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Disparities between Indigenous and Non-Indigenous Educational Attainment: Exploring Factors Related to Low Average School NAPLAN Scores in the Northern Territory

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DISPARITIES BETWEEN INDIGENOUS AND NON-INDIGENOUS EDUCATIONAL
ATTAINMENT

Exploring Factors Related to Low Average School NAPLAN Scores in the Northern Territory

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The Indigenous population is a small minority in most areas of Australia, except the Northern Territory where Indigenous people make up roughly a quarter of the population. Indigenous people have lower educational achievement when compared to non-Indigenous people in Australia, with almost half as many of Indigenous having completed Year 12 or equivalent as non-Indigenous in 2016. The focus of this study was to identify factors that may be influencing the lower educational attainment of Indigenous students. Factors related to increased Indigenous presence in a school were expected to predict lower educational attainment. Full or partial support for some of the hypotheses was found, with the percent of Indigenous students, student to teacher ratio, attendance rates, and school location being associated with educational attainment. The attendance rate of students was associated with the socioeconomic score, student to teacher ratio, and location of schools. The results of the analysis may not be representative due to large amounts of missing data, which excluded most schools in very remote locations.

CHAPTER I

INTRODUCTION

The colonisation of Australia resulted in the Indigenous population becoming a small minority consisting of Aboriginal and Torres Strait Islanders. While these Indigenous Australians made up a small percent of the total Australian population (2.8%, or 649,200 people) in 2016, the Indigenous population was disproportionately spread across Australian states and territories. The Northern Territory had the highest proportion of Indigenous residents (25.5%) (Australian Bureau of Statistics 2017). Indigenous people (Aboriginal and Torres Strait Islanders) had lower educational achievement when compared to non-Indigenous people in Australia, with 47% of Indigenous having completed Year 12 or equivalent compared to 79% of non-Indigenous in 2016 (Australian Bureau of Statistics 2017). The factors that result in the lower educational attainment of Indigenous Australian students is the focus of this thesis, though the historic policies that discouraged Indigenous people from accessing education will also be considered for their influence on Indigenous educational attainment.

Educational attainment has a large influence on how a person's life progresses. For example, some of the effects of low education attainment that make it a cause for concern include decreased mental health (Gutiérrez-García et al. 2017; Lantz et al. 2005), increased cognitive decline (Zahodne, Stern, and Manly 2015), reduced physical health over the lifetime (Leopold and Engelhartdt 2012), increased mortality rates (Lawrence, Rogers, and Zajacova 2016; Gakidou et al. 2010; Montez and Barnes 2016), increased offending and incarceration rates (Hjalmarsson, Holmlund, and Lindquist 2015; Lockwood et al. 2015 Machin, Marie, and Vucic 2011), reduced income, employment prospects, and socioeconomic status (Behrandt et al. 2012; Kena et al. 2016; Ritchie and Bates 2013; van Zon et al. 2017) among individuals with low

educational attainment. These negative implications of low educational attainment, combined with the relatively high proportion of Indigenous people in the Northern Territory, mean that the Northern Territory population is at higher risk than other states of experiencing these effects.

This thesis will explore the student-level factors, educational institution-level factors, and policies that may be relevant to understanding the educational attainment discrepancy between Indigenous and non-Indigenous populations. The student factors that have been found to influence educational attainment in previous literature that will be examined in this research include socioeconomic status, whether students speak the language of instruction as their first language, the ethnicity of students, and the attendance rates of students. The education system factors that will be explored include the student-teacher ratios and the degree of remoteness of schools. The historical and current policies that relate to Indigenous people and to education will be used to interpret the results of the student and education system factors on educational attainment. The results of this research will help to provide further insight into the educational difference occurring between Indigenous and non-Indigenous Australians.

CHAPTER II

LITERATURE REVIEW

This thesis will explore the negative effects of low educational attainment and then move into discussing the factors that have been previously found to influence educational attainment. From there, the relevant policy context will be outlined followed by the gaps in previous literature, and then the study hypotheses.

Low education attainment is generally considered to be school completion of below Year 12 or equivalent (Maani 2000). Evidence for the lower education attainment rates of minority Indigenous populations has been shown consistently in literature (Maani 2000; Marriott and Sim 2015; Reading and Wien 2009), and the education gap in Australia has been known since at least the 1960s (Gray and Beresford 2008).

Effects of Low Education Attainment

Mental health. The effect of low education has been found to have a negative impact on a person's mental health. The study by Gutiérrez-García et al. (2017) also found that youth who neither worked or studied had higher rates of mood, behavioural, and substance use disorders, as well as higher rates of suicidal behaviour when compared with youth who did attend school or had employment. The study by Lantz et al. (2005) also supported that low education is associated with increased mental health problems as respondents with lower education had higher levels of stress than more highly educated respondents.

Cognitive and physical health, and mortality. Cognitive decline has also been found to be influenced by education attainment, with lower education being associated with earlier cognitive

decline. Cognitive decline was slowed in participants that had 9 or more years of education attainment (Zahodne et al. 2015).

Reduced physical health has also been associated with low education attainment. Leopold and Engelhartdt (2012) found that when comparing people aged 50-80 years of low or high education attainment that people with high education attainment had better health than people with low education attainment, and this gap widened with age. Examples of the differences in physical health included that those with lower education had greater limitations in physical functioning than those with higher education. The gap between the two groups on chronic diseases and self-rated health remained constant, with lower educated respondents having increased rates of chronic diseases and lower self-rated health scores. These findings were supported by Vos et al. (2009), who found increased prevalence of diseases in the Indigenous population, along with an overall large health gap between Indigenous and non-Indigenous persons. A lack of exercise and poor diet habits, combined with increased rates of smoking and alcohol misuse were also found to result in increased rates of a range of health problems, including cancer, heart disease, and diabetes for Indigenous Australians. Other evidence for the effect of low education attainment of Indigenous populations include an earlier age of onset for chronic conditions and increased incidence of hospitalisation for non-indigenous populations (Trewin and Madden 2005).

In addition, low education has been associated with increased mortality rates (Montez and Barnes 2016). Mortality rates have been found to decrease with education increases, a degree in particular provides the greatest reduction in mortality, but benefits in longevity at every increase in education (Lawrence et al. 2016). Support for this is evident when in 2001 the gap between Indigenous and non-Indigenous life expectancy was 23.2 years (Cooke et al. 2007).

Lower education attainment can also affect those around a person, with child mortality increased when mothers have low education attainment (Gakidou et al. 2010).

Offending and incarceration rates. The amount of education a person has can also be a predictor of the likelihood that the person will engage in behaviour resulting in convictions and incarceration. Criminal activity overall has been found to be reduced by increased education attainment, even just to the completion of high school (Lochner and Moretti 2004). Hjalmarsson et al. (2015) found that increases in the number of years of school attendance resulted in reduced offending rates, especially for males. A similar effect was also found in the study by Machin et al. (2011), where a reduction in property crime was identified with increases in education and age of leaving school. Increased education also has a protective effect against recidivism, with higher levels of education being a strong predictor of lower likelihoods of recidivism (Lockwood et al. 2015). The rates of incarceration for Indigenous Australians are in line with this, with all Indigenous age groups having higher incarceration rates than non-Indigenous, and particularly high rates for youth aged 10-17 years (White 2014; Trewin and Madden 2005), and overall 13 times higher rates in 2006 (Davidoff and Duhs 2008). The rates of Indigenous incarceration are disproportionate to the population in the Northern Territory, where 86% of those incarcerated were Indigenous in 2015 (Kapellas and Jamieson 2016).

Income, employment, and socioeconomic status. Poor employment prospects and reduced income and socioeconomic status are consistently found to be related to low education attainment (Behrandt et al. 2012; Caldas and Bankston 2005; Kao and Thompson 2003; Kena et al. 2016; van Zon et al. 2017). Jacobson and Mokher (2009) found that education attainment differences had an impact on a person's earnings, with a bachelor or graduate degree translating into much higher earnings than lower education attainment. Carnevale, Rose, and Cheah (2013)

also demonstrated that with every increase in education attainment, there is an increase in earnings over a lifetime. The lifetime earnings of people by education attainment rose from the lowest lifetime earnings of those who had an education of less than high school, up to the highest earners of those who had a doctoral or professional degree. Between 1990 and 2001, Indigenous people had lower median income than non-Indigenous (Cooke et al. 2007), and it would take over 50 years at the 2010 rate of gap reduction for the median Indigenous population income to match the non-Indigenous population (Wilson and Macdonald 2010).

The employment rate for people with low education is understood to be lower than for people with higher education attainment. People in the US in 2015 who did not complete high school had just over a 50% employment rate, while those with a college education had almost a 90% employment rate (Kena et al. 2016). The impact of education attainment on employment rate for women with injuries in Australia has also been noted, with women with no college education less likely to find employment after sustaining an injury (Callander and Lloyd 2016). The lower employment rate of Indigenous Australians corresponds with the effects of lower education attainment on employment, with Indigenous having an employment rate of 43.6% compared with 72.1% for non-Indigenous in 2011 (Gray, Hunter, and Biddle 2014). As education attainment affects income and employment rates, it follows that socioeconomic status would also be affected by education attainment (Caldas and Bankston 2005). Education attainment can be a predictor of socioeconomic status even at a young age, as found by Ritchie and Bates' (2013) study in which the reading and mathematics scores of children aged 7 was a predictor of socioeconomic status for the same participants at age 42.

Contributing factors to low education attainment

   Student background factors. The factors that contribute to a student's education attainment are related broadly to student background factors and education institution factors. Student background factors explored are socioeconomic background, support, ethnicity, language spoken, and attendance rate.

   Socioeconomic background can have a large influence on a student's education attainment. Students of low socioeconomic status have reduced access to capital and education resources, resulting in low education attainment (Azzolini, Schnell, and Palmer 2012). Low socioeconomic status is also linked to reduced likelihood of university entry (Parker et al. 2012). Berzin (2010) found that youth from low-income households had far lower educational aspirations than students from household with higher income. Students who have low-educated parents are also less likely to achieve highly in school (Hintsanen et al. 2011), while students of highly educated parents are more likely to attend a prestigious university and graduate from tertiary education (Triventi 2013).

   The support that a student receives from a parent has been found to have an impact on student education attainment. Parent support is most beneficial to students in the form of social support, such as encouragement and high expectations of educational achievement. Even the perception of social support can have a positive impact on student educational achievement (Ahmed et al. 2010). Support most commonly come from parents who value education and have high education themselves (Berzin 2010; Caldas and Bankston 2005; Purdie and Buckley 2010).

   Education attainment is also influenced by student ethnicity (Berzin 2010). Student ethnicity appears to be detrimental if the student is of a minority (Azzolini et al. 2012). In particular, Indigenous students may be at additional educational disadvantage due to the remote

and small communities that they typically live and the lack of English as a first language (Bradley et al. 2007).

The language background of a student impacts education attainment, as highlighted by Silver, Saunders, and Zarate (2008). In particular, students who are being taught in a language that is not their primary language have lower education attainment (Azzolini et al. 2012; Bradley et al. 2007; Wigglesworth, Simpson, and Loakes 2011). This negative effect on educational attainment is particularly extreme when teachers do not have adequate support or training to be teaching English as a second language (Simpson, Caffrey, and McConvell 2009).

Attendance rate is also understood to be a predictor of education attainment, students who miss multiple days of school having lower educational attainment outcomes (Purdie and Buckley 2010). The effect of missing as little as 10% of school days, or even as little as 11 (or more) days dramatically reduces student educational attainment rates (Innis 2016; Silver et al. 2008).

Education institution factors. Student education attainment is also impacted by the education systems that students are located in. Education system factors include teacher quality, student-teacher ratio, the physical learning environment, and school resources.

