, Haasts Bluff and Kintore were the localities with both the highest numbers of departing and incoming moves.

Table 5.21: Leading destination and source localities for episodes of mobility, Aboriginal students, Mount Liebig, Central West cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Papunya	80	35.6	Papunya	81	44.0
Haasts Bluff	46	20.4	Haasts Bluff	54	29.4
Kintore	44	19.6	Kintore	49	26.6
Alice Springs	27	12.0			
Hermannsburg	12	5.33			

- ***Papunya:***

Papunya recorded 765 episodes of mobility, 97.5% of which occurred within the Central region. Kintore was the most important locality for both departing moves (20.4%) and incoming moves (43.9%) as shown in Table 5.22.

Table 5.22: Leading destination and source localities for episodes of mobility, Aboriginal students, Papunya, Central West cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Kintore	106	20.4	Kintore	108	43.9
Alice Springs	87	16.8	Mount Liebig	80	32.5
Mount Liebig	81	15.6	Haasts Bluff	58	23.6
Hermannsburg	54	10.4			
Haasts Bluff	52	10.0			
Yuendumu	33	6.4			
Imanpa	26	5.0			

Cluster G – Central North (grey nodes):

This cluster was located in the northern part of the Central region and included the localities of Laramba, Ti Tree, Willowra and Yuelamu. A total of 1,464 episodes of mobility were recorded for this cluster, of which 72.4% occurred within the Central region (Table 5.23). The Barkly region was the most important region connecting with this cluster both for inflows (n = 182) and outflows (n = 152). The number of episodes of mobility for individual localities are described below.

Table 5.23: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, Central North cluster, Central region, 2005–2018

Mobility type	Barkly	Big Rivers	Darwin	Total	% of total
Outflows	152	69	1	222	15.2%
Inflows	182	0	0	182	12.4%
Within-region	-	-	-	1,060	72.4%
Total	334	69	1	1,464	

- ***Laramba:***

A total of 364 episodes of mobility were recorded for Laramba, including 256 departing moves and 108 incoming moves, with 97.8% of these episodes being of the within-region mobility type. As shown in Table 5.24, Ti Tree and Yuelamu recorded the highest numbers of both departing moves from and incoming moves to Laramba.

Table 5.24: Leading destination and source localities for episodes of mobility, Aboriginal students, Laramba, Central North cluster, Central region, 2005–2018

Destinations	No. of departing moves	%
Ti Tree	56	21.9
Yuelamu	50	19.5
Alice Springs	39	15.2
Yuendumu	17	6.6
Hermannsburg	16	6.3
Haasts Bluff	15	5.9

Source locality	No. of incoming moves	%
Ti Tree	51	47.2
Yuelamu	42	38.9
Willowra	13	12.0

- ***Ti Tree:***

Ti Tree recorded 593 episodes of mobility, including 419 departing moves and 174 incoming ones. The majority of these (81.1%) occurred within the Central region. Alice Springs, Willowra and Laramba were the 3 leading localities for departing moves (Table 5.25). For incoming moves, Willowra and Laramba were the dominant localities and together accounted for 73.0% of episodes.

Table 5.23: Leading destination and source localities for episodes of mobility, Aboriginal students, Ti Tree, Central North cluster, Central region, 2005–2018

Destinations	No. of departing moves	%
Alice Springs	86	20.5
Willowra	77	18.4
Laramba	51	12.2
Ali Curung	37	8.8
Tennant Creek	31	7.4
Yuendumu	30	7.2
Utopia	29	6.9

Source locality	No. of incoming moves	%
Willowra	71	40.8
Laramba	56	32.2
Ali Curung	32	18.4
Yuelamu	15	8.6

- ***Willowra:***

There were 577 episodes of mobility recorded for Willowra, including 415 departing moves and 162 incoming ones. Within-region mobility type represented 75.0% of all episodes. As shown in Table 5.26, Yuendumu, Ti Tree and Alice Springs were the 3 leading localities for departing moves. Notably, localities in the Barkly (Ali Curung and Tennant Creek) and Big Rivers regions (Lajamanu) both received greater than 10% of departing moves. For incoming moves, Ti Tree and Yuelamu were the dominant source localities, accounting for about 70% of episodes.

Table 5.26: Leading destination and source localities for episodes of mobility, Aboriginal students, Willowra, Central North cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Yuendumu	92	22.2	Ti Tree	77	47.5
Ti Tree	71	17.1	Yuelamu	44	27.2
Alice Springs	60	14.5	Ali Curung	28	17.3
Lajamanu	49	11.8	Laramba	13	8.0
Yuelamu	43	10.4			
Ali Curung	27	6.5			
Tennant Creek	27	6.5			

- ***Yuelamu:***

Yuelamu recorded 314 episodes of mobility, of which 192 were departing moves and 122 incoming ones. The majority of episodes occurred within Central region (90.4%). As shown in Table 5.27, Willowra and Laramba were the top 2 localities for both departing and incoming moves.

Table 5.24: Leading destination and source localities for episodes of mobility, Aboriginal students, Yuelamu, Central North cluster, Central region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Willowra	44	22.9	Laramba	50	41.0
Laramba	42	21.9	Willowra	43	35.3
Alice Springs	38	19.8	Ti Tree	19	15.6
Yuendumu	17	8.9	Ali Curung	10	8.2
Ti Tree	15	7.8			
Ali Curung	10	5.2			

5.3.2 Non-Aboriginal students

We used Gephi to perform network analysis for non-Aboriginal students using various combinations of degree range and resolution, however the modularity scores for these models were consistently negative. A negative modularity score indicates the visualisation contains fewer edges between nodes than would be expected by chance, which means there were no identifiable networks for non-Aboriginal students. Consequently, network visualisation for non-Aboriginal students of the Central region is not presented.

Overall, there were 743 episodes of mobility recorded for non-Aboriginal students in the Central region (Table 5.28). About 40% of these occurred between localities within Central region (39.6%), 33.2% were outflows to other regions and 27.2% were inflows from other regions. The regions with the highest number of mobility episodes (both inflows and outflows) with Central region were Darwin region (37.2%) and Top End region (34.7%).

Table 5.25: Number of episodes of inflow and outflow between regions and within-region mobility, non-Aboriginal students, Central region, 2005–2018

Mobility type	Barkly	Big Rivers	East Arnhem	Darwin	Top End	Total	% of total
Outflows	23	20	11	105	88	247	33.2%
Inflows	30	30	12	62	68	202	27.2%
Within-region	-	-	-	-	-	294	39.6%
Total	53	50	23	167	156	743	
% (of regional total)	11.8%	11.1%	5.1%	37.2%	34.7%		

5.4 Latent class analysis

This section presents the results of the analysis of the characteristics of students in relation to mobility. We performed LCA to identify groups of students with similar patterns and characteristics in relation to mobility. To reduce any biases that may result from inconsistencies in the recording of enrolment and attendance in the early part of the study period, we used Year 1 cohorts from 2009 to 2012 for this part of analysis. This approach selected students who enrolled in Year 1 during the period of 2009–2012, to allow for potentially complete follow-up from Year 1 to Year 6, with the end point of available data in 2018. Data for students enrolled in Year 1 in 2013 were not included because some of these students would not have completed Year 6 in 2018.

We applied the following inclusion criteria to select the study cohort:

1. A student's first enrolment record was Year 1 in the years from 2009 to 2012

2. A student's first enrolment record was in an NT Government school in the Central region
3. The age of the student at first enrolment was between 5 and 7 years.

All records of enrolment and attendance from Year 1 to Year 6 of the selected students were included in the analysis.

5.4.1 Univariate analysis

We first performed univariate analysis with chi-squared analysis on demographic and mobility-related variables to assess the differences between Aboriginal and non-Aboriginal students. A total of 1,253 students were selected into the study cohort, including 669 Aboriginal students and 584 non-Aboriginal students. We present results of univariate analysis in Table 5.29. There was strong evidence for a difference between the 2 groups of students for most variables: English as a second language, attending Years 3 & 5 NAPLAN, preschool and Year 3 attendance, distribution of mobility episodes across calendar months of a year, year level at first mobility episode, number of mobility episodes, mobility category, and ever moved interstate or overseas. Given these differences, we performed separate latent class analysis for Aboriginal and non-Aboriginal children.

Table 5.26: Demographic and mobility-related characteristics of Year 1 students enrolled in NTG primary schools in 2009–2012, by Aboriginal status, Central region

Variable		Aboriginal	Non-Aboriginal	All	p-value
n =		669	584	1,253	
%		53.4	46.6		
Sex					
	Female	50.4	47.6		0.328
	Male	49.6	52.4		
English as a second language					
	No	39.3	70.2		<0.0005
	Yes	60.7	29.8		
Attending NAPLAN Y3 & Y5					
	Not absent	83.7	71.6		<0.0005
	Both absent	2.8	0.2		
	Missing data	13.5	28.3		
Preschool attendance					
	<60%	39.0	19.0		<0.0005

60–79%	15.6	35.5	
≥80%	14.8	21.2	
Missing data	30.6	24.3	
Year 3 attendance			
<60%	28.3	7.9	<0.0005
60–79%	30.8	6.3	
≥80%	40.7	85.3	
Missing data	0.3	0.5	
Calendar month (proportion of total mobility episodes)			<0.0005
Jan	26.3	64.7	
Feb	13.3	4.6	
Mar	8.1	4.8	
Apr	6.7	2.6	
May	6.4	2.3	
Jun	3.9	1.7	
Jul	6.3	7.4	
Aug	8.0	4.0	
Sep	5.5	3.1	
Oct	8.5	1.7	
Nov	6.0	3.1	
Dec	1.0	0.0	
Year level at first mobility episode			0.025
Year 1	30.1	42.8	
Year 2	21.9	19.7	
Year 3	19.5	18.2	
Year 4	13.2	8.3	
Year 5	10.6	7.6	
Year 6	4.8	3.4	
Number of mobility episodes			
0	41.7	54.6	<0.0005
1	23.9	35.6	

2	12.7	6.9	
3–4	10.6	2.2	
5+	11.1	0.7	
Mobility category			<0.0005
Not moved	41.7	54.6	
Only remote to remote	24.2	29.8	
Only urban to urban	19.3	13.5	
Only urban to remote or remote to urban	14.5	1.5	
Mixed	0.3	0.5	
Ever moved to non-NTG schools			0.492
No	97.2	97.8	
Yes	2.8	2.2	
Ever moved interstate or overseas			
No	92.5	87.2	0.002
Yes	7.5	12.8	

5.4.2 Aboriginal students

The process used for LCA is described in Chapter 2. Based on the results of model details and model fit as well as the interpretability of the models, we selected the 4-class model. Details of the model testing results and the model selection process are provided in section C.1 and Table Appendix 5 in Appendix 1.

The 4 groups identified in the model were named according to their mobility characteristics (Table 5.30): Frequent Movers (30 students, representing 4.5% of the cohort), Intrastate Movers (261, 39.0%), Once-off Movers (99, 14.8%) and Stayers (279, 41.7%). Students in the first 3 groups recorded different levels and types of mobility while those in the fourth group did not record any mobility.

The small group of Frequent Movers represented 4.5% of the cohort. Students in this group all recorded 2 or more episodes of mobility, with a 76.7% probability of moving 3 or more times. Students had 66.7% probability of only moving from urban to remote or from remote

to urban areas[ii], and 33.3% probability of only moving from urban to urban areas. All students in this group had ever moved interstate or overseas.

The second group, Intrastate Movers, was the largest group among the 3 groups with varying levels of mobility and represented almost 40% of the cohort of Aboriginal students. Students within this group moved from once to more than 5 times. They had 71.3% probability of moving only from remote to remote areas or from urban to urban areas, but only 2.9% probability of ever moving to non-NTG schools. Their probability of ever moving interstate or overseas was zero.

The third group, Once-Off Movers, were most likely to move just once (90.1%), although they had nearly 10% probability of moving 5 times or more (9.9%). This group of students only moved between remote areas and had comparatively higher probabilities of moving to non-NTG schools (13.0%) or out of the NT (23.7%).

Further characteristics of and differences among the 4 groups are revealed in the post-hoc analysis with chi-squared test (Table 5.31). No evidence of a difference between the 4 groups was found for sex and speaking English as a second language. There was strong evidence of a difference between groups for: preschool attendance, Year 3 attendance, and attending Year 3 and Year 5 NAPLAN. There was also evidence that the 3 groups with different patterns of mobility had different distribution of mobility episodes across the 12 calendar months and year level at first mobility episode.

The fourth group, Stayers, were more likely to have 80% or higher attendance rates in both preschool and Year 3 and were less likely to miss both Year 3 and Year 5 NAPLAN, than the 3 groups with mobility.

Notably, the probability of having preschool attendance of 80% or greater increased from Once-off Movers to Intrastate Movers and then to Frequent Movers as the frequency of mobility increased across these 3 groups. However, the probability of having 80% or greater Year 3 attendance trended in the opposite direction, decreasing as the frequency of mobility increased across the 3 groups. These discrepant results may be a result of the much higher proportion of missing data for preschool attendance.

In terms of distribution of mobility episodes across the 12 calendar months, January and February recorded higher proportions in all 3 groups with mobility. Across other months, May, August and October recorded higher mobility in Frequent Movers, while in Intrastate Movers, the months with higher amounts of mobility were October, August and March. For Once-off Movers, 67% of mobility episodes were recorded in January, followed by February, March and April (6.4%, 5.5% and 4.6% respectively).

[ii] For this variable, urban localities referred to localities in Darwin and Palmerston and the towns of Alice Springs, Katherine, Nhulunbuy and Tennant Creek. Localities in the rest of the Northern Territory were classified as remote.

All Frequent Movers had their first mobility episode in Year 1. The distribution of ‘year level at first mobility episode’ in Intrastate Movers was concentrated in Year 1 through to Year 4 (87.4%). The distribution was more evenly spread across all 6 years for Once-off Movers, except Year 1 which recorded about one-third of mobility episodes (34.3%).

Table 5.30: Results of latent class analysis for mobility-related characteristics of students enrolled in Year 1 in 2009–2012, Aboriginal students, Central region

Variable	Frequent Movers		Intrastate Movers		Once-off Movers		Stayers
n =	30		261		99		279
% (of total 371)	4.5		39.0		14.8		41.7
	Probability	(95% CI)	Probability	(95% CI)	Probability	(95% CI)	Probability
Number of episodes of mobility							
0	0.0		0.0		0.0		100.0
1	0.0		30.5	(24.3~36.6)	90.1	(72.8~100.0)	0.0
2	23.3	(8.2~38.5)	28.3	(22.2~34.5)	0.0		0.0
3–4	56.7	(38.9~74.4)	19.6	(14.6~24.6)	0.0		0.0
5+	20.0	(5.7~34.3)	21.6	(15.2~28.0)	9.9	(0~27.2)	0.0
Mobility category							
Not moved	0.0		0.0		0.0		100.0
Only remote to remote	0.0		28.1	(19.2~37.1)	100.0		0.0
Only urban to urban	33.3	(16.5~50.2)	43.2	(35.8~50.5)	0.0		0.0
Only urban to remote or remote to urban	66.7	(49.8~83.5)	27.9	(22.0~33.9)	0.0		0.0
Mixed	0.0		0.7	(0.0~1.7)	0.0		0.0
Ever moved to non-NTG schools							
No	100.0		97.1	(95.0~99.2)	87.0	(78.3~95.6)	100.0
Yes	0.0		2.9	(0.8~5.0)	13.0	(4.4~21.7)	0.0
Ever moved interstate or overseas							
No	0.0		100.0		76.3	(64.3~88.4)	100.0
Yes	100.0		0.0		23.7	(11.6~35.7)	0.0

Notes: Probabilities are presented as percentages. Some estimates for confidence intervals were either negative or greater than 100% and are presented in the table as 0.0% and 100.0% respectively.