Teacher quality can vary by the amount of training experienced before entering a school as a teacher, the amount of training experienced after they have begun teaching, and by the number of years that the teacher has been in service. Lower quality teachers are those with reduced training pre and post entering service, and fewer years in service (Harris and Sass 2011; Peske and Haycock 2006). Low quality teachers are associated with poorer education attainment outcomes for their students because low quality teachers don't have the skills from experience and training that appropriately promote student education attainment (Montt 2011; Silver et al. 2008).

Another factor related to teachers is the ratio of students to teachers. Research has found that lower ratios of students to teachers result in improved educational outcomes (Adeyemi and Adeyemi 2014; Montt 2011), particularly for male students, students requiring special assistance in the classroom, and students in poverty (Therriault et al. 2017). The resources available to a school can also impact the education attainment of students. For example, the education outcome of students was lower in schools where the learning environment was in poor condition (Duran-Narucki 2008). However, resources such as material quality have not been found to be related to improved education outcomes (Montt 2011). Students attending schools in more remote locations also face disadvantage when compared with students who attend schools in more populated areas (Hernandez-Torrano 2018). This is particularly the case when students are from disadvantaged backgrounds (Odell 2017) or are of Indigenous heritage (Bradley et al. 2007). This may be due to lower teacher quality and higher teacher turnover that has been found to be an issue in more remote locations (Monk 2007).

Policy

Access to education for Indigenous persons has not always been consistent or easy to attain due to historical policies introduced by the dominant coloniser culture, and so the policy context should be taken into consideration when assessing Indigenous education in Australia (Perche 2011). Policies relating to education access are suspected to have an influence on modern Indigenous educational attainment rates.

Historical – general. The European settlement of Australia began in 1788 (Davidoff and Duhs 2008), which resulted in the theft of Indigenous lands and resources (Altman 2015; Weber and Lacey 2005). This behaviour of the colonisers can be understood as social control in the

form of "over-involvement", where the Indigenous people had previously had very little exposure to non-Indigenous people and the colonisers became over-involved in the lives of Indigenous people (Black 2012).

Prior to 1945 there occurred massacres of Indigenous Australians (Cuneen 2005), as well as underpayment, withholding of pay, and prevention of access to education, housing, and welfare. In addition to this, the Australian Government had policy in place from 1910 to 1970 that promoted the forced removal of approximately 10-33% of children from Indigenous parents (Kapellas and Jamieson 2016). The colonisers rejection of Indigenous cultures can be understood as "under-innovation". The children who were removed were typically of mixed-blood; that is, one parent was Indigenous and the other parent was non-Indigenous. The colonial culture was considered superior and the ideal by the dominant colonisers, and so mixed-blood children were removed from their parents and communities under the guise of educating them and assimilating them into the colonial culture (Jacobs 2006; van Krieken 2005; Weber and Lacy 2005). This removal of children can be considered as genocide, as the actions were intended to destroy a party's way of life either in part or fully, and children were removed from families (van Krieken 2005; United Nations. n.d.). Removing children from families can also be considered genocide from the social control perspective, as there was a high degree of inequality between the Indigenous and non-Indigenous populations. The non-Indigenous population had a high degree of functional independence and was higher in social status than the Indigenous population, and the Indigenous population typically had a high degree of immobility which limited or prevented their escape from the situation (Cuneen 2005; Davidoff and Duhs 2008). Full-blood Indigenous children and adults were not provided with education opportunities as they were reportedly expected to die out (Beresford 2004; Kapellas and Jamieson 2016). The efforts to encourage the

expectation that Indigenous people would die out can be viewed as a method of social control, as the non-Indigenous people experienced "over-exposure" to Indigenous cultures and was trying to correct the exposure to a culturally acceptable level (Black 2012).

From 1945 the restrictions to education, training, housing, and welfare were lifted, with an assimilation stance taken with regards to policy. However, access to these services was conditional between 1945 and 1975, with legislative control affecting Indigenous movement, education, healthcare, employment, voting, and welfare (Cuneen 2005; Kanellas and Jamieson 2016). The argument for the forced removal of mixed-blood Indigenous children also changed after 1945 to being based on claims that Indigenous parents were inadequate caregivers who neglected and abused their children, and that the children were disruptive and delinquent. The children who were removed were forbidden of practicing their native languages or cultural or spiritual practices and have become known as the "stolen generations" (Cuneen 2005; Davidoff and Duhs 2008).

In 1967 Indigenous Australians were given the right to vote through a referendum of the Australian population (Davidoff and Duhs 2008; Perche 2011). Then, in 1975 the Racial Discrimination Act was introduced, which disallowed discrimination based on race, descent, national or ethnic origin (Federal Register of Legislation 2014). However, under-payment of Indigenous Australians continued even after the Racial Discrimination Act was introduced (Cuneen 2005). Policies changed from assimilation to integration and self-determination in the 1970s (McGrath and Stevenson 1996). Discussion for giving the land back to Indigenous people began in the 1970s and resulted in reparations in some states and territories (Perche 2011). These discussions can be seen as the result of Indigenous Australians experiencing "over-inferiority", where their status fell so far below the non-Indigenous colonisers that the Indigenous Australians

took action to correct their status through litigation (Black 2012; van Krieken 2005; Weber and Lacey 2005).

Historical – education. As previously mentioned, Indigenous Australians faced exclusion from education and training opportunities prior to the 1970s (Cuneen 2005; Kapellas and Jamieson 2016). In 1989 the National Aboriginal and Torres Strait Islander Education Policy was implemented, with the intention of achieving educational equity between Indigenous and non-Indigenous Australians (Beresford 2004; Gunstone 2013). Other policies following the goals of improving Indigenous Australian education attainment have since been developed and implemented (Department of Education and Training 2017; Gunstone 2013). These policies follow a general formula of emphasising the need to increase the aspirations of Indigenous youth so that they are motivated to achieve higher education attainment, increasing the cultural relevance of education for Indigenous persons, improving financial, academic and personal support for Indigenous persons, and developing alternative pathways for Indigenous persons to continue their education (Behrandt et al. 2012; James et al. 2008; Wilcox 2015).

Current – education. Attendance in school or approved education, training, or work is compulsory from the age of 6, until Year 10 or equivalent, or until the age 17 (Northern Territory Government of Australia 2017). This requirement to attend school forces students who live in remote communities to travel to receive their education, with poorer students having to navigate applications for funding to cover the costs of travel (Northern Territory Government of Australia 2017). For students who live too far away from a school offering the appropriate level of education, they must attend boarding schools (Association of Independent Schools Northern Territory 2018; Department of Education 2017). A student attending a boarding school must leave their family and community behind and enter a new community where they may have no

prior contacts (Stewart and Lewthwaite 2015). Students attending school must undergo instruction for the four hours of the school day in English, with very few schools providing any instruction in Indigenous languages, and very few teachers having the appropriate training or support to provide instruction in Indigenous languages (Simpson et al. 2009; Korff 2017). This requirement that all students must be taught exclusively in English for the first four hours of the school day are indicative that the dominant non-Indigenous culture still experience over-exposure to Indigenous cultures and languages. Forcing a portion of education to be taught only in English is an attempt to correct what Black (2011: 36-42) refers to as "over-exposure". Indigenous Australians have made efforts to correct the lack of Indigenous languages in the classroom, as a result of Indigenous people experiencing what Black (2011: 121-128) would call "under-traditionalism", where they feel that their culture is being threatened or overtaken by another culture (Korff 2017; Simpson et al. 2009; Stewart and Lewthwaite 2015).

The historic difficulty for Indigenous people to access education may have resulted in the Indigenous population generally valuing education less than the non-Indigenous population, and therefore as less of an endeavour to do well in and to support their children in. In addition, the fact that some Indigenous children used to be forcibly removed from their families and communities to attend school may have resulted in a negative association with attending school, particularly when travel or boarding school is required to attend a school. The overall difficulty that Indigenous people faced when it came to education and employment may have contributed to the lower socioeconomic status that they continue to experience in modern times.

Gaps in previous research

While the factors that are associated with lower educational attainment have been explored in the past, the educational attainment of Indigenous people has not been previously explored by comparing schools in the Northern Territory and by assessing the influence that policies have had on Indigenous education. The Northern Territory was chosen because it has the largest proportion of Indigenous people in the population (Australian Bureau of Statistics 2017). This research will explore the school and student factors that could be influencing educational attainment for Indigenous populations in the Northern Territory using the educational attainment of students at lower levels, as this has been found to be predictive of educational attainment at higher levels (Hernandez 2011). The conclusions drawn from this research are intended provide insight into how the educational attainment discrepancy is occurring and potentially how it can be corrected within the Northern Territory. The outcomes are also expected to provide a method for assessing and improving Indigenous educational attainment in the other states and territories of Australia.

Hypotheses

This thesis aims to explore the factors that are influencing the low educational attainment of Indigenous students in the Northern Territory, in comparison with the non-Indigenous population. This study used a sample of schools collected from the total 189 Northern Territory schools through the Australian Curriculum, Assessment and Reporting Authority (ACARA) and uses the schools as the unit of analysis. The goals of this research are to identify the factors that result in low average educational attainment scores. Historically, Indigenous Australians have not had ideal opportunities for educational attainment through colonial policies that had the

intention and effect of separating Indigenous Australians from their families, communities and culture. These colonial policies were replaced with more modern policies relatively recently, so the previous colonial policies may still be influencing the educational attainment of Indigenous students indirectly.

Hypothesis 1 – Educational attainment and socioeconomic status. School average socioeconomic score is positively related with school average educational attainment scores, due to the physical and emotional supports that coincide with socioeconomic status. Families of lower socioeconomic cannot as easily provide the physical or emotional resources that assist with educational attainment as families that are of higher socioeconomic status. The simple access to capital and being able to spend for more than essential items allows parents to provide more educational resources and tools for their children to learn with, than if the same parents did not have access to capital and were living frugally to survive (Azzolini et al. 2012). Emotional support is also more easily provided by parents who are higher in socioeconomic status, with this emotional support affecting educational outcomes by fostering a positive learning for youth (Ahmed et al. 2010; Hintsanen et al. 2011; Triventi 2013). This is especially the case when parents have higher educational attainment themselves, as they are able to better help their children with their education and impart a positive attitude towards learning and more effectively encourage increased educational attainment (Berzin 2010; Caldas and Bankston 2005; Purdie and Buckley 2010). Indigenous people in the Northern Territory are typically of lower socioeconomic status (Cooke et al. 2007), and so the schools with lower socioeconomic scores will have higher percentages of Indigenous students.

Hypothesis 2 – Educational attainment and student-teacher ratio. School student to teacher ratio is positively related to school average educational attainment scores. The student to

teacher ratio has been identified in previous research as having a positive impact on student educational attainment when there are fewer students per teacher. This is due to the additional attention that teachers can provide to students when there are fewer students competing for their attention (Adeyemi and Adeyemi 2014; Montt 2011; Therriault et al. 2017). Therefore, due to lower educational attainment of Indigenous people, the student to teacher ratio is expected to be higher in schools where there are more Indigenous students.

Hypothesis 3 – Educational attainment and school location. The location of a school is related to educational attainment, with schools in more remote location being negatively related to educational attainment scores, and schools in less remote locations being positively related with educational attainment scores. School location is expected to influence educational attainment scores because students attending schools in more remote locations were found by Hernandez-Torrano (2018) and Odell (2017) to have lower educational attainment than their peers attending school sin less remote locations. This relates to Indigenous students as they are more likely to live in remote locations (Australian Bureau of Statistics 2007), and therefore more likely to attend schools in remote locations.

Hypothesis 4 – Educational attainment and attendance rates. School average attendance rates will be positively related to average school educational attainment scores. The effect of attendance rates on educational attainment has been observed in previous research, with lower attendance rates negatively impacting educational attainment (Purdie and Buckley 2010). This effect has been found to be extremely potent, with only a few days of missed school resulting in dramatic reductions in educational attainment outcomes (Innis 2016; Silver et al. 2008).

Hypothesis 5– Educational attainment and language. The use of English at home, as the percent of students at a school who speak a language other than English at home, will be

positively related to school average educational attainment scores. Students who speak a language other than English at home are at a potential disadvantage when it comes to learning and testing. This is because the education attainment testing in Australian schools is conducted in English (Simpson et al. 2009; Korff 2017), which has been found to adversely affect students whose main language is not the language of educational instruction (Azzolini et al. 2012; Wigglesworth et al. 2011). Indigenous students often speak more than one language, and English may not be commonly used leaving Indigenous student at a disadvantage when it comes to learning and testing (Our Languages 2016).

Hypothesis 6– Educational attainment and ethnicity. Ethnicity as the percent of students at a school who are Indigenous will be related to school average educational attainment scores: non-Indigenous students will have higher educational attainment scores than non-Indigenous students. This is expected due to past research that has found that the ethnicity of a student can be a hindrance to educational attainment, with students from minorities having lower educational attainment than students from the majority ethnic group (Azzolini et al. 2012; Berzin 2010). This is applicable to Indigenous students, as they are a minority student group in the Northern Territory.

Hypothesis 7 – Attendance rates and socioeconomic status. The average socioeconomic score of a school will be positively related to a school's attendance rates. As previously discussed, the attendance rate of students can have a dramatic effect on their educational attainment. Reduced attendance is associated with reduced educational attainment (Innis 2016; Purdie and Buckley 2010; Silver et al. 2008). The socioeconomic score is expected of a school is expected to influence the attendance rates for Indigenous and non-Indigenous students because of the impact that the socioeconomic status of students' families can make in the support that

students receive in their learning and education (Ahmed et al. 2010; Azzolini et al. 2012; Caldas and Bankston 2005).

Hypothesis 8 – Attendance rates and school location. The location of a school will be related to average school attendance rates; more remote schools having a negative relationship with attendance rates and less remote schools having a positive relationship with attendance rates. The location of a school is expected to influence attendance rates of students because of the increased difficulty that students in more remote locations may face in traveling to school (Hernandez-Torrano 2018; Northern Territory Government of Australia 2017).

Hypothesis 9 – Attendance rates and language spoken at home. The language a student speaks at home (as the percent of students at a school who speak a language other than English) will be related to average school attendance rates; students who speak a language other than English having lower attendance rates than students who speak English. The language that a student speaks is expected to impact their attendance because speaking a language other than the one of instruction may act as a deterrent to attending school (Korff 2017; Wigglesworth et al. 2011).

Hypothesis 10 – Socioeconomic scores and ethnicity. The ethnicity of a student as the percent of Indigenous students at a school will be negatively related to average school socioeconomic score, with Indigenous students having lower socioeconomic status than non-Indigenous students. Indigenous families already have low educational attainment (Australian Bureau of Statistics 2017), resulting in the Indigenous having lower earnings and socioeconomic status than the non-Indigenous in Australia (Behrandt et al. 2012; Kena et al. 2016; Ritchie and Bates 2013; van Zon et al. 2017).

Summary. These hypotheses together are displayed in Figure 1. The percent of students at a school who are Indigenous (ethnicity) is expected to influence the socioeconomic score a school, with lower percentages of Indigenous students expected to relate to increases in school socioeconomic score. The socioeconomic score of a school, a school's location, and the percent of students who speak a language other than English at home (language spoken at home) are all expected to influence the attendance rates of Indigenous and non-Indigenous students. Increased attendance rates will be related to higher socioeconomic scores, schools in less remote locations, and schools with fewer students who speak a language other than English at home. From here the educational attainment of students will be positively associated with schools that have higher socioeconomic scores, lower student to teacher ratios, less remote locations, higher attendance rates, lower percentages of students who speak a language other than English at home, and lower percentages of Indigenous students.

Figure 1. Diagram of hypotheses
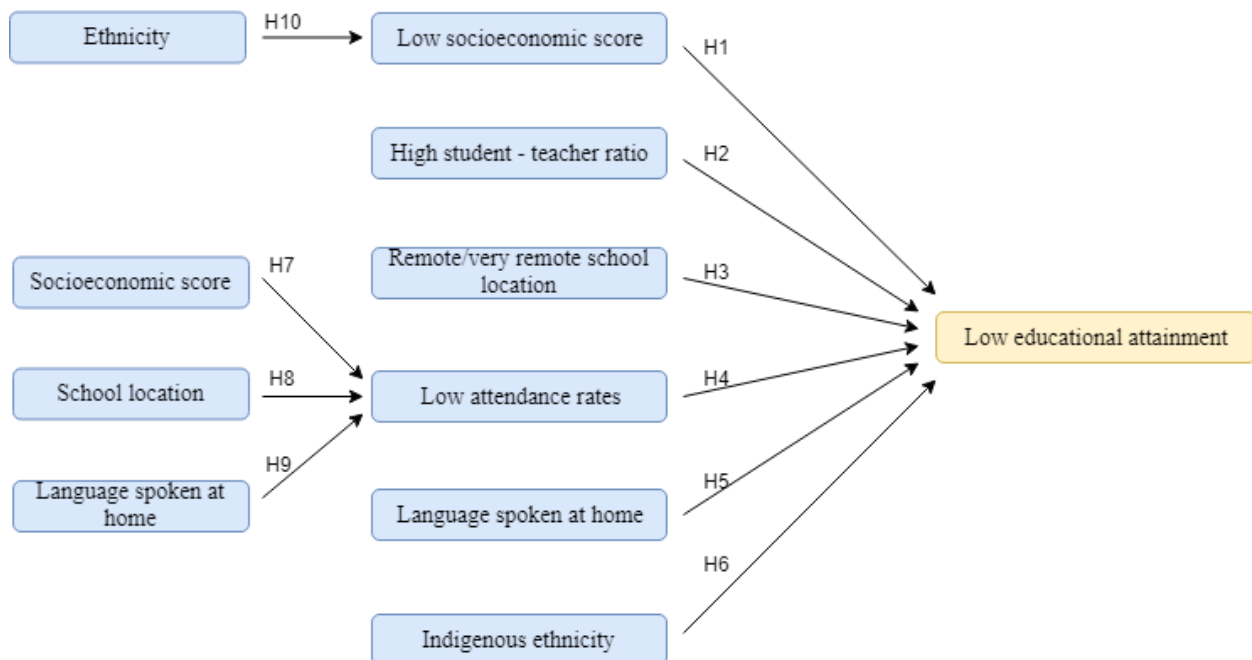
CHAPTER III

METHODOLOGY

Measures

Data on the 188 schools in the Northern Territory was collected for this study. The

schools included preschool and primary schools (transition to Year 6), middle schools (Year 7 to

Year 9), and high schools (Year 10 to Year 12) of both publicly and privately funded schools.

The data consists of schools: locations, the number of students (total, with the percent of

Indigenous students and the percent of students who speak a language other than English

available), number of full-time equivalent teaching staff, attendance rate of students, average

socioeconomic scores, and average educational attainment indicator scores.

The data was collected by the Australian Curriculum, Assessment and Reporting

Authority (ACARA) through the National Assessment Program – Literacy and Numeracy

(NAPLAN) in 2016. ACARA collects data annually through school-based assessments during

the second full week in May (National Assessment Program 2016).

The names of the schools were identified through the publicly available Northern

Territory Government Education Directory's downloadable list of Northern Territory schools

(Northern Territory Government 2017). These schools were then identified on the 'My School'

website (My School 2018) through searching for each individual school, where the relevant data

for each school was then gathered for the 2016 school year. This data is expected to be inclusive

of all schools in the Northern Territory; however, data was not consistently available across all of

the schools if there were too few students in a class or school to prevent the possibility of

identifying a student from the data (the limit was typically under five students).

The Northern Territory school data is expected to represent the population well due to the sample matching the population. However, the results of the Northern Territory school data may not be generalisable to other Australian states or territories due to the unique demographic and geographic composition of the Northern Territory. The data in this study was collected entirely from secondary sources, meaning that no approval from the Institutional Review Board for the Protection of Human Subjects in Research was required.

Variables.

Location. The name of each school was collected, as well as the postcode, and region classification were collected for the purpose of identifying the location of each school. The region classification falls into five categories: major cities, inner regional, outer regional, remote, and very remote. Due to the geography and population density of the Northern Territory, no schools were classified as being in major cities or inner regional.

Socioeconomic indicator. To measure the average level of support and the average socioeconomic status, the average Index of Community Socio-Educational Advantage (ICSEA) was used for each school. ICSEA is a measure of the educational advantage or disadvantage afforded by a school, determined by students' parent's occupation, school education, non-school education, and by the geographic location of a school and the proportion of Indigenous students enrolled. The average ICSEA score is set at 1,000, with below the average being a low score, indicative of a school having many students of low socioeconomic background, and above the average being a high score, indicative of a school having many students of high socioeconomic background.

Student-teacher ratio. The student teacher ratio for each school was determined by dividing the number of full-time equivalent teaching staff by the total number of students enrolled. Full-time equivalent teaching staff is considered as the number of teaching staff employed by a school who combined add to full-time hours. For example, two part-time teaching staff working at 0.5 full-time add up to one full-time teaching staff.

Attendance rates. The attendance rate is considered as the number of full-time equivalent days that full-time students in Years 1-10 attended out of the total number of full-time equivalent days that a student could attend over the first semester. This rate was calculated for the total number of students, as well as split into the Indigenous attendance rate and the non-Indigenous rate for each school.

Ethnicity. Students or parents could indicate if the student was of Indigenous heritage, allowing the number of students who were of Indigenous heritage at each school to be identified. The total number of students at a school was then divided by the number of Indigenous students to determine the percent of students in a school who were of Indigenous heritage.

Primary language. English language use was the percent of students who identified as speaking a language other than English at home or arrived from overseas less than 12 months prior to the time of testing.

Education attainment. The average education attainment for each school was measured through the average NAPLAN scores in each of the five domains: reading, writing, spelling, grammar and punctuation, and numeracy.

Table 1: Summary statistics of the school variables.

Variables	Number	Mean	Standard Deviation	Range
Dependent variables				
Average school NAPLAN reading score	137	433.73	105.53	80 – 630
Average school NAPLAN writing score	142	386.14	107.88	124 – 637
Average school NAPLAN spelling score	142	434.35	87.42	189 – 634
Average school NAPLAN grammar and punctuation score	142	414.58	117.36	0 – 619
Average school NAPLAN numeracy score	142	448.65	83.04	139 – 645
Independent variables				
School ICSEA score	168	774.94	210.27	248 – 1125
School non-English percent	188	55.86	36.19	0 – 1.0
School Indigenous percent	188	0.63	0.38	0 – 1.0
School overall attendance rate	180	0.76	0.15	0.26 – 0.94
School Indigenous attendance rate	94	0.82	0.11	0.32 – 0.96
School non-Indigenous attendance rate	94	0.91	0.04	0.74 – 0.95
School student teacher ratio	188	11.88	4.60	3.08 – 37.5
Postcode	189	865.29	290.58	0800 – 4825
Outer regional	187	0.31	0.46	0 – 1.0
Remote	187	0.21	0.41	0 – 1.0
Very remote	187	0.47	0.50	0 – 1.0

Statistical Analysis

The statistical package Stata 15 was used for all analyses. One observation was dropped because the school had begun operating too recently for there to be any available data.

Univariate Statistics. The basic summary statistics for the variables used in the analyses are represented in Table 1. Diagnostic statistics were run to identify departures in normality for each of the variables (See Appendix B for skewness-kurtosis table). The only variable with an approximately normal distribution was the average school NAPLAN spelling score. All of the other variables were notably non-normally distributed with heavy positive or negative skews (see Appendix A for histograms). Transformation of non-normally distributed data was considered but was not performed because of the increase in model complexity that would occur.