Table 5.31: Results of post-hoc analysis, after latent class analysis, of the characteristics of 4 classes of students enrolled in Year 1 in 2009–2012, Aboriginal students, Central region

Variables used in post-hoc analysis	Frequent Movers (n = 30)	Intrastate Movers (n = 261)	Once-off Movers (n = 99)	Stayers (n = 279)
Sex				
Female	43.3	51.7	55.6	48.0
Male	56.7	48.3	44.4	52.0
English as a second language				
No	26.7	36.4	39.4	43.4
Yes	73.3	63.6	60.6	56.6
Preschool attendance* **				
<60%	36.7	44.8	25.3	38.7
60–79%	6.7	10.3	21.2	19.4
≥80%	13.3	11.9	10.1	19.4
Missing data	43.3	33.0	43.4	22.6
Year 3 attendance* **				
<60%	46.7	38.3	33.3	15.1
60–79%	26.7	31.4	23.2	33.3
≥80%	23.3	29.9	43.4	51.6
Missing data	3.3	0.4	0.0	0.0
Attending NAPLAN Y3 & Y5* **				
Not absent	36.7	85.1	64.7	94.3
Both absent	3.3	4.2	3.0	1.4
Missing data	60.0	10.7	32.3	4.3
Calendar month of mobility (proportion out of all episodes of mobility)* **				
Jan	30.2	21.2	67.0	-
Feb	10.3	14.4	6.4	-
Mar	4.3	8.9	5.5	-
Apr	6.0	7.0	4.6	-
May	13.8	6.1	1.8	-
Jun	4.3	4.0	2.8	-
Jul	6.0	6.7	2.8	-
Aug	9.5	8.4	3.7	-
Sep	4.3	6.2	0.9	-
Oct	8.6	9.3	1.8	-
Nov	1.7	6.9	2.8	-
Dec	0.9	1.2	0.0	-
Year level at first mobility episode* **				
Year 1	100.0	20.7	34.3	-
Year 2	0.0	27.2	12.1	-
Year 3	0.0	23.4	15.2	-
Year 4	0.0	16.1	11.1	-
Year 5	0.0	9.6	16.2	-
Year 6	0.0	3.1	11.1	-

Notes: Figures are presented as percentages. * $p < 0.05$; ** $p < 0.005$; *** $p < 0.0005$

5.4.3 Non-Aboriginal students

For non-Aboriginal students, we adopted a 4-class model after comparing the model fit of the models produced with LCA and their interpretability (see details in section C.2 and Table Appendix 6 in Appendix 1). The 4 groups of students identified were: Frequent Movers (54 students, representing 9.2% of the study cohort), Occasional Movers (155, 26.5%), Once-off Movers (56, 9.6%) and Stayers (319, 54.6%) which was the largest group (Table 5.32).

The group of Frequent Movers was most likely to record more than one episode of mobility. The students in this group were most likely to move twice (72.9%) and moved only from urban to urban areas (79.3%). Students in this group were less likely (3.7%) to ever move to a non-NTG school, but they had 35.8% probability of ever moving interstate or overseas.

Students in the Occasional Movers group were most likely to move only once (97.5%) and only move either from urban to urban areas (23.7%) or from remote to remote areas (23.7%). The probability of students in this group ever moving to non-NTG schools was low (7.1%) and the probability of ever moving interstate or overseas was zero.

The group of Once-off Movers only ever moved once, and all mobility episodes were from remote to remote areas. All students in this group had ever moved interstate or overseas.

The group of Stayers is the largest (54.6%) among non-Aboriginal students and was larger than the corresponding group of Aboriginal students who were Stayers (41.7%), which means that the probability of having no mobility was higher among non-Aboriginal students. This is consistent with the corresponding results of the univariate analysis (Table 5.29).

Post-hoc analysis revealed further characteristics of students in these 4 groups (Table 5.33). No evidence of a difference was demonstrated for sex and speaking English as a second language. There was strong evidence for differences for preschool and Year 3 attendance, attending both Year 3 and Year 5 NAPLAN, the distribution of mobility episodes across the 12 calendar months, and year level at first mobility episode.

As was true for Aboriginal students, Stayers were more likely to have 80% or higher Year 3 attendance rate (92.5%). Among the 3 groups with mobility, the proportion of students with 80% or higher Year 3 attendance decreased as the frequency of mobility increased.

The probability of Stayers having 80% or greater preschool attendance was similar to Frequent Movers (23.2% vs 24.1% respectively) and higher than Occasional Movers (20.0%) and Once-off Movers (10.7%). It is worth noting that the level of missing data is high for this variable. The variable ‘attending Year 3 and Year 5 NAPLAN’ also recorded high levels of missing data. Although there was evidence of a difference for this variable across the groups, it is difficult to interpret the results as the probability of missing both Year 3 and Year 5 NAPLAN is very low in all groups.

With regard to the distribution of mobility episodes across the 12 calendar months, January recorded the highest probability in all 3 groups with mobility. In other months, Frequent

Movers were more likely to move in July (16.8%), followed by August (6.9%) and March (6.1%). For the other 2 groups, because three-quarters or higher of mobility was recorded in January and there was only one episode of mobility in the large majority of students, it was not practical to analyse the distribution of mobility by calendar month.

In terms of year level at first mobility episodes, Frequent Movers were more likely to move in the early years of primary school (Year 1 to Year 3), especially in Year 1 (63.0%). The spread of probability across year levels was much more evenly distributed for Occasional Movers with Year 2 and Year 3 recording the highest probabilities (25.8% and 27.1% respectively). All episodes of mobility occurred in Year 1 for Once-off Movers.

Table 5.32: Results of latent class analysis for mobility-related characteristics of students enrolled in Year 1 in 2009–2012s, non-Aboriginal students, Central region

Variable	Frequent Movers		Occasional Movers		Once-off Movers	Stayers
n =	54		155		56	319
% (of total 584)	9.2		26.5		9.6	54.6
	Probability	(95% CI)	Probability	(95% CI)	Probability	Probability
Number of episodes of mobility						
0	0.0		0.0		0.0	100.0
1	0.0		97.5	(94.7~100.0)	100.0	-
2	72.9	(60.7~85.1)	0.9	(0.0~2.5)	0.0	-
3–4	22.2	(10.9~33.5)	0.8	(0.0~2.3)	0.0	-
5+	4.9	(0.0~11.2)	0.9	(0.0~2.6)	0.0	-
Mobility category						
Not moved	0.0		0.0		0.0	-
Only remote to remote	0.0		75.7	(68.8~82.5)	100.0	-
Only urban to urban	79.3	(68.4~90.2)	23.7	(16.9~30.4)	0.0	-
Only urban to remote or remote to urban	15.0	(5.4~24.7)	0.7	(0.0~1.9)	0.0	-
Mixed	5.7	(0.0~11.9)	0.0	(0.0~0.0)	0.0	-
Ever moved to non-NTG schools						
No	96.3	(91.2~100.0)	92.9	(88.9~97.0)	100.0	100.0
Yes	3.7	(0.0~8.8)	7.1	(3.0~11.1)	0.0	0.0
Ever moved interstate or overseas						
No	64.2	(51.2~77.2)	100.0		0.0	100.0
Yes	35.8	(22.8~48.8)	0.0		100.0	0.0

Notes: Probabilities are presented as percentages. Some estimates for confidence intervals were either negative or greater than 100% and are presented in the table as 0.0% and 100.0% respectively.

Table 5.33: Results of post-hoc analysis, after latent class analysis, of the characteristics of 4 classes of students enrolled in Year 1 in 2009–2012, non-Aboriginal students, Central region

Variables used in post-hoc analysis	Frequent Movers	Occasional Movers	Once-off Movers	Stayers
	(n = 54)	(n = 155)	(n = 56)	(n = 319)
Sex				
Female	53.7	51.0	39.3	46.4
Male	46.3	49.0	60.7	53.6
English as a second language				
No	64.8	70.3	57.1	73.4
Yes	35.2	29.7	42.9	26.7
Preschool attendance**				
<60%	22.2	21.3	17.9	17.6
60–79%	22.2	31.6	28.6	40.8
≥80%	24.1	20.0	10.7	23.2
Missing data	31.5	27.1	42.9	18.5
Year 3 attendance***				
<60%	20.4	15.5	3.6	2.8
60–79%	11.1	6.5	12.5	4.4
≥80%	68.5	76.8	83.9	92.5
Missing data	0.0	1.3	0.0	0.3
Attending NAPLAN Y3 & Y5***				
Not absent	59.3	67.1	1.8	88.1
Both absent	0.0	0.7	0.0	0.0
Missing data	40.7	32.3	98.2	11.9
Calendar month of mobility (proportion out of all episodes of mobility)***				
Jan	46.6	74.4	78.6	-
Feb	5.3	4.3	3.6	-
Mar	6.1	4.9	1.8	-
Apr	3.1	1.8	3.6	-
May	3.1	1.2	3.6	-
Jun	3.1	0.6	1.8	-
Jul	16.8	1.8	1.8	-
Aug	6.9	2.4	1.8	-
Sep	3.8	2.4	3.6	-
Oct	1.5	2.4	0.0	-
Nov	3.8	3.7	0.0	-
Dec	0.0	0.0	0.0	-
Year level at first mobility episode***				
Year 1	63.0	14.8	100.0	-
Year 2	22.2	25.8	0.0	-
Year 3	11.1	27.1	0.0	-
Year 4	1.9	14.2	0.0	-
Year 5	1.9	12.3	0.0	-
Year 6	0.0	5.8	0.0	-

* $p < 0.05$; ** $p < 0.005$; *** $p < 0.0005$

Chapter 6 Student mobility in the Big Rivers region

Key findings

Descriptive statistics

- The number of Aboriginal students enrolled each year was consistently higher than non-Aboriginal students and the difference increased during the period 2013–2018.
- Among Aboriginal students, during 2013–2018, there was a marked increase in mobility from 17.7% of students in 2013 to 30.9% in 2018, an overall increase by 77.5%.
- The majority of Aboriginal and non-Aboriginal students who moved, moved only once in the same calendar year.
- From 2013 to 2018, there was an increasing trend in the number of Aboriginal students who moved for all levels of mobility (once, twice and 3 or more times).
- For Aboriginal students, from 2013 to 2018, the dominant destination category was 'Moved to NTG school' and the number of mobility episodes under this category increased 3.4-fold. For non-Aboriginal students, the dominant destination category was 'Moved interstate or overseas' but the number of episodes under this category showed no evident trends over the whole study period.

Network analysis

- For Aboriginal students, 5 clusters of localities were detected. They were named to align with their general location within the Big Rivers region: Katherine-Big Rivers West, Big Rivers North, Lajamanu-Yuendumu, Big Rivers East, and Borroloola-Robinson River. The average weighted degree was 179.8, which was lower than the corresponding figure of 231.5 for the Central region and 311.1 for the NT, but comparable to 185.4 for the East Arnhem region.
- Clusters of mobility were not evident for non-Aboriginal students due to widely varied source and destination locations for the mobility episodes.

Latent class analysis

- Analysis was conducted to identify characteristics of groups of students with different mobility patterns using the annual Year 1 student cohorts from 2009 to 2012, with 632 Aboriginal students (63.0%) and 371 non-Aboriginal students (37.0%).
- For Aboriginal students, 3 groups were identified: Frequent Movers (63 students, 10.0% of total), Occasional Movers (301, 47.6%) and Stayers (268, 42.4%).
    - **Frequent Movers** tended to have 3 or more episodes of mobility, predominantly moved from urban to remote or from remote to urban localities only, with a 23.5% probability of moving interstate or overseas. **Occasional Movers** tended to move 1 or 2 times, move only between remote localities, and were comparatively less likely (9.5%) to move interstate or overseas.

    - Post-hoc analysis found some evidence of a difference between the 3 groups for Year 3 attendance. As an example, for the outcome of 80% or more attendance, the respective proportions were: **Stayers** (38.9%), **Occasional movers** (42.2%), and **Frequent movers** (27.0%).
- For non-Aboriginal students, 3 groups were identified: Urban Movers (79 students, 21.3% of total), Remote Movers (99, 26.7%), and Stayers (193, 52.0%).
    - **Remote Movers** tended to move only once and moved only between remote localities. **Urban Movers** were more likely to move more than once and mainly moved only between urban localities. Remote Movers were more than twice as likely to ever move interstate or overseas (31.1% vs 13.7%).
    - Post-hoc analysis found students were more likely to move for the first time in Year 1, followed by Year 2, in both groups with mobility.

6.1 Overview

This chapter presents a deep-dive analysis of student mobility in the Big Rivers region. As in the deep-dive for the other 2 regions, we excluded enrolment records for students which were: related to distance education (Katherine School of the Air), not relevant to primary school years, and for students who had died. Schools included in this deep-dive are listed in Table Appendix 11 in Appendix 2. Section 6.2 provides descriptive information for students enrolled in primary schools across all years of available data from 2005 to 2018. The section includes information on the number of student enrolments each year; the number and proportion of students who moved during each year in the region, including information on average annual enrolment; the number of times students moved; categories of movement; and the month of movement. Geographic patterns of movement are presented in section 6.3, including the number of episodes of mobility between regions and between communities. This section includes information presented as visualisations which highlight clusters of localities between which episodes of mobility are more common. Section 6.4 describes the characteristics of children with different patterns of mobility including those children who remained at the same primary school and those children who moved once or many times. For this section, the information is based on children who commenced Year 1 of primary school between 2009 and 2012 with analysis for up to 6 years to Year 6 of primary school education.

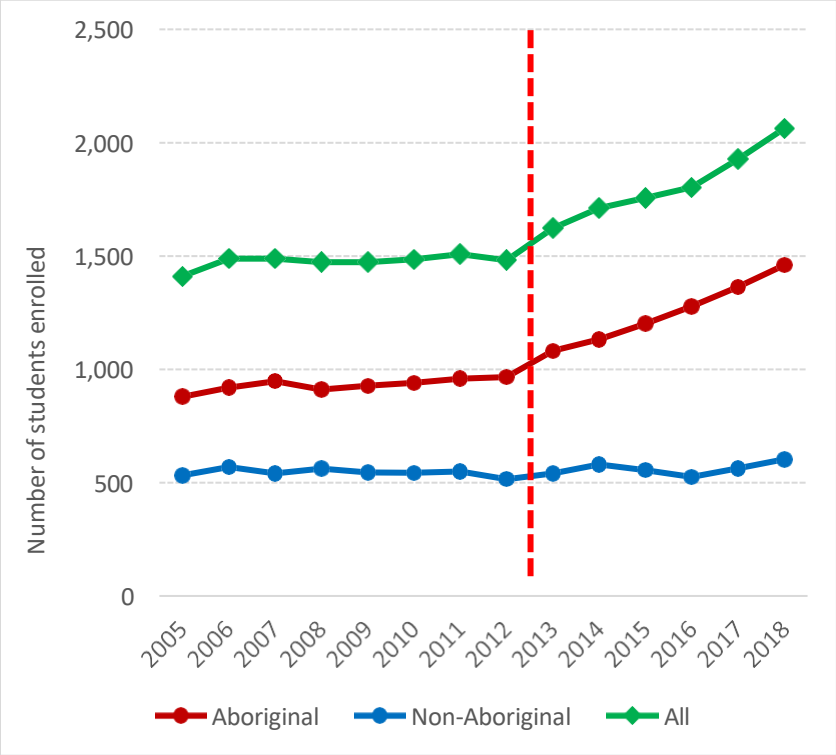
6.2 Descriptive statistics

This section provides descriptive information about students who enrolled in an NT Government primary school in the Big Rivers regions from 2005 to 2018. To recognise changes from 2013 in departmental procedures for recording enrolment and attendance (see section 2.2), we present the results for the period prior to the change (2005–2012, referred to as Period 1) and after the change (2013–2018, referred to as Period 2) separately, and indicate the division of the whole study period into these 2 periods with a red line in the relevant figures.

6.2.1 Annual student enrolment and mobility

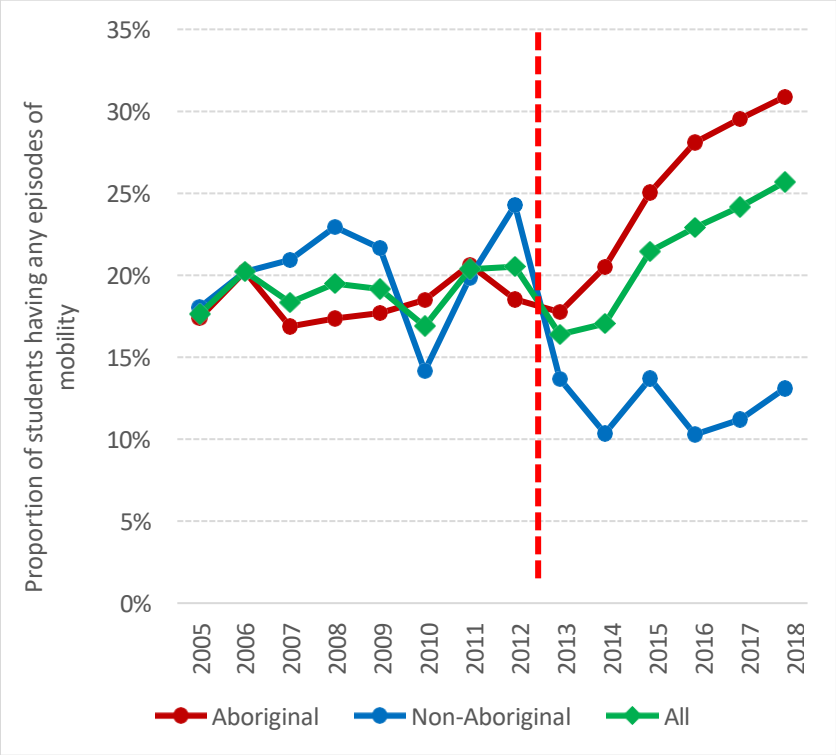
During the study period, there were an average of 1,621 students per year (1,069 Aboriginal and 552 non-Aboriginal students) who were ever enrolled in public primary schools in the Big Rivers region. The annual number of enrolled Aboriginal students was relatively stable during Period 1 but increased consistently each year in Period 2 from 1,082 students in 2013 to 1,460 students in 2018 (Figure 6.1). The annual number of non-Aboriginal students enrolled did not show any evident trend and remained around 550 throughout the study period until a small increase to 603 students in 2018.

Figure 6.1: Number of students ever enrolled in NTG schools in a calendar year, for Aboriginal, non-Aboriginal and total students, Big Rivers region, 2005–2018



The proportion of students with any episode of mobility in each calendar year is presented in Figure 6.2. For Aboriginal students, during Period 1, the proportion of students with an episode of mobility fluctuated between 17.4% and 20.6%, with no apparent trend. During Period 2, there was a marked increase in mobility from 17.7% of students in 2013 to 30.9% in 2018, an overall increase by 77.5%. Among non-Aboriginal students, during Period 1, the proportion of students with any episode of mobility fluctuated markedly between 14% and 24% with no evidence of a trend. For Period 2, the recorded level of mobility was much lower than Period 1, with less fluctuation (between 10% and 13%) and with no evidence of trend.

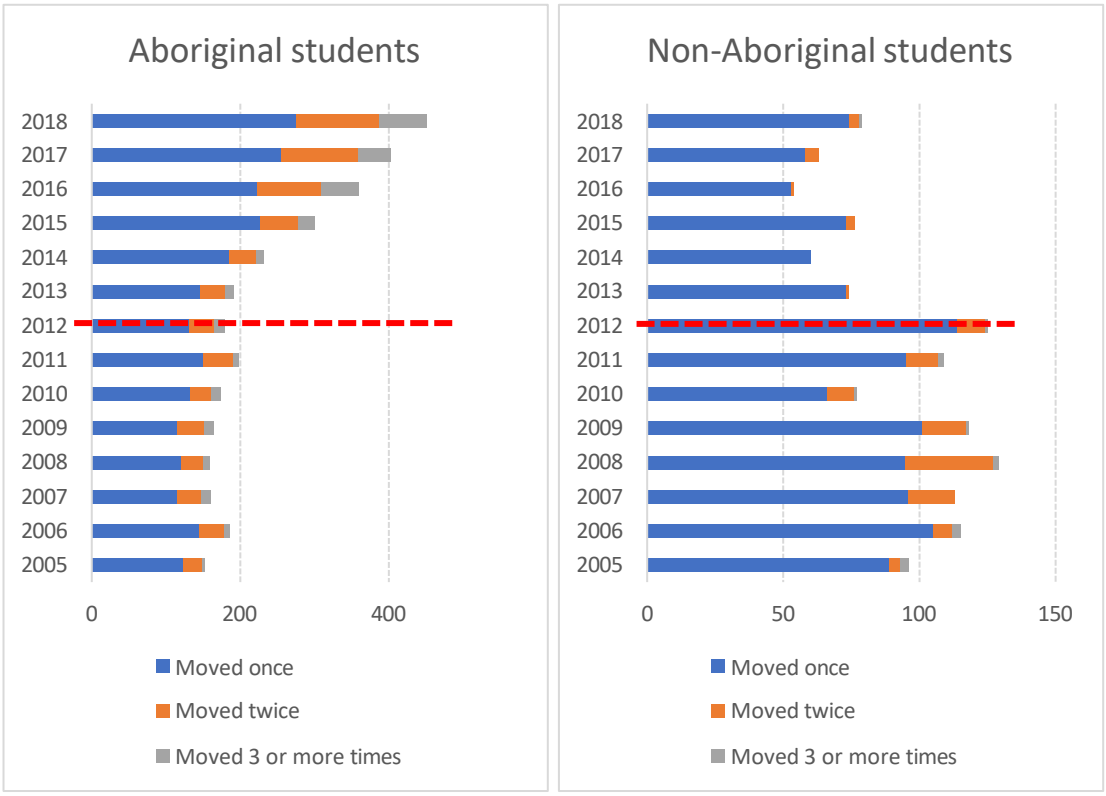
Figure 6.2: Proportion of students enrolled in NTG schools who had any episode of mobility for Aboriginal, non-Aboriginal and total students, Big Rivers region, 2005–2018



6.2.2 Levels of student mobility

The number of students with any level of mobility in a calendar year is presented in Figure 6.3. The majority of both Aboriginal and non-Aboriginal students who moved within a calendar year moved only once, throughout the study period. Among Aboriginal students, in Period 1, the number of students for each of the 3 levels of mobility (moved once, twice and 3 or more times) remained largely unchanged. However, in Period 2, there was a trend of an increasing number of Aboriginal students who moved for all levels of mobility. Among non-Aboriginal students, there were only a small number who moved more than once in a calendar year and no apparent trend in Period 1. During Period 2, there were fewer than 5 students who moved more than once in any calendar year.

Figure 6.3: Number of students and level of mobility, by year, for Aboriginal and non-Aboriginal students, Big Rivers region, 2005–2018

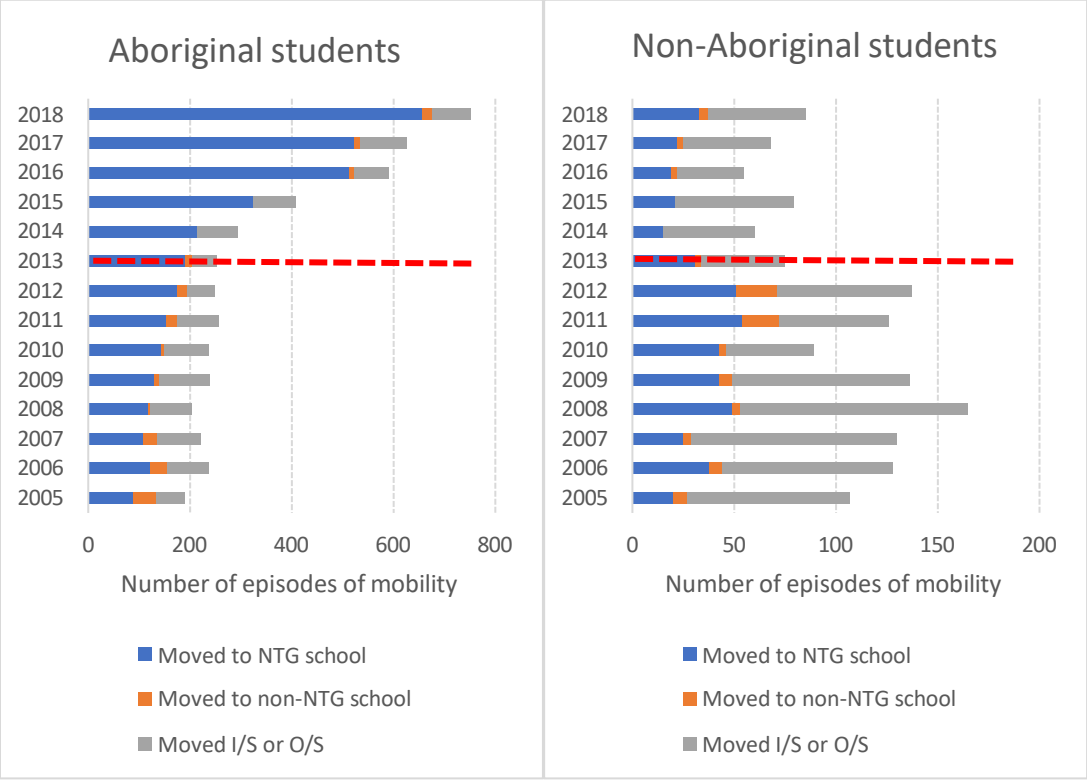


6.2.3 Destination categories for episodes of student mobility

This section presents the annual number of episodes of student mobility by destination categories (Figure 6.4). Among Aboriginal students, the dominant destination category was a move to another NT Government school ('Moved to NTG school'). During Period 1, there was little change in the total number of episodes of mobility, however the number of episodes with the destination category 'Moved to NTG school' increased from 89 in 2005 to 175 in 2012. In Period 2, the total number of episodes increased markedly along with a trend of increasing movement to the destination of NTG schools, from 191 episodes in 2013 to 657 in 2018, a 3.4-fold increase. The number of episodes for the 'Moved to non-NTG school' remained low across the whole study period and there was no evident trend in the 'Moved interstate or overseas' category.

Among non-Aboriginal students, the dominant destination category was 'Moved interstate or overseas'. In Period 1, the number of episodes with the destination category 'Move to NTG school' increased from 20 in 2005 to 51 in 2012; but there was no trend evident in Period 2, with only a small number of episodes each year. The number of episodes with the destination category 'Moved interstate or overseas' showed no evident trends over time in either period, but the average annual number of episodes of 78.4 moving interstate for Period 1 was much higher than the average annual number of 44.7 episodes for Period 2.

Figure 6.4: Number of episodes of mobility for students and category of mobility, by year, for Aboriginal and non-Aboriginal students, Big Rivers region, 2005–2018

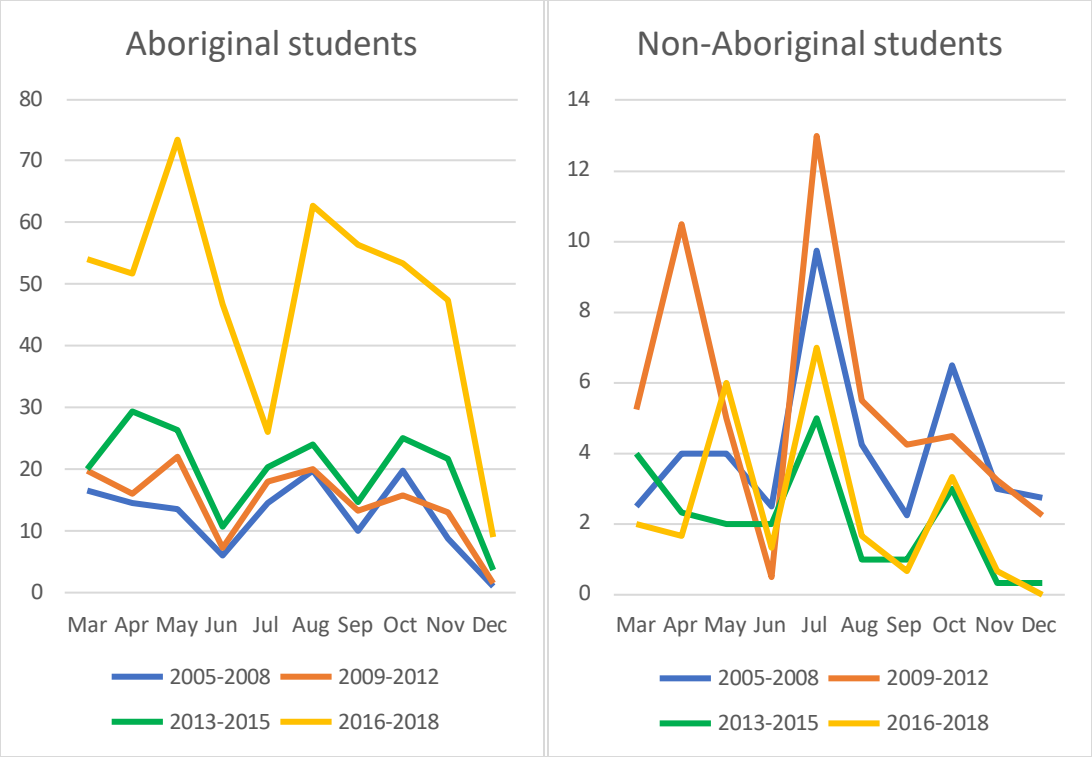


Note – I/S – interstate, O/S - overseas

6.2.4 Timing of student mobility

This section presents results on the timing of mobility across a calendar year. We analysed the number of episodes of mobility by calendar months and calculated the average number for the 12 calendar months for 4 time periods, 2005–2008, 2009–2012, 2013–2015 and 2016–2018 (Figure 6.5). As reported for the East Arnhem and Central regions, there were much higher numbers of mobility episodes in January and February corresponding to the period when many families move at the start of a calendar year. Among Aboriginal students, the number of recorded mobility episodes in any month was much higher in the most recent period (2016–2018) than in the 3 earlier periods. For the period 2016 to 2018, when there was greater recorded mobility, excluding January and February, the months with greatest movement were May, August and September. Among non-Aboriginal students the monthly averages were generally higher in 2009–2012 and 2005–2008. The months with the highest number of mobility episodes were similar across the 4 periods, namely July, May and October.

Figure 6.5: Average number of episodes of student mobility, by month, for 4 time periods (2005–2008, 2009–2012, 2013–2015, 2016–2018) for Aboriginal and non-Aboriginal students, Big Rivers region



6.3 Network analysis with Gephi

This section presents the results of network analysis with the Gephi software program for the Big Rivers region. For network analysis we included all episodes of mobility including movements into and out of the region and within the region, named inflows, outflows and within-region mobility respectively. We refer to episodes of mobility leaving a locality as departing moves and those into a locality as incoming moves, to avoid confusion with the terms of outflows and inflows which are applied at regional level. To protect individual confidentiality, cell counts of less than 10 are suppressed.

6.3.1 Aboriginal students

Parameters and results of network analysis are presented in Table 6.1 and the network visualisation presented in Figure 6.6. As for the other deep-dives presented in this report, to facilitate the detection of networks of student mobility, we excluded localities with a low number of episodes of mobility linked to them. For Aboriginal students, we applied the degree range of 15–156, which meant the number of episodes of mobility linked to any included locality ranged from 15 episodes to the maximum number of 156 episodes. Consequently, localities that recorded less than 15 episodes of mobility over the study period were excluded from the visualisation. This filtering process allowed 949 (70.9%) of pathways to be included for analysis and 22 (91.7%) localities in the Big Rivers region to be visible in the visualisation. The average weighted number of episodes for each locality was

179.8, which means, on average, each locality included in the visualisation for Aboriginal students recorded about 180 episodes of mobility during the study period. Modularity analysis (with a resolution of 0.8) detected 5 clusters of localities with a modularity score of 0.051. This means that probability of movement between localities within the clusters was greater than the more general movement within the region. However, the relatively low modularity score indicates the detected cluster structure is not strong and that there is a high level of movement to other localities outside of these clusters. The 5 clusters were named to align with their general location within the Big Rivers region: Katherine-Big Rivers West, Big Rivers North, Lajamanu-Yuendumu, Big Rivers East, and Borroloola-Robinson River.