Maintaining the variables and not transforming them towards a normal distribution may result in the models erroneously under or over predicting the outcomes.

Collinearity and multicollinearity were assessed through correlation matrices and (after multiple regression) variance inflation factors (see Appendix B for scatter matrices, correlations, and variance inflation factors). In the cases where variables were found to be highly correlated, one was omitted from the analysis to avoid multicollinearity. The variables omitted was based on previous studies and the main research goals.

Hypothesis testing.

Multiple regression methods using ordinary least squares and Cook's D will be used to test the research hypotheses. The dependent variables of average school reading, writing, spelling, grammar and punctuation, and numeracy scores on the independent variables of school characteristics.

Hypothesis 1 – Educational attainment and socioeconomic status. Hypothesis 1 was to be tested using school ICSEA scores as the predictor variable and the average NAPLAN scores for a school as the outcome variables. However, due to the very high correlation between school ICSEA scores and the percent of Indigenous students at a school, the ICSEA score variable was omitted and the percent of Indigenous students at a school retained. This decision was made with the background of the literature in mind, and that the focus of this research is Indigenous student educational attainment and not socioeconomic status.

Hypothesis 2 – Educational attainment and student-teacher ratio. Hypothesis 2 will be tested by using the student-teacher ratio as the predictor variable and the average NAPLAN

school scores as the outcome variable. The student-teacher ratio will be calculated using the number of full-time equivalent teachers and the number of students enrolled at a school.

Hypothesis 3 – Educational attainment and school location. Hypothesis 3 was to be tested using predictor variables related to school locations, such as the postcode and region classification. However, postcode and the region classification of outer regional were found to be highly correlated, and so postcode was omitted from the analysis. The region classification of outer regional was chosen to be retained to maintain consistency within the analysis, allowing the three region classifications to be used for location. The outcome variable will be average NAPLAN scores across the 5 domains.

Hypothesis 4 – Educational attainment and attendance rates. Hypothesis 4 was to be tested using the average school attendance rate of all students, as well as separated by Indigenous and non-Indigenous students as the predictor variables. However, the overall attendance rate of students was very highly correlated with Indigenous attendance rate, and so the overall attendance rate variable was not included in the analysis. The decision to exclude the overall attendance rate allowed the Indigenous attendance rate to be included, meaning that Indigenous and non-Indigenous attendance rates could then be used in the analysis. The outcome variable will be average NAPLAN scores across the 5 domains.

Hypothesis 5 – Educational attainment and language. Hypothesis 5 will be tested using the percent of students at a school that speak a language other than English at home as the predictor variable, and the average NAPLAN scores for a school as the outcome variables.

Hypothesis 6 – Educational attainment and ethnicity. Hypothesis 6 will be tested using the percent of Indigenous students at a school as the predictor variable, and the average NAPLAN scores for a school as the outcome variables.

Hypothesis 7 – Attendance rates and socioeconomic status. The attendance rate of Indigenous students for a school and the attendance rates for non-Indigenous students for a school are the two dependent variables. The overall attendance rate was excluded as a dependent variable due to high correlation with ICSEA scores and Indigenous attendance rate. The independent variable is school ICSEA scores. Due to the two outcome variables, the predictor variables will be run against each outcome variable.

Hypothesis 8 – Attendance rates and school location. The attendance rates of Indigenous and non-Indigenous students are the two dependent variables. Overall attendance rate was highly corelated with Indigenous attendance rate and so was excluded from the dependent variables. The independent variables are the three school location variables by region classification (outer regional, remote, very remote).

Hypothesis 9 – Attendance rates and language spoken at home. The dependent variables are the attendance rates of Indigenous and non-Indigenous students. The overall attendance rate of students was not included as a dependent variable due to high correlation with the language a student speaks at home and the Indigenous attendance rate. The percent of students at a school who speak a language other than English is the independent variable.

Hypothesis 10 – Socioeconomic scores and ethnicity. The ICSEA scores of schools was to be the dependent variable, and the percent of Indigenous students at a school was to perform as the independent variable. However, these two variables were very highly correlated, and so this hypothesis will not be tested.

Multivariate Analysis.

Due to the appearance of outliers in the data, three different models were tested to identify which performed the best in the presence of non-normal distributions and outliers. The models tested included ordinary least squares (OLS), OLS using Cook's D, and robust regression. The OLS followed by Cook's D method was used because Cook's D eliminates influential observations from the model, while robust regression was used because it does not assume normality and outliers are down-weighted automatically. Each of these models were initially run using a selection of variables that were not highly correlated. This was then followed by a process of backward elimination to retain the variables of highest significance. Each of the three models were included to identify which model was most suitable, considering the non-normal distribution of the data and the possible outliers. Each model was compared against the others to distinguish if one model was superior to the others.

Ordinary least squares. The analysis was begun with a full model of ordinary least squares where all of the variables that were not highly correlated were run against each response variable. Following this, a limited model containing only significant variables was identified through backward elimination, where the least significant variables were eliminated from the model one by one, until only significant variables remained.

Cook's D. Similar to the OLS models, a full model using all of the non-highly correlated variables was performed first, followed by a limited model that used backward elimination to retain only variables of significance. Outliers were excluded from the models through the use of Cook's D. The cut off threshold for Cook's D was determined through examining box plots of Cook's D and excluding outliers that were more than 1.5 interquartile range beyond the first or third quartile (Hamilton 2013) (see Appendix C for box plots).

Robust regression. Robust regression was also used to identify if outliers were a major concern in the results. All of the variables were included in a full model and a limited model then followed using backward elimination. The robust method is an iteratively reweighted least squares technique that gives progressively lower weights to observations with large residuals, until convergence is achieved (Hamilton 1992).

The OLS using Cook's D to remove outliers was identified as the best method as it restricted the model to fewer variables and had more low standard errors than the other two methods (Hamilton 2013). This was indicative that outliers were influencing the OLS and robust regression models.

CHAPTER IV

RESULTS

This section begins by discussing the correlation and collinearity of variables in the study, the efforts that were taken to reduce these effects, and how correlation and collinearity impacted hypothesis testing. Following this, the regressions used for hypothesis testing are presented and discussed. With each regression there is also a table summarising the observations that were omitted from the analysis due to the large number of observations omitted.

Correlations and collinearity

Variables that have very strong linear relationships may be multicollinear, resulting in either a lack of unique regression solutions or making the results of a regression unstable or difficult to interpret. In order to avoid these problems, correlation coefficients and variance inflation factors will be used to identify and correct for high correlations and multicollinearity.

A number of variables were highly correlated, see Appendix B for the full correlation table. Table 2 contains the variables that were highly correlated with a school's average socioeconomic score. The average school reading, writing, spelling, and grammar and punctuation scores were strongly and positively correlated with a school's average socioeconomic score. The percent of Indigenous students and the percent of students who spoke a language other than English at a school were strongly negatively correlated with a school's average socioeconomic score. There was also a strong positive correlation between a school's average socioeconomic score and the overall student attendance rate and the Indigenous attendance rate at a school.

Table 2: Variables strongly correlated with average school socioeconomic score.

	Average socioeconomic score
Reading score	0.7294
Writing score	0.8228
Spelling score	0.7067
Grammar and Punctuation score	0.7731
Percent of Indigenous students	-0.9662
Percent of students who spoke a language other than English	-0.7088
Attendance rate	0.8053
Indigenous attendance rate	0.7203

The variables which were very strongly correlated were the percent of Indigenous students at a school can be found in Table 3. The percent of students who spoke a language other than English at home was positively and strongly correlated, while the overall attendance rate, and the Indigenous attendance rate at a school were strongly negatively correlated with the percent of Indigenous students at a school.

Table 3: Variables strongly correlated with the percent of Indigenous students at a school.

	Percent of Indigenous students
Percent of students who spoke a language other than English	0.738
Attendance rate	-0.8418
Indigenous attendance rate	-0.7488

The remaining highly correlated variables can be seen in Table 4. This table demonstrates that there was a strong negative correlation between the percent of Indigenous students at a school and average school writing score and grammar and punctuation score. A negative correlation was also found between school overall attendance rate and the percent of students who spoke a language other than English at home, while a strong positive correlation was found between overall attendance rate and the Indigenous attendance rate. Negative correlations were found between schools in outer regional locations and schools in remote locations, and between schools in outer regional locations and the postcode of a school.

Table 4: Other strong correlations among independent variables.

	Writing	Grammar and Punctuation	Percent of students who spoke a language other than English	Attendance rate	Outer regional location
Percent of Indigenous students	-0.8096	-0.7365			
Attendance rate			-0.7205		
Indigenous attendance rate				0.922	
Remote location					-0.7063
Postcode					-0.8417

The above tables are relevant to the diagnosis of correlations among pairs of variables, but do not address variables that are correlated with more than one other variable (multicollinearity). Variables that are multicollinear cause problems with the interpretation of the regressions, so it is important to identify multicollinearity to reduce or eliminate it, which can be performed on each regression using the using variance inflation factors. The variance inflation factors determine the proportion of variance in each variable that is independent and unexplained by other variables. On all five domains of educational attainment scores, the ICSEA score, overall attendance rate, and postcode were removed due to high collinearity with other variables. Excluding these variables brought the variance inflation factors of the independent variables down from over to 40 to being under 4.

Regressions

Due to the non-normal distribution and skewness of the data, three different methods were used to identify the model that was least affected by outliers and was not reliant upon implausible assumptions of normality. The three methods were ordinary least squares (OLS), OLS followed by removal of outliers using Cook's D, and robust regression. Choosing the best

model was performed by identifying the method that had the lowest coefficient standard errors. As a result of this, the method using OLS followed by Cook's D was chosen as the best out of the three methods. The OLS followed by Cook's D not only had the most coefficients with the lowest standard errors, but it also removed variables that had been included in the standard OLS and in the robust regression models. The exclusion of these variables from the Cook's D method is indicative that these variables had only retained significance due to outliers in the standard OLS and robust regressions. For these reasons, the results of using OLS followed by Cook's D will be focussed on in this section. The standard OLS results will be included in tables for reference.

Reading scores. Three variables were found to be significant predictors for school average reading score. These were the percent of Indigenous students at a school, the student-teacher ratio, and if the school was in an outer regional location. There were 113 observations omitted from the regression. See Table 5 for an overview of the characteristics of the schools omitted.

Table 5: Summary of observations omitted from reading score regression

Variables	Number	Mean	Standard Deviation	Range
Non-English percent	113	0.76	0.31	0 – 1.0
Indigenous percent	113	0.86	0.28	0 – 1.0
Student-teacher ratio	113	10.26	5.10	0.11 – 37.5
Indigenous attendance rate	19	0.74	0.15	0.32 – 0.91
Non-Indigenous attendance rate	19	0.88	0.06	0.74 – 0.95
Outer regional	112 (11)	0.10	0.30	0 – 1.0
Remote	112 (19)	0.17	0.38	0 – 1.0
Very remote	112 (81)	0.72	0.45	0 – 1.0

The predicted reading score for a school is 761.12 when the percent of Indigenous students at a school is 0, the student to teacher ratio is 0, and a school is not outer regional, as

shown in Table 6. However, this interpretation is not practical, as it is not possible to have a student to teacher ratio of 0. The coefficient of -266.64 for the percent of Indigenous students at a school is significant ($t = -13.02$, $p < 0.000$) once the student to teacher ratio and whether a school is in an outer regional location or not are controlled for. This indicates that reading score decreases by 266.64 points for every one percentage point increase in Indigenous students at a school. The student to teacher ratio is also significant ($t = -7.39$, $p < 0.000$) with a coefficient of -11.15, once the percent of Indigenous students and whether a school is in an outer regional location or not are controlled for. The coefficient of -11.15 tells us that for every one point increase in student to teacher ratio, the reading score decreases by 11.15 points. The final variable that was a significant predictor for reading score was when a school was in an outer regional location. The coefficient for outer regional was -22.14 ($t = -2.31$, $p = 0.024$), once the percent of Indigenous students and the student to teacher ratio at school were controlled for. The outer regional coefficient indicates that schools which are located in outer regional areas have a reading score that is lower by 22.14 points. Altogether, the percent of Indigenous students, student to teacher ratio, and outer regional location of a school account for 71.28% of the variance in average school NAPLAN reading score ($R^2_a = 0.7128$). The statistical model is significant, with an F-value of 62.21 ($p < 0.000$). The confidence intervals for each variable will not be discussed, except for the following example. The precent of Indigenous students at school has a confidence interval of -307.46 and -225.82, indicating that the true slope of the regression has a 95% possibility of lying between these two values.