Table 6.1: Parameters and results of network analysis with Gephi, Aboriginal students, Big Rivers region, 2005–2018

Item	Values
Degree range	15–156
Big Rivers localities visible (% out of the total of 24)	22 (91.7%)
Edges (% visible)	949 (70.9%)
Modularity score	0.051
Number of modularity communities identified	5
Average weighted degree	179.8

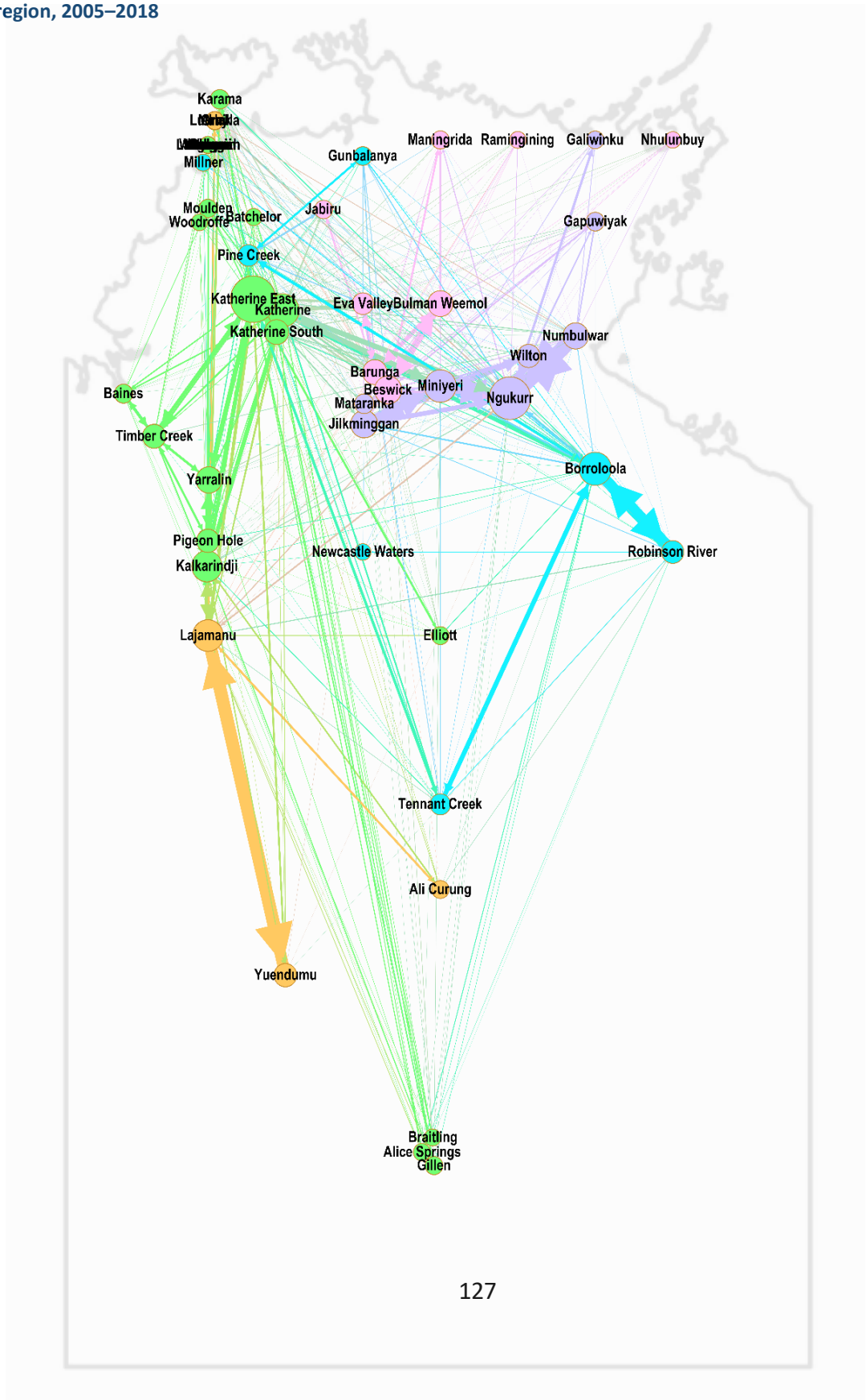
Details on the numbers of inflows, outflows and within-region mobility episodes are presented in Table 6.2. The dominant type of mobility was within-region, which accounted for almost two-thirds (64.9%) of the total of 9,529 episodes of mobility visible in the Gephi visualisation. There were similar proportions of outflows and inflows to other regions (17.7% and 17.5% respectively). Darwin region received the greatest number of outflows from Big Rivers (603 episodes) while the highest number of inflows was from the Top End region (432 episodes).

Table 6.2: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, Big Rivers region, 2005–2018

Mobility type	Barkly	Central	East Arnhem	Darwin	Top End	Total	% of total
Outflows	275	368	172	603	264	1,682	17.7%
Inflows	309	353	391	180	432	1,665	17.5%
Within-region	-	-	-	-	-	6,182	64.9%
Total	584	721	563	783	696	9,529	

% (of total of inflows and outflows: 3347)	17.4%	21.5%	16.8%	23.4%	20.8%

Figure 6.6: Clusters of localities detected with modularity analysis in Gephi, Aboriginal students, Big Rivers region, 2005–2018



The 5 clusters of localities are described below.

Cluster A – Katherine-Big Rivers West (light green nodes):

This cluster consisted of the service town of Katherine and localities in the western part of Big Rivers region, including Baines, Timber Creek, Yarralin, Pigeon Hole and Kalkarindji. This cluster also contained mobility connections to Alice Springs, Elliott (in the Barkly Region) and a number of localities in the Top End and Darwin regions. More details are provided in Table 6.3. As shown in the table, about two-thirds of mobility episodes were within-region movements with outflows and inflows with other regions accounting for 17.0% and 16.8% respectively. The Darwin region received the highest number of outflows among regions while the inflows from regions were distributed fairly evenly among the 4 remote regions with only a small proportion coming from the Darwin region. The mobility connections for Katherine and the selected remote localities of Baines, Timber Creek, Yarralin, Pigeon Hole and Kalkarindji are presented in Tables 6.4 to 6.10.

Table 6.3: Number of episodes of inflow and outflow and within-region mobility, Aboriginal students, Katherine-Big Rivers West cluster, Big Rivers region, 2005–2018

Mobility type	Barkly	Central	East Arnhem	Darwin	Top End	Total	% of total
Outflows	125	136	15	297	53	626	17.0%
Inflows	148	144	163	24	138	617	16.8%
Within-region	-	-	-	-	-	2,437	66.2%
Total	273	280	178	321	191	3,680	

- ***Katherine Town*** (the service town, including 3 localities: Katherine, Katherine South and Katherine East):

Katherine town recorded a total of 2,526 episodes of mobility (representing 68.6% of the cluster's mobility episodes). As the total number of episodes was relatively large, we analysed these episodes in relation to the Big Rivers region. The majority of mobility episodes (64.7%) occurred within the region (Table 6.4). There were similar proportions of inflows and outflows. The Darwin region was the dominant destination region for outflows, followed by the Central region. Barkly, Central and Top End regions were the major regions contributing inflows to Katherine town. Overall, Darwin region was the most connected region with Katherine town, accounting for one-third of mobility episodes that were not within-region.

Table 6.4: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, Katherine town, Katherine-Big Rivers West cluster, Big Rivers region, 2005–2018

Mobility type	Barkly	Central	East Arnhem	Darwin	Top End	Total	% of total
Outflows	87	99	13	209	48	456	18.1%
Inflows	112	105	21	92	106	436	17.3%
Within-region	-	-	-	-	-	1,634	64.7%
Total	199	204	34	301	154	2,526	
% (of regional total)	22.3%	22.9%	3.8%	33.7%	17.3%		

Within the Katherine-Big Rivers cluster, Kalkarindji and Timber Creek ranked the first and second destination and source localities for episodes of mobility for Katherine town (Table 6.5).

Table 6.5: Leading destination and source localities for episodes of mobility, Aboriginal students, Katherine town, Katherine-Big Rivers West cluster, Big Rivers region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Kalkarindji	113	7.89	Kalkarindji	116	14.5
Timber Creek	102	7.12	Timber Creek	97	12.13
Ngukurr	100	6.98	Yarralin	83	10.38
Miniyeri	96	6.7	Tennant Creek	66	8.25
Borroloola	75	5.24	Baines	36	4.5
Yarralin	71	4.96	Elliott	34	4.25

- ***Baines:***

Baines recorded 95 departing moves and 83 incoming ones, with 84.2% and 83.1% of them occurring within the Big Rivers region respectively. Timber Creek was the most important locality for Baines for both departing and incoming moves, accounting for over 40% of episodes for both, followed by Katherine and Katherine East (Table 6.6).

Table 6.6: Leading destination and source localities for episodes of mobility, Aboriginal students, Baines, Katherine-Big Rivers West cluster, Big Rivers region, 2005–2018

Destinations	No. of departing moves	%	Source locality	No. of incoming moves	%
Timber Creek	41	43.2	Timber Creek	35	42.7
Katherine	18	19.0	Katherine	17	20.5
Katherine East	17	17.9	Katherine East	14	16.9

- ***Timber Creek:***

The majority (about 90%) of mobility episodes to and from Timber Creek (238 incoming moves and 238 departing moves) were within-region. Over 40% of moves to and from Timber Creek were connected with the multiple localities within Katherine (Table 6.7, some statistics to other parts of Katherine town are not shown in table). Other important localities for mobility were Baines, Pigeon Hole, Kalkarindji and Yarralin.

Table 6.7: Leading destination and source localities for episodes of mobility, Aboriginal students, Timber Creek, Katherine-Big Rivers West cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%	Source locality	No. of incoming moves	%
Katherine East	72	30.3	Katherine East	71	29.8
Baines	35	14.7	Baines	41	17.2
Yarralin	33	13.9	Yarralin	31	13.0
Pigeon Hole	25	10.5	Pigeon Hole	28	11.8
Katherine	22	9.2	Katherine	23	9.7
Kalkarindji	18	7.6	Kalkarindji	12	5.0

- ***Yarralin:***

The majority of the 320 incoming moves and 288 departing ones for Timber Creek were within-region mobility episodes (85.9% and 83.7% respectively). About 24% of departing moves went to Katherine town, 23.4% to Kalkarindji and 18.4% to Pigeon Hole (Table 6.8). As for incoming moves, Kalkarindji recorded the highest number (24.0%) followed by Pigeon Hole (23.6%) and Katherine East (20.8%).

Table 6.8: Leading destination and source localities for episodes of mobility, Aboriginal students, Yarralin, Katherine-Big Rivers West cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%	Source locality	No. of incoming moves	%
Kalkarindji	75	23.4	Kalkarindji	69	24.0
Katherine East	65	20.3	Pigeon Hole	68	23.6
Pigeon Hole	59	18.4	Katherine East	60	20.8
Timber Creek	31	9.7	Timber Creek	33	11.5
Katherine South	13	4.1	Wagaman	14	4.9
Wagaman	13	4.1			

- ***Pigeon Hole:***

Over 90% of the total of 213 outflows and 224 inflows for Pigeon Hole occurred within the region (Table 6.9). The most important destination localities were Kalkarindji and Yarralin (36.6% and 30.4% of all outflows, respectively). These 2 localities were also the most important source localities (39.9% and 27.7%, respectively).

Table 6.9: Leading destination and source localities for episodes of mobility, Aboriginal students, Pigeon Hole, Katherine-Big Rivers West cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%	Source locality	No. of incoming moves	%
Kalkarindji	82	36.6	Kalkarindji	85	39.9
Yarralin	68	30.4	Yarralin	59	27.7
Timber Creek	28	12.5	Katherine East	25	11.7
Katherine East	18	8.0	Timber Creek	25	11.7
Katherine	10	4.5	Katherine	11	5.2

- ***Kalkarindji:***

All departing moves from Kalkarindji occurred within the Big Rivers region along with 75.4% of incoming moves (Table 6.10). The most important destination localities were Pigeon Hole and Yarralin (accounting for 18.5% and 15.0% of all departing moves respectively). These 2 localities also recorded the highest numbers of incoming moves, representing 21.5% and 19.6% respectively.

Table 6.10: Leading destination and source localities for episodes of mobility, Aboriginal students, Kalkarindji, Katherine-Big Rivers West cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%	Source locality	No. of incoming moves	%
Pigeon Hole	85	18.5	Pigeon Hole	82	21.5
Yarralin	69	15.0	Yarralin	75	19.6
Lajamanu	67	14.6	Katherine	55	14.4
Katherine	57	12.4	Katherine East	43	11.3
Katherine East	47	10.2	Ali Curung	20	5.2
Ali Curung	19	4.1	Timber Creek	18	4.7

Cluster B - Big Rivers North (pink nodes):

This cluster was located in the northern part of the Big Rivers region. Localities categorised within this cluster included Barunga, Beswick, Eva Valley and Bulman-Weemol. Mobility connections for this cluster extended to Top End and East Arnhem regions including the localities of Maningrida, Ramingining, Gapuwiyak and Nhulunbuy. Further details are provided in Table 6.11. The majority of mobility episodes (61.0%) were within-region with slightly fewer outflows than inflows involving other regions (18.9% and 20.1%, respectively). More than half of outflows (52.3%) were to the Top End region and similarly 60.1% of inflows came from the Top End region. Mobility statistics for individual localities of this cluster are described below.

Table 6.11: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, Big Rivers North cluster, Big Rivers region, 2005–2018

Mobility type	Barkly	Central	East Arnhem	Darwin	Top End	Total	% of total
Outflows	20	8	53	62	157	300	18.9%
Inflows	19	5	50	53	191	318	20.1%
Within-region	-	-	-	-	-	966	61.0%
Total	39	13	103	115	348	1,584	

- ***Beswick:***

This locality recorded 223 departing moves (140, 62.8% being within-region) and 360 incoming moves (273, 75.8% being within-region). Destination localities with the highest numbers of departing moves were Bulman-Weemol and Barunga (24.4% and 10.6% of all

departing moves, respectively), both within the Big Rivers North cluster (Table 6.12). The localities with the highest numbers of incoming moves were also Bulman-Weemol (40.4%) and Barunga (16.1%).

Table 6.12: Leading destination and source localities for episodes of mobility, Aboriginal students, Beswick, Big Rivers North cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%	Source locality	No. of incoming moves	%
Bulman-Weemol	88	24.4	Bulman-Weemol	90	40.4
Barunga	38	10.6	Barunga	36	16.1
Ngukurr	29	8.1	Gapuwiyak	19	8.5
Maningrida	25	6.9	Maningrida	16	7.2
Katherine	21	5.8	Eva Valley	13	5.8
Gapuwiyak	19	5.3			
Katherine East	19	5.3			

- ***Barunga:***

Barunga recorded 268 departing moves (193, 72.0% being within-region) and 220 incoming moves (141, 64.1% being within-region). Localities with highest numbers of departing and incoming moves with Barunga were Bulman-Weemol and Eva Valley (Table 6.13).

Table 6.13: Leading destination and source localities for episodes of mobility, Aboriginal students, Barunga, Big Rivers North cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%	Source locality	No. of incoming moves	%
Bulman-Weemol	53	19.8	Bulman-Weemol	57	25.9
Eva Valley	51	19.0	Eva Valley	42	19.1
Beswick	36	13.4	Beswick	38	17.3
Jabiru	21	7.8	Jabiru	19	8.6
Katherine	16	6.0	Gunbalanya	12	5.5
Katherine East	13	4.9			
Gunbalanya	11	4.1			

- ***Eva Valley:***

Eva Valley recorded 160 departing moves and 131 incoming moves with 81.9% and 71.8% of them being within-region, respectively. Localities with the highest numbers of departing moves to Eva Valley were Barunga and Katherine (accounting for 26.3% and 16.3% of all departing moves, respectively, Table 6.14). For incoming moves, the source localities with the highest numbers of episodes were Barunga and Bulman-Weemol, representing 38.9% and 13.7% of all incoming moves, respectively.

Table 6.14: Leading destination and source localities for episodes of mobility, Aboriginal students, Eva Valley, Big Rivers North cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%	Source locality	No. of incoming moves	%
Barunga	42	26.3	Barunga	51	38.9
Katherine	26	16.3	Bulman-Weemol	18	13.7
Beswick	13	8.1	Pine Creek	15	11.5
Pine Creek	13	8.1	Beswick	10	7.6
Bulman-Weemol	12	7.5			

- ***Bulman-Weemol:***

A total of 317 departing moves and 194 incoming ones were recorded for Bulman-Weemol, with 86.1% and 79.9% being within-region, respectively. Localities of this cluster that recorded the highest numbers of departing and incoming moves were Beswick and Barunga (Table 6.15).

Table 6.15: Leading destination and source localities for episodes of mobility, Aboriginal students, Bulman-Weemol, Big Rivers North cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%	Source locality	No. of incoming moves	%
Beswick	90	28.4	Beswick	88	45.4
Barunga	57	18.0	Barunga	53	27.3
Katherine	35	11.0	Maningrida	18	9.3
Katherine East	29	9.2	Eva Valley	12	6.2
Maningrida	19	6.0			
Eva Valley	18	5.7			

Cluster C - Lajamanu-Yuendumu (orange nodes):

This was a moderately well circumscribed cluster with a substantial proportion of episodes of mobility being between Lajamanu and Yuendumu (in the Central region), a low number of episodes between Lajamanu and Ali Curung (in the Barkly region), and an even lower number of episodes involving a few Darwin suburbs. Only 22.1% of all mobility episodes were within-region (Table 6.16). For comparison, 40.4% of all mobility episodes were outflows, of which 60% (189 of 315) were to destinations in the Central region. About 60% of inflows for this cluster were also from the Central region. Details on student mobility for Lajamanu, which is the only locality of this cluster within Big Rivers regions, are presented below.

Table 6.16: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, Lajamanu-Yuendumu cluster, Big Rivers region, 2005–2018

Mobility type	Barkly	Central	East Arnhem	Greater Darwin	Top End	Total	% of total
Outflows	45	189	3	76	2	315	40.4%
Inflows	35	175	65	2	15	292	37.5%
Within-region	-	-	-	-	-	172	22.1%
Total	80	364	68	78	17	779	

- ***Lajamanu:***

Lajamanu recorded 487 departing moves and 292 incoming ones. Notably, only 35.3% of departing moves were within the region, but all incoming moves to Lajamanu came from outside the region (Table 6.17). Yuendumu was the dominant destination and source locality (accounting for 36.3% of outflows and 54.8% of inflows).

Table 6.17: Leading destination and source localities for episodes of mobility, Aboriginal students, Lajamanu, Lajamanu-Yuendumu cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%
Yuendumu	177	36.3
Kalkarindji	63	12.9
Katherine East	38	7.8
Ali Curung	29	6.0
Ludmilla	27	5.5
Katherine	19	3.9

Source locality	No. of incoming moves	%
Yuendumu	160	54.8
Ludmilla	25	8.6
Karama	24	8.2
Ali Curung	23	7.9
Malak	12	4.1

Cluster D - Big Rivers East (purple nodes):

Localities contained in this cluster were Jilkminggan, Mataranka, Miniyeri[iii], Ngukurr, Wilton and Numbulwar, all located in the eastern part of Big Rivers region. The mobility network of this cluster also extended to Galiwinku and Gapuwiyak within the East Arnhem region. As shown in Table 6.18, the great majority of mobility episodes for this cluster were within-region (80.4%). Darwin and Top End regions accounted for the highest proportions of inflows and outflows to other regions. Mobility statistics for individual localities of this cluster are provided below.

Table 6.18: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, Big Rivers East cluster, Big Rivers region, 2005–2018

Mobility type	Barkly	Central	East Arnhem	Darwin	Top End	Total	% of total
Outflows	11	14	100	99	36	260	10.2%
Inflows	14	11	70	100	46	241	9.4%
Within-region	-	-	-	-	-	2,058	80.4%
Total	25	25	170	199	82	2,559	

- ***Jilkminggan:***

This locality recorded 345 departing moves and 291 incoming ones with 96% being within-region episodes for both types. Table 6.19 shows dstination localities with the highest numbers of departing moves from Jilkminggan were Miniyeri (35.7%), Wilton (18.0%) and Ngukurr (17.1%). The highest numbers of inflows were from the same localities; Miniyeri (42.3%), Wilton (21.7%) and Ngukurr (21.3%).

[iii] Note: Miniyeri is the Australian Bureau of Statistics SA2 locality name, which covers an area that includes the community of Minyerri.

Table 6.19: Leading destination and source localities for episodes of mobility, Aboriginal students, Jilkminggan, Big Rivers East cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%	Source locality	No. of incoming moves	%
Miniyeri	123	35.7	Miniyeri	123	42.3
Wilton	62	18.0	Wilton	63	21.7
Ngukurr	59	17.1	Ngukurr	62	21.3
Mataranka	32	9.3	Mataranka	32	11.0
Borroloola	19	5.5			
Katherine East	13	3.8			

- ***Mataranka:***

Mataranka recorded 116 departing moves and 82 incoming ones with 88.8% and 81.7% being within-region episodes, respectively. Destination localities with the highest numbers of departing moves and source localities with the highest numbers of incoming moves were both Jilkminggan and Wilton (Table 6.20).

Table 6.20: Leading destination and source localities for episodes of mobility, Aboriginal students, Mataranka, Big Rivers East cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%	Source locality	No. of incoming moves	%
Jilkminggan	32	27.6	Jilkminggan	32	39.0
Wilton	16	13.8	Wilton	21	25.6
Beswick	13	11.2			
Miniyeri	12	10.3			
Katherine East	10	8.6			

- ***Miniyeri:***

Miniyeri recorded 504 departing moves and 335 incoming ones. The majority (93.5% of departing moves and 92.2% of incoming ones) of these episodes of mobility occurred within the Big Rivers region. The 2 leading localities for departing and incoming moves were Ngukurr and Jilkminggan (Table 6.21).

Table 6.21: Leading destination and source localities for episodes of mobility, Aboriginal students, Miniyeri, Big Rivers East cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%	Source locality	No. of incoming moves	%
Ngukurr	126	25.0	Ngukurr	131	39.1
Jilkminggan	123	24.4	Jilkminggan	123	36.7
Katherine East	70	13.9	Wilton	36	10.8
Wilton	39	7.7	Mataranka	12	3.6
Borroloola	25	5.0			
Katherine	19	3.8			

- ***Ngukurr:***

Ngukurr recorded higher numbers of student mobility episodes than other localities in this cluster. In total, 821 departing moves and 595 incoming ones were recorded. Of these, 83.2% of departing moves and 78.8% of incoming ones were within-region episodes. The 2 leading destination and source localities were both Numbulwar and Miniyeri (Table 6.22).

Table 6.22: Leading destination and source localities for episodes of mobility, Aboriginal students, Ngukurr, Big Rivers East cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%	Source locality	No. of incoming moves	%
Numbulwar	204	24.9	Numbulwar	200	33.6
Miniyeri	131	16.0	Miniyeri	126	21.2
Wilton	79	9.6	Wilton	79	13.3
Jilkminggan	62	7.6	Jilkminggan	59	9.9
Katherine East	62	7.6	Galiwinku	28	4.7
Beswick	32	3.9	Gapuwiyak	15	2.5
Galiwinku	32	3.9			

- ***Wilton:***

A total of 220 departing moves and 205 incoming moves were recorded for Wilton, 98.6% and 95.6% of them being within-region episodes, respectively. Major destination and source localities were the same, namely Ngukurr, Jilkminggan and Miniyeri (Table 6.23).

Table 6.23: Leading destination and source localities for episodes of mobility, Aboriginal students, Wilton, Big Rivers East cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%	Source locality	No. of incoming moves	%
Ngukurr	79	35.9	Ngukurr	79	38.5
Jilkminggan	63	28.6	Jilkminggan	62	30.2
Miniyeri	36	16.4	Miniyeri	39	19.0
Mataranka	21	9.6	Mataranka	16	7.8

- ***Numbulwar:***

Ngukurr recorded 312 departing moves and 264 incoming ones, with 81.1% and 79.2% of them being within-region episodes, respectively. Ngukurr was the most important destination locality (64.1%) and source locality (77.3%) as shown in Table 6.24.

Table 6.24: Leading destination and source localities for episodes of mobility, Aboriginal students, Numbulwar, Big Rivers East cluster, Big Rivers region, 2005–2018

Destination locality	No. of departing moves	%	Source locality	No. of incoming moves	%
Ngukurr	200	64.1	Ngukurr	204	77.3
Gapuwiyak	12	3.9	Gapuwiyak	18	6.8
Katherine East	12	3.9			

Cluster E - Borroloola-Robinson River (light blue nodes):

This cluster was located in the south-eastern part of Big Rivers region. A total of 927 episodes of mobility were recorded for this cluster, with about 60% occurring within-region between the 2 main localities, Borroloola and Robinson River. In addition, there were some inflows and outflows between these 2 localities and Tennant Creek and Newcastle Waters in the Barkly region, as well as episodes involving a number of Darwin suburbs. As shown in Table 6.25, most mobility episodes occurred within-region (59.2%). There were similar proportions of inflows and outflows to other regions. Barkly and Darwin regions accounted for the highest numbers of outflows, while Barkly region was the dominant region for inflows from other regions. Mobility statistics for individual localities of this cluster are provided below.

Table 6.25: Number of episodes of inflow and outflow between regions and within-region mobility, Aboriginal students, Borroloola-Robinson River cluster, Big Rivers region, 2005–2018

Mobility type	Barkly	Central	East Arnhem	Darwin	Top End	Total	% of total
Outflows	74	21	1	69	16	181	19.5%
Inflows	93	18	43	1	42	197	21.3%
Within-region	-	-	-	-	-	549	59.2%
Total	167	39	44	70	58	927	

- ***Borroloola:***

This locality recorded 519 outflows and 326 inflows, with 70.7% and 48.5% of these occurring within the region, respectively. As shown in Table 6.26, Robinson River (29.1%) and Katherine East (10.4%) were the major destinations for departing moves while Robinson River (48.5%) and Tennant Creek (19.3%) were the major source localities for incoming moves.

Table 6.26: Leading destination and source localities for episodes of mobility, Aboriginal students, Borroloola, Borroloola-Robinson River cluster, Big Rivers region, 2005–2018

Destination locality	No. of outflows	%
Robinson River	151	29.1
Katherine East	54	10.4
Tennant Creek	46	8.9
Pine Creek	38	7.3
Ngukurr	31	6.0
Miniyeri	24	4.6

Source locality	No. of inflows	%
Robinson River	158	48.5
Tennant Creek	63	19.3
Karama	14	4.3
Elliott	10	3.1

- ***Robinson River:***

Robinson River recorded 211 departing moves and 180 incoming ones, with 86.3% and 83.9% of them being within-region, respectively. Borroloola was the dominant destination locality (74.9%) and source locality (83.9%) as shown in Table 6.27.

Table 6.27: Leading destination and source localities for episodes of mobility, Aboriginal students, Robinson River, Borroloola-Robinson River cluster, Big Rivers region, 2005–2018

Destination locality	No. of outflows	%	Source locality	No. of inflows	%
Borroloola	158	74.9	Borroloola	151	83.9

6.3.2 Non-Aboriginal students

Various models for Gephi network analysis were trialled, with varying combinations of degree range and resolution, however the modularity scores for these models were consistently negative. A negative modularity score indicates that the corresponding visualisation contains fewer edges between nodes than expected by chance and hence the networks detected are not meaningful. We therefore have not presented a visualisation of network analysis for non-Aboriginal students for the Big Rivers region.

Overall, there were 861 episodes of mobility recorded for the non-Aboriginal students of Central region (Table 6.28). Among these, 31.5% were within-region episodes, 40.4% were outflows to other regions and 28.1% were inflows from other regions. The region with the highest overall mobility activities (inflows plus outflows) with Big Rivers region was Top End region (45.3%), followed by Darwin region (33.9%).

Table 6.28: Number of episodes of inflow and outflow between regions and within-region mobility, non-Aboriginal students, Big Rivers region, 2005–2018

Mobility type	Barkly	Central	East Arnhem	Darwin	Top End	Total	% of total
Outflows	9	30	24	127	158	348	40.4%
Inflows	19	20	21	73	109	242	28.1%
Within-region	-	-	-	-	-	271	31.5%
Total	28	50	45	200	267	861	
% (of regional total)	4.7%	8.5%	7.6%	33.9%	45.3%		

6.4 Latent class analysis

This section presents the results of the analysis of the characteristics of students in relation to mobility. LCA was performed to identify subsets of students who shared similar characteristics. We used the annual cohorts of 2009–2012 for this analysis for 2 reasons: first to reduce the effects of the inconsistency in recording of enrolment and attendance in the early part of the study period (reported in Chapter 2), and secondly to optimise the length of follow-up from Year 1 to Year 6. The selection of the study cohort was carried out by applying the following inclusion criteria:

1. A student's first enrolment record was Year 1 in the years from 2009 to 2012
2. A student's first enrolment record was in an NT Government school in the Big Rivers region
3. The age of the student at first enrolment was between 5 and 7 years.

All records of enrolment and attendance of the selected students, from Year 1 to Year 6, were included in the analysis.

6.4.1 Univariate analysis

We first performed univariate analysis with chi-squared analysis on demographic and mobility-related variables to assess any differences between Aboriginal and non-Aboriginal students. A total of 1,003 students were selected into the study cohort, including 632 Aboriginal students and 371 non-Aboriginal students. Results of univariate analysis are presented in Table 6.29. There was strong statistical evidence of differences between the 2 groups of students for the majority of variables examined, including: English as a second language, preschool and Year 3 attendance, distribution of mobility episodes across calendar months of a year, year level at first mobility episode, number of mobility episodes, mobility category, and ever moved interstate or overseas. Considering the differences between the 2 groups, we performed separate latent class analysis for Aboriginal and non-Aboriginal students.

Table 6.29: Demographic and mobility-related characteristics of Year 1 cohorts enrolled in NTG primary schools in 2009–2012, by Aboriginal status, Big Rivers region

Variable		Aboriginal	Non-Aboriginal	All	p-value
n =		632	371	1003	
%		63.0	37.0		
Sex					
	Female	50.3	52.0	51.0	0.602
	Male	49.7	48.0	49.1	
English as a second language					
	No	29.8	86.5	50.8	<0.0005
	Yes	70.3	13.5	49.3	
Attending NAPLAN Y3 & Y5					
	Not absent	97.6	99.3	98.1	0.079
	Both absent	2.4	0.7	1.9	
Preschool attendance					
	<60%	55.2	14.5	42.3	<0.0005
	60–79%	16.2	21.3	17.8	
	≥80%	28.6	64.3	39.9	
Year 3 attendance					
	<60%	27.7	0.8	17.5	<0.0005
	60–79%	31.2	4.9	21.2	
	≥80%	41.2	94.3	61.3	

Calendar month (proportion of total mobility episodes)				<0.0005
Jan	21.0	60.9	28.8	
Feb	15.4	5.0	13.4	
Mar	8.4	4.3	7.6	
Apr	8.4	6.8	8.1	
May	9.0	1.4	7.6	
Jun	3.5	0.7	3.0	
Jul	5.9	8.2	6.4	
Aug	8.4	3.2	7.4	
Sep	5.5	1.8	4.8	
Oct	6.5	4.3	6.0	
Nov	6.9	2.1	6.0	
Dec	1.0	1.4	1.1	
Year level at first mobility episode				<0.0005
Year 1	29.3	38.8	32.5	
Year 2	16.7	29.2	20.9	
Year 3	19.3	12.4	16.9	
Year 4	13.8	10.1	12.6	
Year 5	13.8	7.3	11.6	
Year 6	7.2	2.3	5.5	
Number of mobility episodes				
0	42.4	52.0	46.0	<0.0005
1	18.8	33.2	24.1	
2	14.2	8.1	12.0	
3–4	13.0	4.9	10.0	
5+	11.6	1.9	8.0	
Mobility category				<0.0005
Not moved	42.4	52.0	46.0	
Only remote to remote	29.6	27.5	28.8	
Only urban to urban	13.3	16.7	14.6	
Only urban to remote or remote to urban	13.9	3.8	10.2	
Mixed	0.8	0.0	0.5	
Ever moved to non-NTG schools				
No	98.9	98.1	98.6	0.31
Yes	1.1	1.9	1.4	
Ever moved interstate or overseas				
No	93.4	89.0	91.7	0.014
Yes	6.7	11.1	8.3	

6.4.2 Aboriginal students

We followed the process described in Chapter 2 to perform Latent Class Analysis (LCA) and compared the test results on model fit before adopting a 3-class model. Details of the process of selecting the best fit model of LCA are provided in section D.1 and Table Appendix 7 in Appendix 1. The 3-class model consisted of 3 groups of students named according to their mobility characteristics: Frequent Movers (63 students, 10.0% of total), Occasional Movers (301, 47.6%) and Stayers (268, 42.4%) as shown in Table 6.30. Students in the first 2 groups had different frequency and types of mobility while those in the third group did not have any mobility.