Table 6: Regression of mean reading scores on school characteristics

	OLS with Cook's D	OLS	Robust
Number of observations	75	85	85
Constant	761.12 (26.67)***	1340.18 (154.58)***	1336.02 (165.33)***
Indigenous percent	-266.64 (20.47)***	-279.87 (21.65)***	-280.87 (23.16)***
Student-teacher ratio	-11.15 (1.83)***	-9.19 (1.80)***	-9.25 (1.93)***
Non-Indigenous attendance rate	-	-674.25 (165.71)***	-667.03 (177.25)***
Outer regional	-22.14 (9.18)*	-24.75 (10.45)*	-26.02 (11.18)*

Writing scores. Two variables were found to be significant predictors of writing score. These were the percent of Indigenous students at a school and the student to teacher ratio. There were 118 total observations omitted from the spelling score regression, the details for which are in Table 7.

Table 7: Summary of observations omitted from writing score regression

Variables	Number	Mean	Standard Deviation	Range
Non-English percent	116	0.74	0.32	0 – 1.0
Indigenous percent	116	0.84	0.30	0 – 1.0
Student-teacher ratio	116	10.31	5.06	3.08 – 37.5
Indigenous attendance rate	22	0.76	0.15	0.32 – 0.92
Non-Indigenous attendance rate	22	0.89	0.05	0.74 – 0.94
Outer regional	115 (13)	0.11	0.32	0 – 1.0
Remote	115 (22)	0.19	0.40	0 – 1.0
Very remote	115 (79)	0.69	0.47	0 – 1.0

When all of the independent variables are set to 0, writing score is predicted to be 630.80, as displayed in Table 8. However, this is not applicable in the real world since the student to teacher ratio cannot be 0. The coefficient for the percent of Indigenous students at a school was significant at -201.72 ($t = -13.41$, $p < 0.000$) once the student to teacher ratio was controlled for. This means that the writing score decreased by 201.72 points for every one percentage point increase in Indigenous students at a school. The student to teacher ratio also had a significant coefficient of -8.19 ($t = -1.32$, $p < 0.000$) with the percent of Indigenous students controlled for.

From this, it can be interpreted that the writing score would decrease by 8.19 points for every

one point increase in student to teacher ratio. The total variance accounted for by the percent of

Indigenous students and student to teacher ratio was 71.55% for average school NAPLAN

writing score ($R^2_a = 0.7155$). The statistical model is significant, with an *F*-value of 90.28 ($p <$

0.000).

Table 8: Regression of mean writing scores on school characteristics

	OLS with Cook's D	OLS	Robust
Number of observations	72	85	85
Constant	630.80 (21.63)***	949.42 (131.47)***	891.08 (125.97)***
Indigenous percent	-201.72 (15.05)***	-247.76 (17.00)***	-230.33 (16.28)***
Student-teacher ratio	-8.16 (1.32)***	-6.63 (1.49)***	-6.86 (1.43)***
Non-Indigenous attendance rate	-	-352.45 (140.99)*	-292.48 (135.09)*

Spelling scores. The variables that were significant predictors of spelling score were the

percent of Indigenous students at a school, the student to teacher ratio, and the non-Indigenous

attendance rate. There were 112 observations not included in the regression, see Table 9 for

details.

Table 9: Summary of observations omitted from spelling score regression

Variables	Number	Mean	Standard Deviation	Range
Non-English percent	112	0.74	0.32	0 – 1.0
Indigenous percent	112	0.84	0.31	0 – 1.0
Student-teacher ratio	112	10.32	5.15	3.08 – 37.5
Indigenous attendance rate	18	0.78	0.15	0.32 – 0.92
non-Indigenous attendance rate	18	0.88	0.06	0.74 – 0.95
Outer regional	111 (12)	0.11	0.31	0 – 1.0
Remote	111 (18)	0.16	0.37	0 – 1.0
Very remote	111 (80)	0.72	0.45	0 – 1.0

When the above mentioned three variables are controlled for, the spelling score is

1113.64, displayed in Table 10. However, the student to teacher ratio cannot be set to 0, so this is

not a practical interpretation in a real-world setting. If the student to teacher ratio and non-Indigenous attendance rate are controlled for, then the coefficient for the percent of Indigenous students at a school was significant at -215.51 (t = -12.12, p <0 .000). This indicates that for every one percent increase in Indigenous students at a school, the spelling score decreases by 215.51 points. The student to teacher ratio had a coefficient of -11.44 (t = -6.27, p <0 .000) once the percent of Indigenous students and the non-Indigenous attendance rate were controlled for. As such, the spelling score can be expected to decrease by 11.44 points for every one point increase in student to teacher ratio. The coefficient for the non-Indigenous attendance rate was -440.33 (t = -2.09, p =0 .040) once the percent of Indigenous students and the student to teacher ratio were controlled for. The coefficient indicates that the spelling score decreases by 440.33 points for every one percentage point increase in non-Indigenous attendance rate. The percent of Indigenous students, student to teacher ratio, and non-Indigenous attendance rate contributed to 66.34% of the average school spelling score (R^2_a = 0.6634). The statistical model is significant, with an F-value of 50.27 (p < 0.000).

Table 10: Regression of mean spelling scores on school characteristics

	OLS with Cook's D	OLS	Robust
Number of observations	76	85	85
Constant	1113.64 (186.040***	1124.84 (147.31)***	1132.69 (155.61)***
Indigenous percent	-215.51 (17.78)***	-225.70 (19.03)***	-225.54 (20.11)***
Student-teacher ratio	-11.44 (1.83)***	-10.11 (1.67)***	-10.35 (1.76)***
Non-Indigenous attendance rate	-440.33 (210.24)*	-466.63 (157.97)*	-471.38 (166.87)**

Grammar and Punctuation scores. Two variables were found to be significant predictors of grammar and punctuation scores. These variables were the percent of Indigenous students at a school and the student to teacher ratio. The grammar and punctuation score regression did not include 113 observations, as represented in Table 11.

Table 11: Summary of observations omitted from grammar and punctuation score regression

Variables	Number	Mean	Standard Deviation	Range
Non-English percent	113	0.75	0.31	0 – 1.0
Indigenous percent	113	0.86	0.29	0 – 1.0
Student-teacher ratio	113	10.17	5.01	3.08 – 37.5
Indigenous attendance rate	19	0.73	0.16	0.32 – 0.92
non-Indigenous attendance rate	19	0.88	0.06	0.74 – 0.95
Outer regional	112 (10)	0.09	0.29	0 – 1.0
Remote	112 (21)	0.19	0.39	0 – 1.0
Very remote	112 (80)	0.71	0.45	0 – 1.0

If the percent of Indigenous students and the student to teacher ratio were set to 0, then the grammar and punctuation score was predicted to be 683.38 (Table 12). However, this interpretation is not appropriate in reality since the student to teacher ratio at a school cannot be 0. The percent of Indigenous students at a school had a coefficient of -234.71 (t = -10.86, p <0 .000) when the student to teacher ratio was controlled for. This coefficient indicates that the grammar and punctuation score decreases by 234.71 points for every one percentage point increase in Indigenous student percent at a school. The coefficient for student to teacher ratio was -9.21 ($t = -5.05$, $p < 0$ .000) once the percent of Indigenous students at a school was controlled for. The grammar and punctuation score can be understood to decrease by 9.21 points for every one point increase in student to teacher ratio. The percent of Indigenous students and the student to teacher ratio at a school made up 61.27% of the average school grammar and punctuation score

The percent of Indigenous students, student to teacher ratio, and non-Indigenous attendance rate ($R^2_a = 0.6127$). The statistical model is significant, with an *F*-value of 59.53 ($p < 0.000$).

Table 12: Regression of mean grammar and punctuation scores on school characteristics

	OLS with Cook's D	OLS	Robust
Number of observations	75	85	142
Constant	683.38 (30.39)***	1326.62 (21.57)***	647.91 (20.82)***
Indigenous percent	-234.71 (21.62)***	-277.38 (21.57)***	-221.32 (13.09)***
Student-teacher ratio	-9.21 (1.83)***	-7.18 (1.89)***	-7.11 (1.25)***
Non-Indigenous attendance rate	-	-720.29 (179.06)***	-

Numeracy scores. Three variables were found to be significant predictors of numeracy score. These variables were the percent of Indigenous students at a school, the student to teacher ratio, and the non-Indigenous attendance rate. Table 13 contains the observations that were omitted from the regression.

Table 13: Summary of observations omitted from numeracy score regression

Variables	Number	Mean	Standard Deviation	Range
Non-English percent	110	0.76	0.31	0 – 1.0
Indigenous percent	110	0.86	0.28	0 – 1.0
Student-teacher ratio	110	10.10	5.04	3.08 – 35.7
Indigenous attendance rate	16	0.73	0.16	0.32 – 0.92
non-Indigenous attendance rate	16	0.88	0.06	0.74 – 0.95
Outer regional	109 (9)	0.80	0.28	0 – 1.0
Remote	109 (19)	0.17	0.38	0 – 1.0
Very remote	109 (80)	0.74	0.44	0 – 1.0

If all the variables were controlled for, then the numeracy score, shown in Table 14, was predicted to be 893.70. This score is not applicable in the real-world though, as the student to teacher ratio cannot be 0. The percent of Indigenous students at a school had a coefficient of -229.98 ($t = -10.44$, $p < 0.000$) once the other two variables were controlled for. This indicates that the numeracy score decreases by 229.98 points for every one percentage point increase in Indigenous students at a school. The coefficient for student to teacher ratio was -11.29 ($t = -6.59$, $p < 0.000$) when the percent of Indigenous students and the non-Indigenous attendance rate were

controlled for. The numeracy score can be expected to decrease by 11.29 points for every one point increase in student to teacher ratio. The attendance rate of Indigenous students had a coefficient of -206.11 (t = -3.1, p =0.003) if the percent of Indigenous students at a school and the student to teacher ratio were controlled for. A one percentage point increase in Indigenous attendance rate would then correspond with a 206.11 decrease in numeracy score. For average school reading score, 63.75% was accounted for through the percent of Indigenous, student to teacher ratio, and the Indigenous attendance rate at a school (R^2_a = 0.6375). The statistical model is significant, with an *F*-value of 46.14 ($p < 0.000$).

Table 14: Regression of mean numeracy scores on school characteristics

	OLS with Cook's D	OLS	Robust
Number of observations	78	85	84
Constant	893.70 (56.83)***	1325.99 (143.81)***	868.21 (61.55)***
Indigenous percent	-229.98 (22.04)***	-238.83 (23.02)***	-232.23 (23.92)***
Student-teacher ratio	-11.29 (1.71)***	-9.40 (1.67)***	-12.32 (1.91)***
Indigenous attendance rate	-206.11 (66.42)**	-153.34 (67.87)*	-159.27 (70.48)*
Non-Indigenous attendance rate	-	-547.01 (162.74)**	-

Indigenous attendance rates. The attendance rates for Indigenous students was significantly predicted by four variables using the OLS following removal of outliers using Cook's D. These four variables were socioeconomic score, student to teacher ratio, outer regional location, and remote location. The location classification of very remote was omitted from the analysis due to high collinearity with the remote and outer regional location variables. There were 110 observations omitted from the Indigenous attendance regression, see Table 15 for an overview of the excluded observations.