Of the 2 groups with mobility, all Frequent Movers had 3 or more episodes of mobility (more likely to have 3–4 episodes of mobility, 61.7%), while Occasional Movers had 67.1% probability of moving 1 or 2 times. In terms of mobility category, Occasional Movers were more likely to move only between remote localities (60.1%) or between urban localities (25.8%) only.[iv] By comparison, Frequent Movers predominantly moved from urban to remote or from remote to urban localities only (83.3%). Both groups rarely moved to non-NTG schools (Frequent Movers 4.6%; Occasional Movers 1.5%), but Frequent Movers had almost 1 in 4 (23.5%) probability of ever moving interstate or overseas, compared to 9.5% in Occasional Movers.

Post-hoc analysis was performed to demonstrate other characteristics of the 3 identified groups (Table 6.31). There was no evidence of a difference between the 3 groups for sex ($p = 0.818$) and Year 3 attendance ($p = 0.115$), but evidence of a difference was found for English as a second language ($p = 0.014$), preschool attendance ($p < 0.0005$) and absent from Year 3 and Year 5 NAPLAN ($p < 0.0005$). Stayers were least likely to speak English as a second language (66.1%) while Frequent Movers were more likely to do so than Occasional Movers (84.1% vs 71.6%). Frequent Movers were least likely to have 80% or higher attendance rate in preschool (6.4%), however the results on preschool attendance should be interpreted with caution given the moderately high levels of missing data in 2 of the 3 groups (25.4% in Frequent Movers and 24.6% in Stayers). Although no evidence of a difference was found between the 3groups for Year 3 attendance, it is worth noting that Occasional Movers had comparable, if not better attendance, than Stayers and compared favourably with Frequent Movers (42.2% with 80% or more attendance vs 27.0%). Nearly 10% of Frequent Movers were absent from both Year 3 and Year 5 NAPLAN, compared with 1.5% of Occasional Movers and 1.3% of Stayers.

No evidence for a difference was found in the distribution of mobility episodes across the 12 calendar months between the 2 groups with mobility. The same was true for the

[iv] For this variable, urban localities referred to localities in Darwin and Palmerston and the towns of Alice Springs, Katherine, Nhulunbuy and Tennant Creek. Localities in the rest of the Northern Territory were classified as remote.

distribution of the year level at first mobility episode across the 6 years of primary school. However, it is worth noting that in both groups with mobility, students were most likely to move for the first time in Year 1, with 43.9% of Frequent Movers first moving in Year 1 and 26.3% in Occasional Movers.

Table 6.30: Results of latent class analysis for mobility-related characteristics of students enrolled in Year 1 in 2009–2012, Aboriginal students, Big Rivers region

Variable	Frequent Movers		Occasional Movers		Stayers
n =	63		301		268
% (of total 632)	10.0		47.6		42.4
	Probability	(95% CI)	Probability	(95% CI)	Probability
Number of episodes of mobility					
0	0.0	-	0.0	-	100.0
1	0.0	-	38.2	(32.0~44.5)	-
2	0.0	-	28.9	(23.6~34.2)	-
3–4	61.7	(45.1~78.2)	15.9	(10.7~21.1)	-
5+	38.3	(21.8~54.9)	17.0	(12.1~21.8)	-
Mobility category					
Not moved	0.0	-	0.0	-	100.0
Only remote to remote	0.0	-	60.1	(53.1~67.0)	-
Only urban to urban	7.2	(0.0~40.7)	25.8	(19.2~32.3)	-
Only urban to remote or remote to urban	83.3	(52.4~100.0)	14.2	(9.5~18.8)	-
Mixed	9.5	(0.8~18.2)	0.0	-	-
Ever moved to non-NTG schools					
No	95.4	(84.8~100.0)	98.5	(96.5~100.0)	100.0
Yes	4.6	(0.0~15.2)	1.5	(0.0~3.5)	-
Ever moved interstate or overseas					
No	76.5	(62.2~90.8)	90.5	(87.1~93.9)	100.0
Yes	23.5	(9.2~37.8)	9.5	(6.1~12.9)	-

Note: Probabilities are presented as percentages. Some estimates for confidence intervals were either negative or greater than 100% and are presented in the table as 0.0% and 100.0% respectively.

Table 6.31: Results of post-hoc analysis (after latent class analysis) of the characteristics of 3 classes of students enrolled in Year 1 in 2009–2012, Aboriginal students, Big Rivers region

Variables used in post-hoc analysis	Frequent Movers	Occasional Movers	Stayers
	(n = 63)	(n = 301)	(n = 268)
Sex			
Female	47.6	49.6	51.5
Male	52.4	50.4	48.5
English as a second language*			
No	15.9	28.4	33.9
Yes	84.1	71.6	66.1
Preschool attendance***			
<60%	55.6	41.0	44.9
60–79%	12.7	17.2	9.3
≥80%	6.4	28.7	21.3
Missing data	25.4	13.1	24.6
Year 3 attendance			
<60%	34.9	26.1	24.6
60–79%	30.2	25.8	32.9
≥80%	27.0	42.2	38.9
Missing data	7.9	6.0	3.7
Attending NAPLAN Y3 & Y5***			
Not absent	76.2	96.6	84.1
Both absent	9.5	1.5	1.3
Missing data	14.3	1.9	14.6
Calendar month of mobility (proportion out of all episodes of mobility)			
Jan	17.4	22.4	-
Feb	15.4	15.5	-
Mar	12.5	6.9	-
Apr	8.4	8.4	-
May	8.7	9.1	-
Jun	3.2	3.7	-
Jul	7.1	5.5	-
Aug	7.1	8.9	-
Sep	5.5	5.6	-
Oct	6.8	6.3	-
Nov	7.4	6.8	-
Dec	0.6	1.1	-

Year level at first mobility episode				
	Year 1	43.9	26.3	-
	Year 2	19.3	16.4	-
	Year 3	10.5	21.2	-
	Year 4	14.0	13.7	-
	Year 5	10.5	14.3	-
	Year 6	1.8	8.2	-

* p < 0.05; ** p < 0.005; *** p < 0.0005

6.4.3 Non-Aboriginal students

The same process of LCA model building and selection was performed for the cohort of non-Aboriginal students (n = 371) with details of the process reported in section D.1 and Table Appendix 8 in Appendix 1. We adopted a 3-class model and named the 3 groups according to their mobility characteristics: Urban Movers (79 students, 21.3% of total), Remote Movers (99, 26.7%) and Stayers (193, 52.0%) as presented in Table 6.32. Students in the first 2 groups had different levels and types of mobility while those in the third group did not record any mobility. The proportion of Stayers among non-Aboriginal students was higher than among Aboriginal students (52.0% vs 42.4%).

We first compared the 2 groups with mobility. The fact that non-Aboriginal students were more likely to move interstate or overseas than Aboriginal students (reported in section 6.2.3) should be taken into consideration when interpreting these results. This is because once they moved interstate or overseas, no further information on their mobility could be included in the analysis.

Almost all Remote Movers moved only once (96.9% probability) and moved only between remote localities (100% probability). By comparison, Urban Movers were more likely to move more than once (63.1%) than once only (36.9%) and mainly moved only between urban localities (75.2%). There was no evidence of difference in 'ever moved to non-NTG schools' (due to overlapping 95% confidence intervals), although the point estimate was higher among Urban Movers (6.3% vs 1.9%). A greater difference was suggested for the probability among students who ever moved interstate or overseas given the barely overlapping 95% confidence intervals: Remote Movers were more than twice as likely to ever move interstate or overseas (31.1% vs 13.7%).

We also performed post-hoc analysis to analyse other characteristics of the 3 identified groups (Table 6.33). There was no evidence of a difference between the 3 groups in sex (p = 0.144), English as a second language (p = 0.442) and Year 3 attendance (p = 0.192), but some evidence for a difference was found for preschool attendance (p < 0.0005) and absent from Year 3 and Year 5 NAPLAN (p < 0.0005). However, the results for preschool attendance should be interpreted with caution given the high level of missing data.

Evidence of a difference was found in the distribution of mobility episodes across the 12 calendar months between the 2 groups with mobility (p < 0.0005). However, after excluding

January and February (the 2 months at the beginning of the year in which many families moved and enrolled their child in a new school), there was no evidence of a difference (p = 0.431). Notably, for Urban Movers, after excluding January and February, the peak months for mobility were July, April and October, which coincided with the beginning of school terms.

There was no evidence of a difference between the 2 groups with mobility in the distribution of the year level at first mobility episode across the 6 years of primary school. However, as observed among Aboriginal students, students were more likely to move for the first time in Year 1, followed by Year 2, in both groups.

Table 6.32: Results of latent class analysis for mobility-related characteristics of students enrolled in Year 1 in 2009–2012, non-Aboriginal students, Big Rivers region

Variable	Urban Movers		Remote Movers		Stayers
n =	79		99		193
% (of total 371)	21.3		26.7		52.0
	Probability	(95% CI)	Probability	(95% CI)	Probability
Number of episodes of mobility					
0	0.0	-	0.0	-	100.0
1	36.9	(26.0~47.7)	96.9	(91.2~102.6)	0.0
2	36.4	(25.1~47.6)	0.0	(0.0~0.0)	0.0
3–4	18.7	(9.8~27.6)	2.7	(-2.1~7.4)	0.0
5+	8.0	(1.8~14.2)	0.4	(-2.0~2.8)	0.0
Mobility category					
Not moved	0.0	-	0.0	-	100.0
Only remote to remote	7.8	(-3.4~19.0)	100.0	(100.0~100.0)	0.0
Only urban to urban	75.2	(62.7~87.6)	0.0	-	0.0
Only urban to remote or remote to urban	17.0	(8.8~25.2)	0.0	-	0.0
Mixed	0.0	-	0.0	-	0.0
Ever moved to non-NTG schools					
No	93.7	(88.4~99.0)	98.1	(95.2~101.0)	100.0
Yes	6.3	(1.0~11.6)	1.9	(-1.0~4.8)	0.0
Ever moved interstate or overseas					
No	86.3	(78.6~93.9)	68.9	(59.0~78.8)	100.0
Yes	13.7	(6.1~21.4)	31.1	(21.2~41.0)	0.0

Notes: Probabilities are presented as percentages. Some estimates for confidence intervals were either negative or greater than 100% and are presented in the table as 0.0% and 100.0% respectively.

Table 6.33: Results of post-hoc analysis (after latent class analysis) for the characteristics of 3 classes of students enrolled in Year 1 in 2009–2012, non-Aboriginal students, Big Rivers region

Variables used in post-hoc analysis	Urban Movers (n = 79)	Remote Movers (n = 99)	Stayers (n = 193)
Sex			
Female	58.2	56.6	47.2
Male	41.8	43.4	52.9
English as a second language			
No	82.3	86.9	88.1
Yes	17.7	13.1	11.9
Preschool attendance* **			
<60%	10.1	8.1	9.3
60–79%	15.2	11.1	14.0
≥80%	34.2	26.3	50.8
Missing data	40.5	54.6	25.9
Year 3 attendance			
<60%	2.5	0.0	0.5
60–79%	2.5	8.1	4.2
≥80%	93.7	89.9	94.8
Missing data	1.3	2.0	0.5
Attending NAPLAN Y3 & Y5* **			
Not absent	87.3	45.5	86.0
Both absent	0.0	1.0	0.5
Missing data	12.7	53.5	13.5
Calendar month of mobility (proportion of all episodes of mobility)* **			
Jan	47.1	83.2	-
Feb	8.1	0.0	-
Mar	5.8	1.9	-
Apr	8.1	4.7	-
May	1.2	1.9	-
Jun	1.2	0.0	-
Jul	10.9	3.7	-
Aug	4.0	1.9	-
Sep	1.7	1.9	-
Oct	6.9	0.0	-
Nov	2.9	0.9	-
Dec	2.3	0.0	-
Year level at first mobility episode			
Year 1	41.8	36.4	-
Year 2	29.1	29.3	-
Year 3	16.5	9.1	-
Year 4	5.1	14.1	-
Year 5	7.6	7.1	-
Year 6	0.0	4.0	-

* $p < 0.05$; ** $p < 0.005$; *** $p < 0.0005$

Chapter 7 Discussion

7.1 The design of the study and its significance

This study investigated the patterns and characteristics of student mobility for primary school students attending NT Government schools, using linked administrative datasets for the period from 2005 to 2018. The research questions listed in section 1.3 concern the 3 essential elements of student mobility: *the mobility event (how)*, *the localities involved (where)* and *the student (who)*. Our study employed a comprehensive set of analysis methods to address these 3 elements and their various aspects regarding student mobility as described below.

1. **Descriptive statistics** was used to quantify student mobility on the following measures:
    - the number and proportion of students who moved
    - the number of times students moved
    - distribution of destination categories for episodes of mobility (moving to NTG school; moving to non-NTG school, and moving interstate or overseas)
    - the timing (month of a year) when students moved
    - the year level when students moved.

The analysis with its focus on *how students moved* (the mobility event) provides valuable information on the quantity, frequency, destination, timing and year level of its occurrence, which can be used to inform relevant policies and resource allocation. For example, the results on the timing of student mobility and the year level when students moved can be used to inform educational policies and practices so that schools are better prepared for patterned influx and efflux of students.

The observation of different patterns and values for mobility measures before 2013 (Period 1) and the period from 2013 onwards (Period 2) confirms the impact of the enhanced system of recording enrolment on the data series and is an important consideration for the interpretation of some of the results. This change has also justified minimising the influence of the earliest years by the use of the Year 1 annual cohorts of 2009–2012 for third component of analysis, latent class analysis.

2. **Gephi network analysis** was used to estimate and visualise patterns of student mobility by:
    - detecting whether and how the network of student mobility could be aggregated into clusters of localities with higher levels of internal connection than connection with other localities
    - quantifying geographical student mobility into, out of and between remote localities and regions.

This analysis had a focus on *where students moved from and to* – the source and destination localities involved. The visualisations, produced with Gephi modularity analysis, summarises episodes of student mobility by presenting a wide range of location data with quantitative networking information about mobility between localities and the clustering of related localities. The results of this analysis provide insights into the scale and, to some extent, predictable patterns of student mobility. This information can be used by both education authorities and local school staff to know where students may come from and move to, which can inform strategies for managing enrolment systems and staffing as well as supporting regional collaboration to better support students' educational needs.

3. Characteristics of students using **latent class analysis** for
    - detecting groups of students within the study cohort who share similar characteristics related to mobility
    - analysing additional demographic and educational characteristics of the groups of students.

With a focus on *who moved and who did not* (i.e. the student), this analysis yielded an understanding about the profiles of students across different mobility categories. This understanding is important for classroom teachers who have direct contact with students daily and are best situated to provide tailored guidance and assistance to students according to their respective mobility profiles. The goal may not be to reduce student mobility but to better prepare students for anticipated mobility events that can disrupt their learning.

One major feature of this study was to use linked administrative datasets to increase the detection of destination localities where students moved to after departing a school. Additionally, in this study, we widened the definitions for student mobility to include long absences without recommencing at a second school. This is important for student mobility investigations in the NT because a substantial proportion of Aboriginal students may be missing from schools for extended periods, during which time they may travel with their families for social, cultural or festive activities. While this approach may not fit the common definition for student mobility (changing enrolment from an original school to a new school), the long absence has similar impacts on classroom teaching and resource allocation. Including long absences without re-enrolment as a form of mobility improves the relevance of the results for the NT setting.