Table 15: Summary of observations omitted from Indigenous attendance regression

Variables	Number	Mean	Standard Deviation	Range
Socioeconomic score	91	640.84	174.64	248 – 1089
Non-English percent	111	0.75	0.31	0 – 1.0
Student-teacher ratio	111	10.16	5.05	3.08 – 37.5
Outer regional	110 (8)	0.07	0.26	0 – 1.0
Remote	110 (20)	0.18	0.39	0 – 1.0
Very remote	110 (81)	0.74	0.44	0 – 1.0

With all variables controlled for, the Indigenous attendance rate is 35%, visible in Table 16. However, this is not possible in reality because the student to teacher ratio and the socioeconomic score cannot be 0. The socioeconomic score was a significant positive predictor of Indigenous attendance rates, with a coefficient of 0.0003 ($t = 7.25$, $p <0.000$) once the other variables were controlled for. This coefficient indicates that the Indigenous attendance rate increases by 0.03% for every 1point increase in socioeconomic score. With other variables controlled for, student to teacher ratio had a coefficient of 0.004 ($t = 2.01$, $p =0.048$) indicating that the Indigenous attendance rate increases by 0.4% for every one point increase in student to teacher ratio. The coefficient for outer regional location was 0.16 ($t = 8.81$, $p <0.000$) once the other variables were controlled for. From this, the Indigenous attendance rate can be interpreted as increasing by 16% in outer regional locations. The remote variable had a coefficient of 0.16 ($t = 9.3$, $p <0.000$) with other variables controlled for, meaning that the Indigenous attendance rate increase by 16% in remote locations. The socioeconomic score, student to teacher ratio, and outer regional location contributed to 81.94% of the Indigenous attendance rates ($R^2_a = 0.8194$). The statistical model is significant, with an F-value of 87.23 ($p < 0.000$).

Table 16: Indigenous attendance rates

	OLS with Cook's D	OLS	Robust
Number of observations	77	88	88
Constant	0.35***	0.27***	0.27 (0.05)***
Socioeconomic score	0.0003 (0.00004)***	0.0005 (0.0001)***	0.0004 (0.00005)***
Student-teacher ratio	0.004 (0.002)*	-	0.007 (0.002)**
Outer regional location	0.16 (0.02)***	0.12 (0.02)***	0.13 (0.02)***
Remote location	0.16 (0.02)***	0.12 (0.02)***	0.13 (0.02)***

Non-Indigenous attendance rates. Four variables were significant predictors of non-Indigenous attendance rates. These variables were that same as those for the Indigenous attendance rates: socioeconomic score, student to teacher ratio, outer regional location, and remote location. The variable for very remote location was again omitted from the analysis due to collinearity with the outer regional and remote variables. Table 17 contains the observations that were not included in the non-Indigenous attendance rate regression.

Table 17: Summary of observations omitted from non-Indigenous attendance regression

Variables	Number	Mean	Standard Deviation	Range
Socioeconomic score	91	631.66	162.70	248 – 1089
Non-English percent	111	0.76	0.30	0 – 1.0
Student-teacher ratio	111	10.09	5.02	3.08 – 37.5
Outer regional	110 (8)	0.07	0.26	0 – 1.0
Remote	110 (21)	0.19	0.40	0 – 1.0
Very remote	110 (80)	0.73	0.45	0 – 1.0

The non-Indigenous attendance rate is 78% (see Table 18) when all variables are at 0. However, as mentioned previously, the socioeconomic score and the student to teacher ratio values cannot be 0 in the real-world. With all other variables controlled for, the socioeconomic coefficient was 0.0001 ($t = 4.51$, $p < 0.000$), meaning that the attendance rate of non-Indigenous students is predicted to increase by 0.01% for every one point increase in socioeconomic score. The student to teacher ratio coefficient of 0.003 ($t = 4.75$, $p < 0.000$) when other variables are

controlled for indicates that there is an increase in non-Indigenous attendance rate of 0.3% when there is a one point increase in student to teacher ratio. The coefficient value of 0.02 ($t = 2.94$, $p = 0.004$) when the other variables are controlled for can be interpreted as a non-Indigenous attendance rate increase of 2% when in an outer regional location. A similar result was found for remote location, with coefficient 0.02 ($t = 3.66$, $p < 0.000$) when all other variables were controlled for. This indicates that the attendance rate for non-Indigenous students increases by 2% when in remote locations. Socioeconomic score, student to teacher ratio, outer regional location, and remote location of a school made up 56.94% of the non-Indigenous attendance rates ($R^2_a = 0.5694$). The statistical model is significant, with an F-value of 26.13 ($p < 0.000$).

Table 18: Non-Indigenous attendance rates

	OLS with Cook's D	OLS	Robust
Number of observations	77	88	87
Constant	0.78***	0.78***	0.82 (0.00002)***
Socioeconomic score	0.0007 (0.00002)***	0.0001 (0.00003)***	0.00005 (0.00002)**
Student-teacher ratio	0.003 (0.0007)***	-	0.004 (0.0008)***
Outer regional location	0.02 (0.01)**	0.02 (0.01)*	-
Remote location	0.02 (0.01)***	0.02 (0.01)*	-

CHAPTER V

DISCUSSION

Low educational attainment has been linked with a variety of negative health behaviours and outcomes (Gutiérrez-García et al. 2017; Leopold and Engelhartdt 2012; Montez and Barnes 2016; Zahodne et al. 2015), as well as reduced earning potential (van Zon et al. 2017) and increased incarceration rates (Hjalmarsson et al. 2015; Lockwood et al. 2015). Indigenous people in the Northern Territory of Australia typically have low educational attainment, and this population makes up about a quarter of the population which makes the effects of low educational attainment particularly notable and concerning among this population and territory (Australian Bureau of Statistics 2017).

Previous research on educational attainment discrepancies between populations has focussed on student and education institution factors. This study had the intention of broadening the scope from which educational attainment discrepancies can be assessed, namely by attempting to identify the effects of previous and current policy on educational attainment.

Hypothesis 1 – Educational attainment and socioeconomic status.

This hypothesis was not tested due to the high correlation found between socioeconomic status and educational outcome scores on four out of five of the domains (reading, writing, spelling, and grammar and punctuation) and high correlation with the percent of Indigenous students at a school. The high correlation between socioeconomic status and the percent of Indigenous students at a school resulted in only one of these variables being used as an independent variable in the hypotheses relating to educational attainment scores. The percent of Indigenous students at a school was chosen to be retained in the analysis and socioeconomic

status omitted because the focus of this research is Indigenous students, and not socioeconomic status.

The extremely high correlation between schools that had high percentages of Indigenous students and low ICSEA scores is not a surprising result. This correlation can be understood as the result of the low educational attainment of Indigenous Australians (which has been shown through the literature review) since educational attainment is associated with socioeconomic status.

Hypothesis 2 – Educational attainment and student-teacher ratio.

The student to teacher ratio at a school was found to be a significant predictor across all five domains of educational attainment, with increases in student to teacher ratio being associated with decreases in school average NAPLAN scores. These impact that student to teacher ratio had on educational attainment was not large, but it was consistent. The decrease in NAPLAN scores supports the hypothesis that having fewer students per teacher is related to improved educational attainment.

Hypothesis 3 – Educational attainment and school location.

Average school reading scores were significantly lower in schools that were in outer regional locations. However, schools that were in areas classified as being remote or very remote were not significant predictor of educational attainment, and the writing, spelling, grammar and punctuation, and numeracy scores were not predicted by the location of a school. Therefore, the hypothesis that students attending schools in more remote locations would have lower educational attainment than students attending schools in less remote areas is not supported by

the results. This outcome was most likely influenced by the large number of schools in very remote locations that were omitted from the analysis for privacy reasons.

Hypothesis 4 – Educational attainment and attendance rates.

The average school score for spelling was significantly predicted by the attendance rate of non-Indigenous students, and the average school numeracy score was significantly predicted by the Indigenous attendance rate. None of the other NAPLAN scores were significantly predicted by the Indigenous or non-Indigenous attendance rates. The hypothesis that lower attendance rates are predictive of educational attainment was not supported by this data, as the attendance rates that were associated with spelling and numeracy scores were associated with decreases in those scores.

Hypothesis 5 – Educational attainment and language.

No support was found for the hypothesis that language influenced educational attainment across any of the school average NAPLAN scores.

Hypothesis 6 – Educational attainment and ethnicity.

Strong support was found for the hypothesis that educational attainment differs by ethnicity, with high percentages of Indigenous students at a school being a significant predictor of decreases in educational attainment.

Hypothesis 7 – Attendance rates and socioeconomic status.

Support was found for the hypothesis that schools with higher socioeconomic status would have better attendance rates. Attendance for both Indigenous and non-Indigenous students was increased as the socioeconomic score of a school increased. While the hypothesis was supported, the amount that attendance rates increased with socioeconomic score were small.

Hypothesis 8 – Attendance rates and school location.

The area that a school was located in, either outer regional or remote were both significantly associated with increases in Indigenous and non-Indigenous attendance rates. The effect of schools in very remote locations was not able to be assessed as the variable was too highly correlated with the outer regional and remote variables.

Hypothesis 9 – Attendance rates and language spoken at home.

The hypothesis that the attendance rates of students would be affected by the language a student spoke at home was not supported by the analyses.

Hypothesis 10 – Socioeconomic scores and ethnicity.

This hypothesis was not tested due to the very high correlation between school average socioeconomic score and student ethnicity. The high correlation is indicated in Figure 2 by the grey arrows, while the black lines represent the supported hypotheses.

Figure 2. Diagram of supported hypotheses
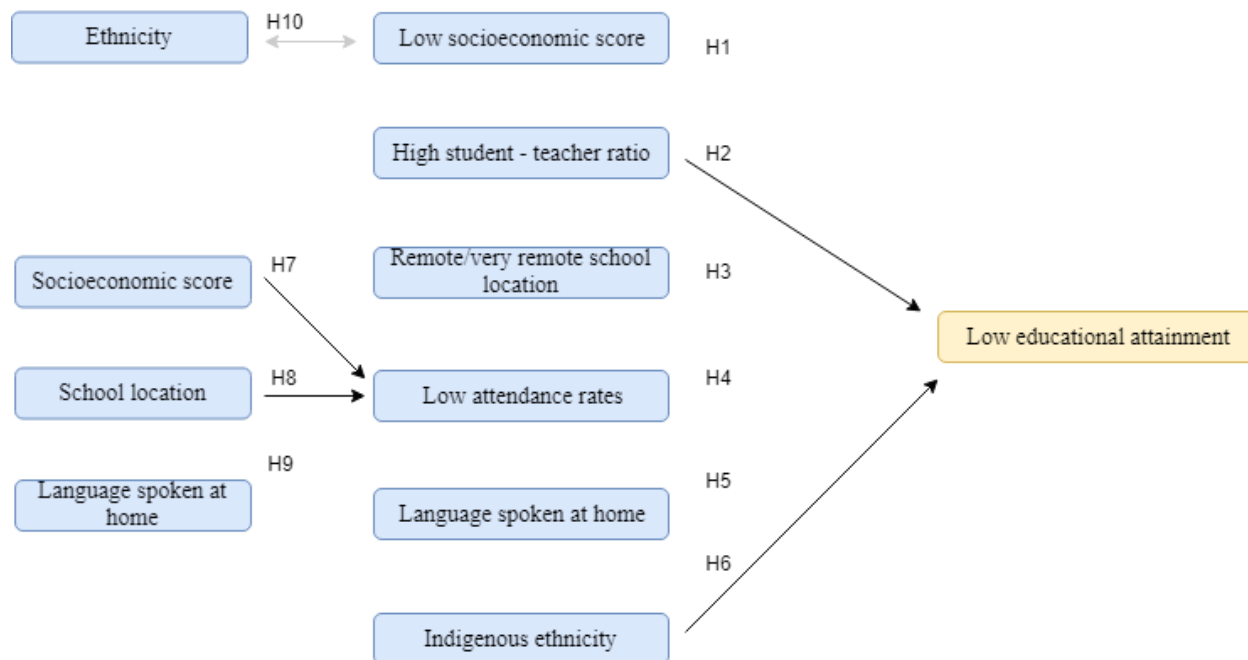
Implications of findings

      The educational attainment of students in the Northern Territory is related to a number school and student factors. These factors influence how well a student performs in the classroom and succeeds in educational attainment. This educational attainment then goes on to predict outcomes throughout a person's life, with lower educational attainment linked to lower health (Gutiérrez-García et al. 2017; Lantz et al. 2005; Lawrence et al. 2016; Leopold and Engelhartdt 2012) and socioeconomic outcomes (Hjalmarsson et al. 2015; Kena et al. 2016; Lockwood et al. 2015; van Zon et al. 2017).