One important question that remains for a comprehensive understanding of student mobility is - "*Why do students move*?" This question was outside the scope of the current study and will require a separate research project with a survey and interviews with families. However, during the current study the investigators benefited from regular meeting with experienced educators, including with advisory groups based in the 3 deep-dive regions. Members of these groups were generous with their contribution to the project and provided valuable interpretation of the patterns of movement. This information is

included later in this discussion but should not be seen to replace a detailed future investigation of *"why"* with the direct engagement of the families of students.

To the best of our knowledge, this is the first study to utilise an extensive repository containing linked person-level records from multiple datasets and a comprehensive set of analysis methods to investigate the 3 elements of student mobility. The importance of the study lies not only in the relevance of the results to inform NT's educational policy, practice enhancement and resource allocation, but also in it demonstrating the utility of the analysis methods for a broader understanding of and response to the high levels of population movement in the Northern Territory.

7.2 Student mobility in the Northern Territory

In this section we discuss the major findings from the analysis for students across the NT, the possible causes and implications for policy and practice. Parts of this discussion, for the NT, also apply to the more localised deep-dives for the 3 regions and are not repeated within the separate discussions of results from regional deep-dives in later sections.

7.2.1 Greater and more frequent mobility among Aboriginal students

From 2013 to 2018 (Period 2), the proportion of students having an episode of mobility was consistently and substantially higher among Aboriginal students. In the last year of the study period, 2018, 26.3% of Aboriginal students moved, more than double the proportion of non-Aboriginal students (12.4%). There was also an increasing trend in the proportion of students who moved in each calendar year among both Aboriginal and non-Aboriginal students. In terms of the number of times students moved during their primary school years, the majority of students moved only once; however, there was a much higher proportion of Aboriginal students who moved twice or 3 or more times, and both of these categories showed an increasing trend in Period 2.

The gradual roll-out of the updated information system and/or gradually improved proficiency of staff entering data into the system may have played a role in the early increase during Period 2. However, there were policies and practices implemented during the same period which would also have contributed to the observed increase. For example, the Remote School Attendance Strategy (RSAS) was implemented in 2014 as an Australian Government initiative to improve school attendance in remote communities.[32] Under this strategy, truancy officers were employed in 19 remote NT communities to work with families, parents and community organisations to encourage children to attend school every day. While positive impact on school attendance have been reported,[32] the work of truancy officers in monitoring school attendance and enrolment might have also contributed to the observed increase in mobility by enrolling children with previously poor engagement and greater mobility. However, given the substantial increase in the proportion of students having mobility during Period 2 (Aboriginal students by 64.8%, from 16.0% to 26.2%, and

non-Aboriginal students by 27.8%, from 9.7% to 12.4%), it is likely that part of the increased mobility was a true increase.

Members of the advisory groups also proposed regional factors that may have impacted on levels of student mobility. Over the study period, there were improvements in road conditions and increased availability of regular public transport services, both of which facilitated movement in remote areas and in turn may have contributed to the increase in student mobility. For example, the Regional and Remote Bus Trial Program started 2-year trial services in the East Arnhem region in 2010, and in the Katherine (Bodhi Bus) and Alice Springs (Centre Bush Bus) areas in 2011.[33] In 2013, the NT Government funded the program for a further 3 years. This program coincided with a period of rapid increase in student mobility, and it is likely that the improved access to public transport contributed to the increase.

The recent increases in student mobility, especially among Aboriginal students, warrant further investigation and monitoring with current data. Given the widely reported negative impacts of student mobility on students' learning and academic performance, policies and services that mitigate the education risk associated with student mobility are critical.

7.2.2 Different mobility profiles for Aboriginal and non-Aboriginal students

Our study found that Aboriginal students were more likely to have intrastate movements and movements to public schools, while non-Aboriginal students were more likely to move interstate, findings that are consistent with previous studies.[6,9]

Additionally, our study found peak levels of student mobility (within the school year) among Aboriginal students were in May, August and October, while the corresponding peaks for non-Aboriginal students were generally a month earlier in April, July and October. Our use of the enrolment date as the date of mobility[v] was the same for both groups and will have influenced their respective mobility statistics equally. There may be multiple reasons why Aboriginal students are delayed when commencing school, with irregular transport, inadequate funds and being stranded and vehicles breaking down having been cited as reasons for Aboriginal people's delayed return to their home communities.[34] The Annual Shows are held in Alice Springs, Tennant Creek, Katherine and Darwin on consecutive weekends through July every year, and always attract a large number of Aboriginal families from remote communities. Members of the deep-dive advisory groups suggested the shows as one reason for students' delayed return to school in August. An understanding of the peak months for mobility, though imprecise, can be used to inform planning for remote schools; for example, more flexible start and end dates for school terms may suit a majority of Aboriginal students by accommodating their patterns of mobility.

[v] Records for the date of departure from a school were often missing, and enrolment date in a new school was therefore used as date of mobility.

Our study also found the student mobility for Aboriginal students was greater in the earlier years of primary school than in later years, which was most evident in 2016–2018. This pattern supports the introduction of measures to respond to student mobility from Year 1.

7.2.3 Patterns of mobility by localities

The network analysis with Gephi modularity analysis is an innovative way to investigate the patterns of student mobility. Among the 7 NT clusters, Central, Arnhem Land and Darwin-Top End clusters recorded the highest volumes of mobility in terms of inflows, outflows and within-cluster mobility, and together accounted for approximately 60% of all mobility episodes (either as source localities or destination localities). The Central cluster consisted of several groups of localities sharing common Aboriginal languages, including the 'Warlpiri Triangle'[35] that extended from Yuendumu and Nyirripi to Lajamanu in the Big Rivers region. The Arnhem Land cluster included both West and East Arnhem Land localities indicating the close relationships across Arnhem Land. The close relationship between the 2 communities of Borroloola and Robinson River, forming the Borroloola-Robinson River cluster, is demonstrated with the high number of intra-cluster mobility episodes and demonstrates an opportunity for the schools in these 2 localities to work together when planning and delivering education activities for primary school students. A similar opportunity is demonstrated in the Big Rivers East cluster where localities located in different regions, East Arnhem region and Big Rivers region, have overlapping student mobility.

Across the NT, the clusters of localities for the mobility of Aboriginal students suggest opportunities to respond to mobility with closer alignment of school within clusters, noting that some of these clusters contain localities in different administrative regions. By contrast, for non-Aboriginal students, the cluster of localities were generally consistent with administrative boundaries.

7.2.4 Profiles of groups of students by their mobility characteristics

The latent class analysis for Aboriginal students indicated 5 groups of children: Once-off movers, Occasional movers, Frequent movers, Intrastate movers and Stayers. Almost half (49.2%) of the students were Stayers, who recorded no mobility. The Stayers were likely to speak English as a second language (66.5%), have low preschool attendance but comparatively good attendance in Year 3. Among the other 4 groups of Aboriginal students, the students in the groups that moved 1 or 2 times (Once-off and Occasional movers) had higher Year 3 attendance rates and more commonly moved in January. The Frequent mover and Intrastate mover groups had the greatest proportion of children who moved 3 or more times and highest proportions who were likely to speak English as a second language (both around 70%) and had a greater proportion of children who were absent for both Year 3 and Year 5 NAPLAN assessments. In summary, characteristics associated with students with greater mobility were: being absent for Years 3 and 5 NAPLAN, speaking English as a second language, and having lower Year 3 attendance.

The latent class analysis for non-Aboriginal students suggested 6 groups. Among these students, nearly 60% were Stayers who did not move during primary school years. Across the other groups most students had a high probability of moving only once, with a small proportion moving twice (7.1%) and a smaller group (0.9%) moving 3 or more times. One explanation for the low proportion of students moving more than 2 times was that information was not available after students moved interstate or overseas. Similarly, there will have been a small proportion of students who moved to non-government schools and for whom information on subsequent movements was unavailable.

In summary, Aboriginal students with varying levels of mobility have gradients in most measured characteristics, information which may be used to inform policymakers and school staff when planning for student needs. The high level of interstate movement of non-Aboriginal students suggests that the profiles for non-Aboriginal students will not be as informative as those for Aboriginal students.

7.3 Student mobility in the East Arnhem region

7.3.1 Descriptive statistics

In the East Arnhem region, the trends in annual numbers of students ever enrolled and the annual proportion of students having any episode of mobility were similar to the trends for the NT, except for non-Aboriginal students among whom the number of students declined through the period from 2013 to 2018 (Period 2). This decline is consistent with the closure of the local alumina refinery facilities at the end of 2013, which led to the departure of many non-Aboriginal families. As described in the previous section for the NT, the Remote School Attendance Strategy (RSAS) was implemented in 2014, with truancy officers employed to encourage students (especially Aboriginal students) to attend to school.[32] This strategy is likely to have contributed to the increase in the number of enrolled Aboriginal students through Period 2. The third school term commences in July each year and the delay in the peak in the mobility episodes for Aboriginal students until in August, compared with the peak in July for non-Aboriginal students, is consistent with reports from the advisory group of the impact of attendance of families at the Royal Darwin Show, as discussed above.

7.3.2 Network analysis with Gephi

The network analysis for the mobility of Aboriginal students within the East Arnhem region indicated 4 clusters of related localities which provide greater detail than the analysis at NT level. The clusters were described as West Arnhem, Galiwinku-Gapuwiyak, Nhulunbuy-Yirrkala and East Arnhem South. The West Arnhem cluster extended to Maningrida (in the Top End region) while the East Arnhem South cluster overlapped the majority of the Big Rivers East cluster detected in the network analysis for the NT. Notably, there was a large

number of Aboriginal students who left school but remained in Yirrkala for extended periods of time.

7.3.3 Latent class analysis

The latent class analysis indicated 2 groups of Aboriginal students termed the Movers and the Stayers. Nearly two-thirds of Aboriginal students belonged to the Stayers group, which had 93.7% probability of having no mobility. This is much higher than the 49.2% estimated for the corresponding NT analysis for Aboriginal students. Among East Arnhem students, the Movers only moved within the NT and had a low probability of moving to non-NTG schools (3%) or interstate or overseas (3%). Among non-Aboriginal students in East Arnhem, a significant group (14.3%) of students formed a group of Interstate movers, while a smaller group (5.2%) termed Intrastate movers, moved within the NT, including to non-NTG schools. The largest group (80.5%) of non-Aboriginal students were termed Occasional movers, most of whom did not move (62.9%) while a minority (37.1%) moved once. This finding that a comparatively low proportion of non-Aboriginal students have higher levels of mobility is different from results for the other 2 regions and may reflect the relative stability of families who remained after the closure of the alumina refinery facilities.

The limited size of the study cohort and the small number of mobility-related covariates may explain the low number of groups of students detected in this analysis. A future investigation with a larger study cohort and a wider range of covariates may improve the models and increase the number of groups of students.

7.4 Student mobility in the Central region

7.4.1 Descriptive statistics

There were trends of increasing annual numbers of students ever enrolled in the period from 2013–2018 (Period 2) for both Aboriginal and non-Aboriginal students. The possible reasons listed for the NT analysis may also apply to the Central region. Other more local influences include the Kids in Town Engaging in School (KITES) program, an innovative teaching program which commenced in 2012 and was implemented to encourage children from remote communities coming into Alice Springs to attend school.[36] These children came to Alice Springs to stay for different periods of time and for various reasons. One of the effects of the KITES program could be better recording of mobility episodes and higher numbers of enrolments. The Northern Territory Emergency Response (NTER) or 'The Intervention' officially stopped in 2012,[37] and was associated with the cessation of a wide range of services offered in Alice Springs and the return of many Aboriginal families to their home communities. The reduction in the mobility of these families between their home communities and Alice Springs may, in part, have caused the drop in the proportion of students having any mobility reported in section 5.2.1.

The higher numbers of mobility episodes for Aboriginal students recorded in August each year align with major events held in July each year, including the Alice Springs Show and football carnivals which attract Aboriginal people from remote communities to Alice Springs. Aboriginal children coming into Alice Springs with their families return to their community and have a delayed enrolment after the start of school and into August. As reported in the literature, annual sports events, such as football carnivals,[38] can be a powerful driver for student mobility in the NT, and in particular, in the Central region.

7.4.2 Network analysis with Gephi

The network analysis for the mobility of Aboriginal students within the Central region indicated 7 clusters of related localities. For most clusters the aggregation of localities is consistent with the distribution of traditional lands and languages across Central Australia:

- The Alice Springs cluster, which includes Hermannsburg and Wallace Rockhole, approximates the traditional country for the *Western Arrernte language*.[39]
- The 2 main localities of the Finke-Titjikala cluster, Finke and Titjikala, are located in the country of Luritja speakers.
- Central South cluster containing localities of Areyonga, Kaltukatjara and Mutitjulu, align with the *Pitjantjatjara*.
- The Central West cluster roughly matches the areas for the language *Pintupi Luritja*.
- The Yuendumu-Nyirripi cluster of the Central region and the Lajamanu-Yuendumu cluster of the Big Rivers region overlap and have extensive between-cluster and within-cluster mobility activities. These clusters reflect the well-documented 'Warlpiri Triangle', where people speak *Warlpiri*, and again demonstrating an association between Aboriginal students' mobility and language and cultural-based social connections.[35] Of note, one of the communities of the Warlpiri Triangle, Willowra, was not included in the Yuendumu-Nyirripi cluster, but was associated with a different cluster. The reason for this exception is unknown.

It has been reported in the literature that Aboriginal people in Central Australia have a long-established tendency to move within areas where the same language is spoken. These Aboriginal groups traditionally moved within defined geographic areas with seasonal movement to access water, food, shelter and other resources. Such movement was guided by traditional knowledge and cultural practices passed down through generations.[5]

The understanding of the detected clusters of localities may be put into good use by policymakers and local school staff. For example, as there are expected patterns of mobility of students of localities within the cluster, staff of the schools in the cluster can collaborate in recording students' movements, school attendance and enrolment; and, when planning processes for facilitating improved continuity of education delivery despite the mobility of the student. The schools can also consider sharing resources, including teachers, to respond to the temporary flows of students between localities.

7.4.3 Latent class analysis

The latent class analysis of mobility variables for Aboriginal students in Central Australia suggests 4 groups. Of Aboriginal students, 41.7% were Stayers, which is lower than the corresponding group in the East Arnhem region (63.9%) and all NT Aboriginal children (49.2%) in the study cohort, but similar to the corresponding group in the Big Rivers region (42.4%). The distribution and characteristics of the groups of Aboriginal students in the Central region are generally similar to the corresponding groups of all NT Aboriginal students.

For non-Aboriginal students there were also 4 groups, with the proportion of Stayers group (54.6%) similar to all NT non-Aboriginal students (57.7%). The great majority of students within 2 groups, Once-off Movers and Occasional Movers, moved only once and together accounted for about 36% of students. This is similar to the results of the NT non-Aboriginal students of whom the 3 groups of Once-off Movers accounted for 34.4% of students. In summary, the patterns and characteristics of the 4 groups of non-Aboriginal students in the Central region are also similar to the 6 groups identified in the analysis for all NT non-Aboriginal students.

7.5 Student mobility in the Big Rivers region

7.5.1 Descriptive statistics

Again, there were trends of increasing annual numbers and increasing proportion of students with an episode of mobility among Aboriginal students enrolled in the period from 2013–2018 (Period 2). These changes are likely to be for similar reasons discussed previously. In discussion with the local advisory group the changing state of road conditions was suggested as a further reason. Many roads are closed during the wet season, thereby limiting the mobility of Aboriginal people. In April, at the end of the wet season, mobility usually increases. This seasonal influence may partially explain the delayed peak in the number of mobility episodes in May. Similar to the East Arnhem region, the Katherine and Darwin shows, held in late July, may contribute to delays in peak enrolment for third school term until August. Other studies have described seasonal movements of Aboriginal populations in the Big Rivers regions between NT communities and across the state borders to nearby communities in Queensland or Western Australia during the wet season[40]; a pattern reflected in the mobility of students. As described in section 7.2.1, the bush bus services (Bodhi Bus) introduced in 2011 and football carnivals are additional reasons for increased mobility towards the regional centre of Katherine. For non-Aboriginal students, the reasons for the patterns of mobility are likely to be different. Many workers across the region are employed on seasonal or annual contracts. Many contracts are timed to finish in June, with families moving in July.