      A school factor that influences educational attainment in the Northern Territory is the student to teacher ratio in a classroom, regardless of the educational attainment measure. Having fewer students per teacher affords teachers better opportunity to maintain order in the classroom, provide a stimulating learning environment, and give each student more attention than if there

are many students per teacher (Adeyemi and Adeyemi 2014; Montt 2011; Therriault et al. 2017). This finding is not particularly of note, policy-wise.

The location of schools has been correlated with the educational attainment of students in previous literature, with decreases in educational attainment found in more remote locations (Hernandez-Torrano 2018). The findings in this study that students in schools in outer regional locations had decreased educational attainment than students in schools in non-outer remote locations was surprising. The outer regional classification, while being relatively remote, is the least remote school location classification in the Northern Territory due to the geography and population density. This result was most likely impacted by the lack of schools in remote locations with available data, meaning that most of the schools in the sample were in outer regional locations. There was only one school with five or fewer total students, indicating that the schools which had insufficient students for the data to be public either had fewer than five students per year level, or that fewer than five students attended on the day of NAPLAN testing. While indirect, this outcome provides possible evidence that students in remote locations have difficulty in attending school regularly or for the full day. The majority of students in remote locations are Indigenous, and so the low attendance could be sign of old colonial policies continuing to have the effect of discouraging Indigenous students from attending school.

A student-level factor that is understood to influence educational attainment is school attendance rates, since attending school provides more opportunities to learn the curriculum that students will be tested on than not attending school (Innis 2016; Silver et al. 2008; Purdie and Buckley 2010). However, strong support for this was not found across the average NAPLAN scores of schools. The cases where attendance rate did impact NAPLAN scores, the effect was quite strong with large changes in educational attainment scores associated with small changes in

attendance rates. This narrow support for the effect of attendance rate may be due to the limited data provided for attendance rates, restricting the sample to schools with more students and higher attendance rates on the day of NAPLAN testing.

The percent of students who spoke a language other than English at home did not have a significant impact on NAPLAN scores, yet the percent of a students at a school who were Indigenous was a predictor of NAPLAN scores. These results appear to be contradictory, especially when many Indigenous students speak multiple languages (Wigglesworth et al, 2011). However, perhaps it is indicative that English has become more pervasive among Indigenous communities and that the policy enforcing that the first four hours of school be taught in English is effective.

The extremely high correlation of socioeconomic status and percent of Indigenous students at school is very telling, though not unexpected about the state of Indigenous families in the Northern Territory. Indigenous in the Northern Territory have lower educational attainment (Gray et al. 2014), and lower educational attainment is well-linked to lower socioeconomic outcomes (Azzolini et al. 2012). As a result, it is not surprising that schools with higher percentages of Indigenous students have lower socioeconomic scores. The strong relationship between the percent of Indigenous students at a school and the socioeconomic score of a school indicate that the effect of colonial policies that were intended to reduce the educational attainment of Indigenous persons have not yet passed. Instead, Indigenous people continue to have lower educational attainment and reduced socioeconomic status when compared with their non-Indigenous peers.

Factors that influenced attendance rates were explored since attendance rates are so well-known to be related to educational attainment. The factors that were found to explain some of the

attendance rates for both Indigenous and non-Indigenous students were related to socioeconomic status, student to teacher ratio, and school location. However, each of these factors only had a minor impact on attendance rates, so there are other variables that were not included in this sample or dataset that are more influential and yet to be identified.

Attempts to improve education attainment

There have been some attempts to improve the educational attainment outcomes of Indigenous students in Australia. These include health-related approaches and increasing the cultural sensitivity of schools. Another approach would be to reduce the student to teacher ratio in classrooms, as supported by the findings in this study.

Health. Improving the physical health has been considered important in improving Indigenous education attainment, especially since health problems common to Indigenous populations include hearing and vision loss, which can result in a serious impediment to participation in the classroom (Davidoff and Duhs 2008; Gracey and King 2009). Improving the mental health of Indigenous students has also been explored as opportunities to improve Indigenous education attainment, with increased Indigenous education attainment potentially occurring through improved mental health documented in the study by Turner, Richards, and Sanders (2007). In this study, parents of "at risk" youth attended a program that was designed to improve their parenting skills. Reduced problem behaviour was noted in the children of the parents that attended the program.

Cultural. Improving the education attainment of Indigenous students has also been approached from a cultural angle. Historically, the school systems of post-colonial countries (such as Australia) there is typically a lack of Indigenous cultural relevance in the classroom, of

which a change to increasing the Indigenous cultural relevance is expected to improve

Indigenous education attainment (Devlin 2009; Lowe 2017; Pidgeon 2009; Wilcox 2015).

Schooling methods that include community and cultural relevance have been trialled and

received encouragement (Brayboy and Castagno 2009; McKinley 2005). Improving cultural

relevance in the classroom includes the use of Indigenous languages in the classroom. Providing

learning opportunities in a bilingual setting that includes an Indigenous language provides

increased accessibility to the classroom for Indigenous students (McKinley 2005; Nicholls

2008).

Student to teacher ratio. The results of this study indicate that a reduction in the student

to teacher ratio in the classroom would also lead to improved student educational outcomes. That

is, having fewer students per teacher in a classroom would allow teachers to spend more time

and energy assisting individual students in a classroom. Previous research has found this to be

particularly beneficial for male students and students in poverty (Adeyemi and Adeyemi 2014;

Montt 2011; Therriault et al. 2017). Therefore, schools with higher percentages of Indigenous

students could benefit from lower student to teacher ratios in the classroom due to the extremely

high correlation between average school socioeconomic score and percent of Indigenous

students.

Limitations.

Many of the schools did not provide complete data, particularly for attendance rates in

schools that were classified as being in remote locations. There was also substantial missing data

from the educational attainment indicators. These missing data resulted in the analysis being run

on much smaller datasets than the population of schools that was originally gathered. The

restriction down to smaller sample sizes was due to school data being omitted by ACARA when there were too few students present in a class and there were concerns that the students present may be identifiable through the data. Another issue was that these results may have also been affected by the variables being non-normally distributed.

The dramatic reduction in sample size may have resulted in omitting the schools that had the most useful data relating to predicting NAPLAN scores, especially if there were very few students in a class. For example, if the schools that were excluded were all schools that had high percentages of Indigenous students and high percentages of students who spoke a language other than English, then the some of the hypotheses may have found more support. If possible, future research may want to us the full data without omissions, if ACARA can provide that for research purposes. Transformation of the variables may also make a difference to the results and interpretation of the analysis. Multiple years of data may also be interesting for identifying trends, particularly if the trends coincide with any changes in policy that relate to education or the Indigenous population. Another avenue for future research could include analysing the characteristics of the schools with missing data to determine a better picture of what is being omitted from analyses using Northern Territory NAPLAN data. Another avenue for future research is conducting this analysis on the other states and territories of Australia.

Conclusions

The lack of data makes it difficult to make conclusions about the role of policy on Indigenous educational attainment in the Northern Territory. The strongest and most consistent findings related to educational attainment in the Northern Territory were that higher percentages of Indigenous students heavily decreased average school educational attainment scores, and

increases in student to teacher ratio decreased educational attainment scores more subtly. The effect of student to teacher ratio is well-documented, so this was not an unexpected finding. The effect of the percent of Indigenous students in a school on educational attainment scores was also not unexpected, since Indigenous people in the Northern Territory are typically of lower socioeconomic status, and lower socioeconomic status has been known to be associated with reduced educational attainment outcomes. The strong relationship that was found between Indigenous percent at a school and socioeconomic score lend support to the idea that the colonial policies discouraging Indigenous people from accessing education are still having an effect in modern times, in spite of more modern policies taking their place. This indicates that current policies are not as effective as they could be at improving the educational attainment of Indigenous Australians in the Northern Territory.