7.5.2 Network analysis with Gephi

The network analysis for the mobility of Aboriginal students indicated 5 clusters of related localities. An explanation of these recorded movements should be interpreted in the context of additional movements to nearby communities in Western Australia (e.g. Kununurra) and Queensland (e.g. Doomadgee, Burketown and Mt Isa) which were not captured by the datasets used for this study.

Among the 5 clusters, the Lajamanu-Yuendumu cluster aligns with the corresponding Yuendumu-Nyirripi cluster of the Central region, reflecting the areas in which the Warlpiri language is common. Similar to the Central region, this cluster demonstrates the social cultural connections that influence the patterns of student mobility.

On the eastern side of the region, some localities of the Big River East cluster, such as Numbulwar and Ngukurr, overlap with the East Arnhem South cluster, within the East Arnhem region. The extent of this connection may be limited, in the analysis, by the filtering and removal of localities with low numbers of mobility connections.

The Borroloola-Robinson River cluster mainly consisted of the 2 communities of Borroloola and Robinson River. It has historically strong mobility connections with Doomadgee, Burketown and Mt Isa, which are not shown in our analysis. It is of interest that this cluster has an unexpected mobility connection to Pine Creek which suggests some connections based on mining activities in the 3 localities.

Localities in the largest cluster in the region, Katherine-Big Rivers West (e.g. Baines, Bulla Camp, Timber Creek and Kalkarindji) are also reported to have mobility connections with Western Australia localities (e.g. Kununurra) which were not recorded in this analysis.

7.5.3 Latent class analysis

The results of latent class analysis for Aboriginal students of the Big Rivers region were moderately different from those of the Central region, with only 3 groups identified, and no distinct group of Once-off Movers. Other characteristics of the identified groups of Aboriginal students were similar in these 2 regions. The characteristics of the 3 identified groups of non-Aboriginal students within the Big Rivers region were similar to those of the Central region as well.

7.6 Limitations and future research

Our study has several limitations. First, as revealed in the descriptive analysis, prior to the introduction of the enhanced system of recording enrolment and attendance in 2013 (especially during the earlier years of the study period), there were many inconsistencies in the recording of enrolment and attendance data. The inclusion of data from the earlier period will have led to some undercounting of episodes of mobility and incomplete data. We have therefore presented data separately for the periods before and after the change

and focused most comments on the later period. The study cohort for the latent class analysis reduced the reliance on data from earlier years by using annual Year 1 cohorts from 2009 to 2012. A second example of the impact of incomplete data is that the date of departure from a school was often missing in enrolment records, requiring the use of enrolment dates, for next enrolment, as a reference for the timing of movement. The missingness was greatly reduced in Period 2. Future studies will benefit from use of more current data.

A second limitation, which again relates to the completeness of data, is that not all episodes of mobility were captured within the available datasets. The network analysis provides clear patterns of movement and identifies clusters of localities between which movement was much more common. The analysis also includes data tables with the number of episodes of mobility between linked communities. These numbers are indicative only and not a precise measurement of the total number of episodes of movement. The identified clusters are important for informing services, but the numbers presented in data tables should not be used as precise measures.

A final limitation, relevant to the latent class analysis, is that the range of variables available in this study was limited and may not have included critical factors. This has resulted in the defining of groups of children based on limited information and which in some cases provided limited discrimination between groups. This is particularly the case for Aboriginal students in East Arnhem, a limitation which is compounded by the relatively small number of students available in this analysis. Two examples of potentially important factors not available for this study were employment (or income) of parents, and the availability of suitable housing. Many young Aboriginal families in the NT have uncertain incomes and may not have their own house, with both factors likely to have a major influence on decisions by families to move. A future study could specifically focus on “why do students move?” which will provide valuable information to enhance education support for children moving between locations.

Appendix 1: Technical details of latent class analysis

List of acronyms:

- AIC: Consistent Akaike information criterion
- BIC: Bayesian information criterion
- aBIC: Sample size adjusted BIC
- VLMR-LRT: Vuong-Lo-Mendell-Rubin likelihood-ratio test
- LMR-A-LRT: Lo-Mendell-Rubin adjusted likelihood-ratio test
- PB-LRT: Parametric bootstrap likelihood-ratio test

A. Latent class analysis for the Northern Territory

A.1 Aboriginal students

For Aboriginal students, we conducted LCA for 2-, 3-, 4-, 5- and 6-class solutions and compared the results to determine the optimal number of classes for the best fit model (Table Appendix 1). The magnitude of log-likelihood, AIC, BIC and aBIC all decrease as the number of classes increases incrementally from 2 to 5, but increases as the number of classes goes from 5 to 6. That the aBIC value of the 5-class model is the lowest suggests it is the best fit model. Additionally, the PB-LRT produced a significant p-value, indicating the 5-class model is a better fit than the 4-class model. The insignificant p-value in all 3 likelihood-ratio tests for the 6-class model indicates that the 5-class model is a better fit. The entropy for 5-class model is reasonably close to 1 (0.900). Therefore, we determined that the 5-class model fits the best and adopted it.

Table Appendix 1: Comparison of model fit test results for latent class analysis, Aboriginal students, NT

Model	log-likelihood	AIC	BIC	aBIC	Entropy	VLMR-LRT	LMR-A-LRT	PB-LRT
2 classes	-7912.597	15867.19	15997.34	15930.61	1.000	0.000	0.000	0.000
3 classes	-7773.192	15610.38	15808.70	15707.02	0.919	0.000	0.000	0.000
4 classes	-7707.468	15500.94	15767.42	15630.79	0.914	0.002	0.002	0.000
5 classes	-7657.330	15422.66	15757.31	15585.73	0.900	0.140	0.142	0.000
6 classes	-7677.767	15485.53	15888.36	15681.82	0.940	1.000	1.000	1.000

A.2 Non-Aboriginal students

For non-Aboriginal students, LCA was performed for 2-class through to 7-class models (Table Appendix 2). We applied basically the same process as in section A1 above and found the 6-class model to have the lowest aBIC value, an entropy of 0.959 which is close to 1, and a significant PB-LRT ($p < 0.0005$), indicating it to be the best fit model. That the 7-class model has a higher aBIC and produces an insignificant p-value in all 3 likelihood-ratio tests

further supports that the 6-class model is the best fit one. We therefore adopted the 6-class model for non-Aboriginal students.

Table Appendix 2: Comparison of model fit test results for latent class analysis, non-Aboriginal students, NT

Model	log-likelihood	AIC	BIC	aBIC	Entropy	VLMR-LRT	LMR-A-LRT	PB-LRT
2 classes	-10597.679	21237.36	21378.87	21312.14	1.000	0.000	0.000	0.000
3 classes	-9954.260	19972.52	20188.16	20086.47	0.989	0.000	0.000	0.000
4 classes	-9755.909	19597.82	19887.58	19750.94	0.991	0.108	0.110	0.000
5 classes	-9681.765	19471.53	19835.42	19663.82	0.947	0.000	0.000	0.000
6 classes	-9627.465	19384.93	19822.95	19616.40	0.959	1.000	1.000	0.000
7 classes	-9684.065	19520.13	20032.27	19790.77	0.930	1.000	1.000	1.000

B. Latent class analysis for the East Arnhem region

B.1 Aboriginal students

We conducted LCA for 2-, 3- and 4-class solutions for Aboriginal students of the East Arnhem region. As shown in Table Appendix 3, the value of aBIC increases, instead of decreases, as the number of classes increase from 2 to 4. That the 2-class model has the lowest aBIC, an entropy reasonably close to 1 (0.844) and produces a significant p-value in all 3 likelihood tests, suggests it is the best fit model. Additionally, the 3-class model produces an insignificant p-value at the PB-LRT (0.1818) and further supports the better fit of the 2-class model. We therefore adopted the 2-class model for Aboriginal students.

Table Appendix 3: Comparison of model fit test results for latent class analysis, Aboriginal students, East Arnhem region

Model	log-likelihood	AIC	BIC	aBIC	Entropy	VLMR-LRT	LMR-A-LRT	PB-LRT
2 classes	-648.132	1322.263	1377.737	1336.472	0.844	0.025	0.027	0.000
3 classes	-644.827	1329.654	1414.998	1351.513	0.858	0.000	0.000	0.182
4 classes	-644.826	1343.653	1458.867	1373.162	0.546	0.011	0.011	1.000

B.2 Non-Aboriginal students, East Arnhem region

We also conducted LCA for 2-, 3- and 4-class solutions for non-Aboriginal students of the East Arnhem region. The value of aBIC decreases from the 2-class model to the 3-class one, but then increases as the number of classes increases to 4, indicating the 3-class model is the better fit model (Table Appendix 4). That all 3 likelihood-ratio tests produce a significant p-value for the 3-class model but an insignificant p-value for the 4-class model, indicates the 3-class model is better fit. Additionally, that the entropy for the 3-class model is the highest among the 3 models and close to 1 (0.918) further supports its better fit. We therefore adopted the 3-class model for non-Aboriginal students.

Table Appendix 4: Comparison of model fit test results for latent class analysis, non-Aboriginal students, East Arnhem region

Model	log-likelihood	AIC	BIC	aBIC	Entropy	VLMR-LRT	LMR-A-LRT	PB-LRT
2 classes	-495.207	1012.414	1055.283	1020.385	0.721	0.000	0.000	0.000
3 classes	-485.926	1005.853	1072.104	1018.171	0.918	0.007	0.008	0.000
4 classes	-485.926	1017.852	1107.486	1034.517	0.594	0.609	0.609	1.000

C. Latent class analysis for the Central region

C.1 Aboriginal students, Central region

LCA was performed from a 2-class model all the way to a 5-class model (Table Appendix 5). We stopped at 5-class model because the value of aBIC reached the lowest value at 4-class model and then started to increase at 5-class model. Further, all log-likelihood ratio tests yielded a non-significant p-value from 5-class model, indicating that the 5-class model is not a better fit than the 4-class model. The entropy is high at 0.934 for the 4-class model. This model yielded a significant p-value in the PB-LRT, indicating it is a better model than the 3-class model. An observation of the model details led us to believe that the model has good interpretability for our project. We therefore decided to adopt the 4-class model.

Table Appendix 5: Comparison of model fit for latent class analysis, Aboriginal students, Big Rivers region

Model	log-likelihood	AIC	BIC	aBIC	Entropy	VLMR-LRT	LMR-A-LRT	PB-LRT
2 classes	-1626.312	3294.624	3389.245	3322.569	1.000	0.0000	0.0000	0.0000
3 classes	-1594.55	3253.1	3397.285	3295.683	0.908	0.6639	0.6662	0.0000
4 classes	-1569.595	3225.191	3418.939	3282.411	0.934	1.0000	1.0000	0.0000
5 classes	-1564.588	3237.177	3480.489	3309.036	0.941	0.2529	0.2568	0.6667

C.2 Non-Aboriginal students, Central region

We performed LCA for 2-class to 6-class models following the same principles described for Aboriginal students above (Table Appendix 6). The value of aBIC was lowest in the 3-class and 4-class models. But all 3 LRTs yielded a significant p-value with the 4-class model, indicating it is a better fit than the 3-class model. We checked the model details and believe it has good interpretability. Therefore, we decided to adopt the 4-class model.

Table Appendix 6: Comparison of model fit for latent class analysis, non-Aboriginal students, East Arnhem region

Model	log-likelihood	AIC	BIC	aBIC	Entropy	VLMR-LRT	LMR-A-LRT	PB-LRT
2 classes	-1006.72	2055.44	2147.208	2080.54	1.000	0.0000	0.0000	0.0000
3 classes	-939.375	1942.75	2082.587	1980.998	0.996	0.0000	0.0000	0.0000
4 classes	-921.866	1929.733	2117.638	1981.129	0.996	0.0000	0.0000	0.0000
5 classes	-915.328	1938.656	2174.631	2003.201	0.933	0.0044	0.0048	0.0000
6 classes	-910.861	1951.722	2235.766	2029.414	0.893	1.0000	1.0000	0.0000

D. Latent class analysis for the Big Rivers region

D.1 Aboriginal students, Big Rivers region

We started LCA with the 2-class model and carried it on through until we stopped at the 5-class. As shown in Table Appendix 7, the sample size adjusted BIC reached the lowest point with the 3-class solution, which produced a significant p-value in all 3 log-likelihood ratio tests and yielded a high entropy of 0.940. The interpretability with the model was also considered good. We therefore adopted the 3-class model.

Table Appendix 7: Comparison of model fit for latent class analysis, Aboriginal students, Big Rivers region

Model	log-likelihood	AIC	BIC	aBIC	Entropy	VLMR-LRT	LMR-A-LRT	PB-LRT
2 classes	-1487.934	3017.867	3111.294	3044.621	1.000	0.0000	0.0000	0.0000
3 classes	-1466.182	2996.364	3138.728	3037.132	0.940	0.0100	0.0106	0.0000
4 classes	-1449.861	2985.722	3177.024	3040.503	0.914	0.0110	0.0116	0.0000
5 classes*	-1434.387	2976.774	3217.014	3045.57	0.894	0.0615	0.0636	0.0000

D.2 Non-Aboriginal students, Big Rivers region

We performed LCA with 2-class model all the way to 5-class model. As shown in Table Appendix 8, the sample size adjusted BIC reached the lowest point with the 3-class solution, which produced a significant p-value in all 3 log-likelihood ratio tests and yielded a high entropy of 0.983. The interpretability of the 3-class model was also considered good. We therefore adopted the 3-class model.

Table Appendix 8: Comparison of model fit for latent class analysis, non-Aboriginal students, Big Rivers region

Model	log-likelihood	AIC	BIC	aBIC	Entropy	VLMR-LRT	LMR-A-LRT	PB-LRT
2 classes	-702.986	1443.972	1518.379	1458.099	1.000	0.0000	0.0000	0.0000
3 classes	-662.571	1383.141	1496.711	1404.703	0.965	0.1007	0.1029	0.0000
4 classes	-652.808	1383.615	1536.347	1412.613	0.983	1.0000	1.0000	0.0128
5 classes	-645.713	1389.426	1581.32	1425.859	0.982	0.0919	0.0954	0.1154

Appendix 2: Supplementary materials for regional deep-dive analysis

Table Appendix 9: Public primary schools included in the deep-dive for the East Arnhem region

School name
Alyangula Area School
Alyarrmandumanja Umbakumba School
Angurugu School
Baniyala Garrangali School
Gapuwiyak School
Laynhapuy Homelands School
Milingimbi School
Milyakburra School
Nhulunbuy Primary School
Ramingining School
Shepherdson College
Yirrkala School

Table Appendix 10: Public primary schools included in the deep-dive for the Central region

School name
Acacia Hill School
Alcoota School
Amoonguna School
Areyonga School
Bonya School
Bradshaw Primary School
Braitling Primary School
Finke School
Gillen Primary School
Haasts Bluff School
Harts Range School
Imanpa School
Laramba School
Larapinta Primary School
Mbunghara School
Mount Allan School
Mulga Bore School
Mutitjulu School
Ntaria School
Nyirripi School
Papunya School
Ross Park Primary School
Sadadeen Primary School
Stirling School
Ti Tree School
Titjikala School

Wallace Rockhole School
Walungurru School
Watarrka School
Watiyawanu School
Willowra School
Yuendumu School
Yulara School

Table Appendix 11: Public primary schools included in the deep-dive for the Big Rivers region

School name
Amanbidji School
Barunga School
Borroloola School
Bulla Camp School
Bulman School
Casuarina Street Primary School
Clyde Fenton Primary School
Jilkminggan School
Kalkaringi School
Katherine South Primary School
Kintore Street School
Lajamanu School
MacFarlane Primary School
Manyallaluk School
Mataranka School
Minyerri School
Ngukurr School
Numbulwar School
Pigeon Hole School
Pine Creek School
Robinson River School
Timber Creek School
Urapunga School
Wugularr School
Yarralin School

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