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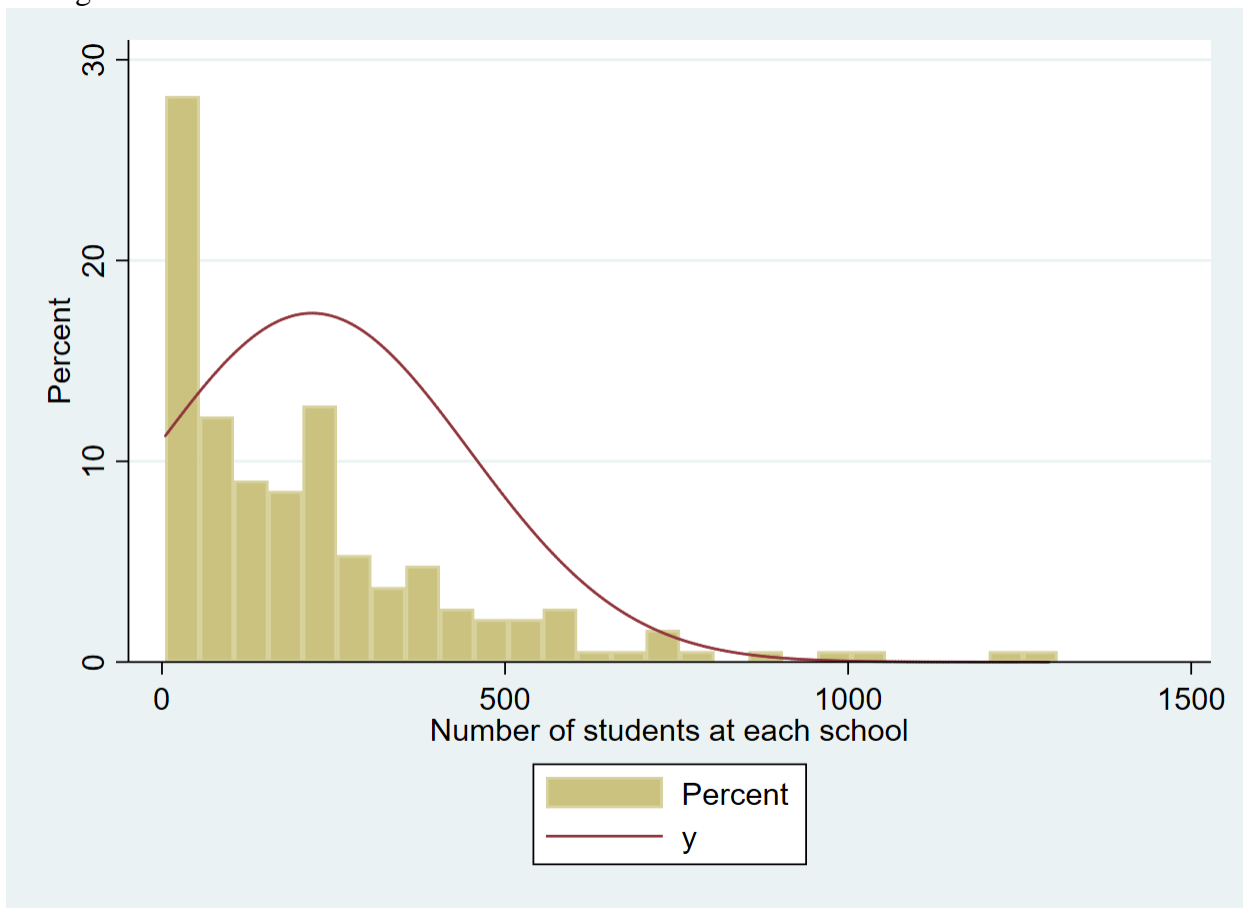
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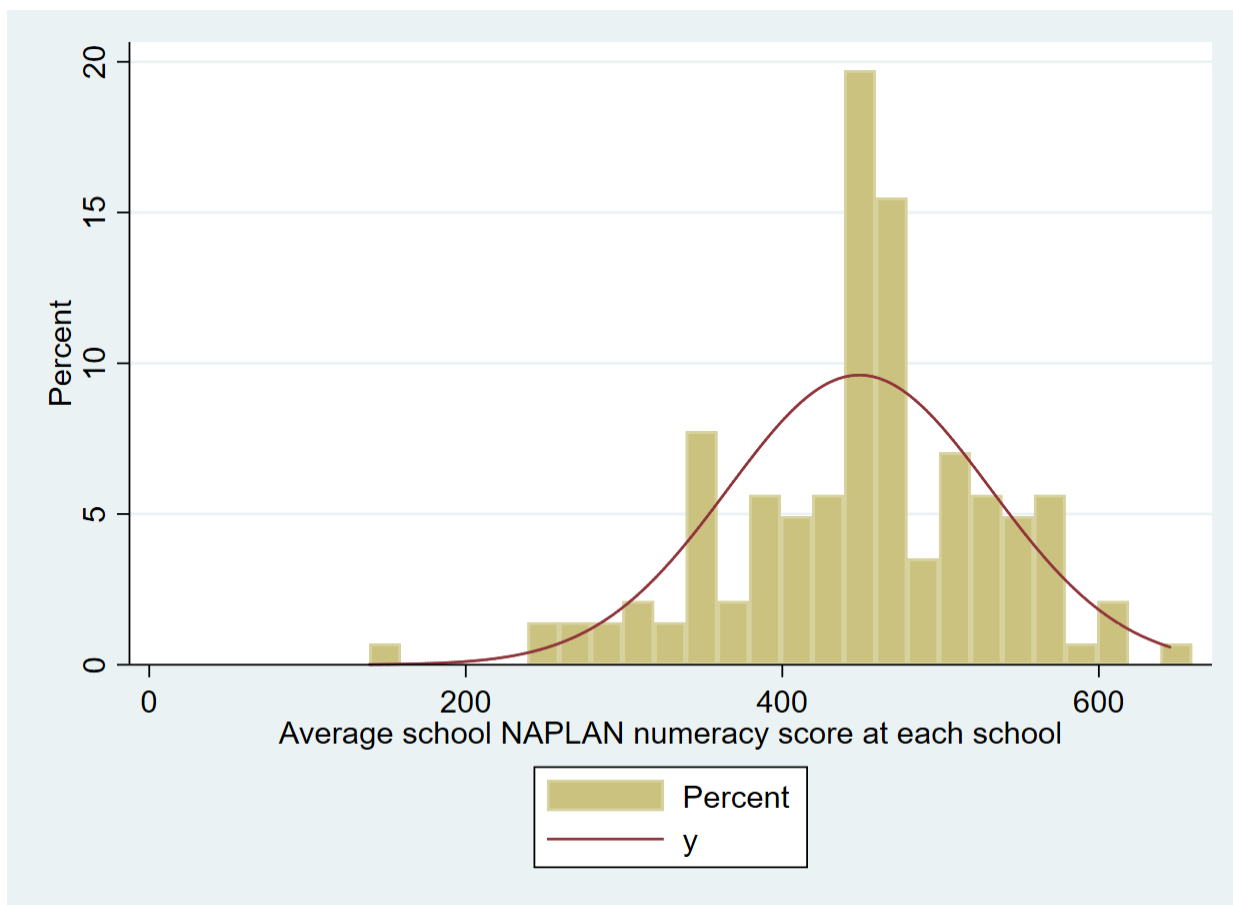
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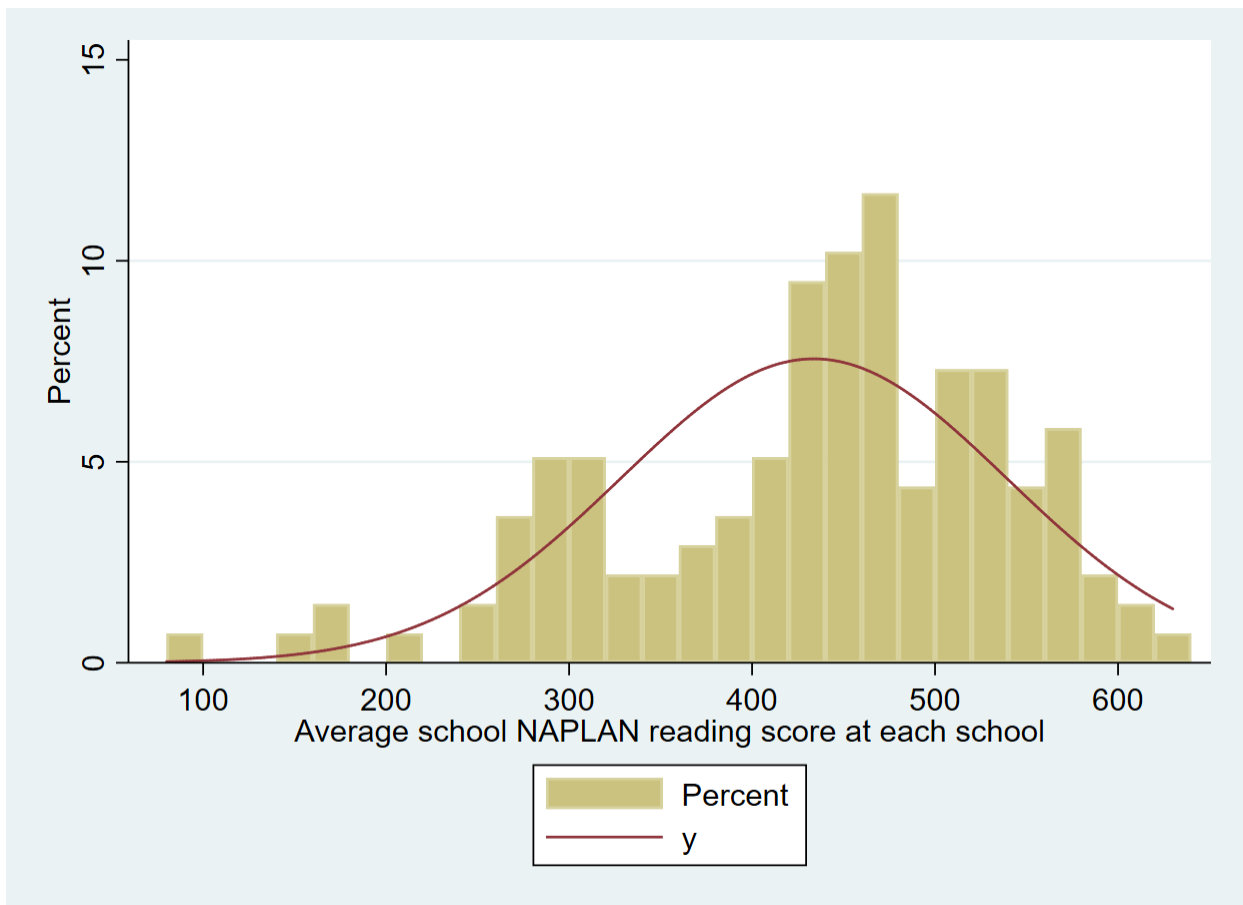
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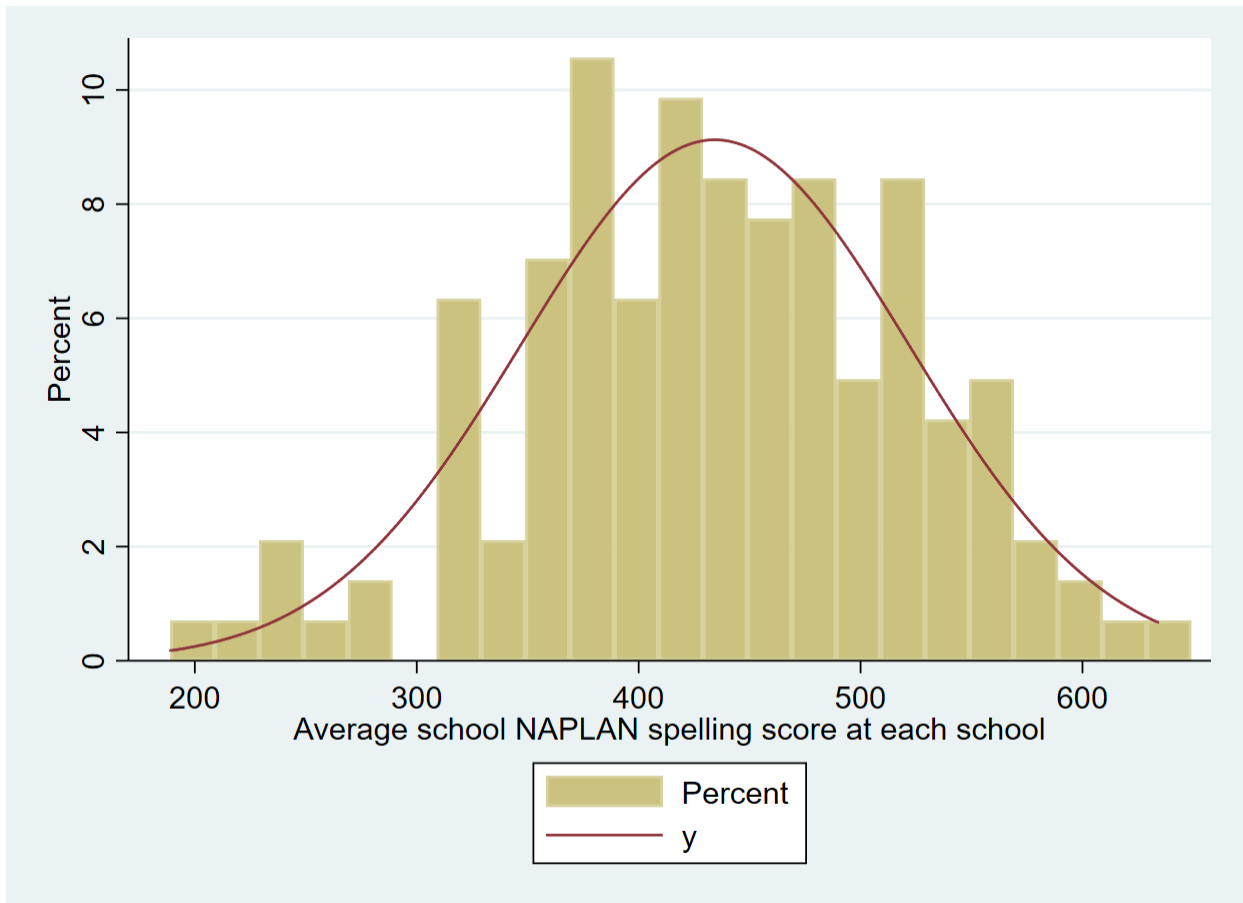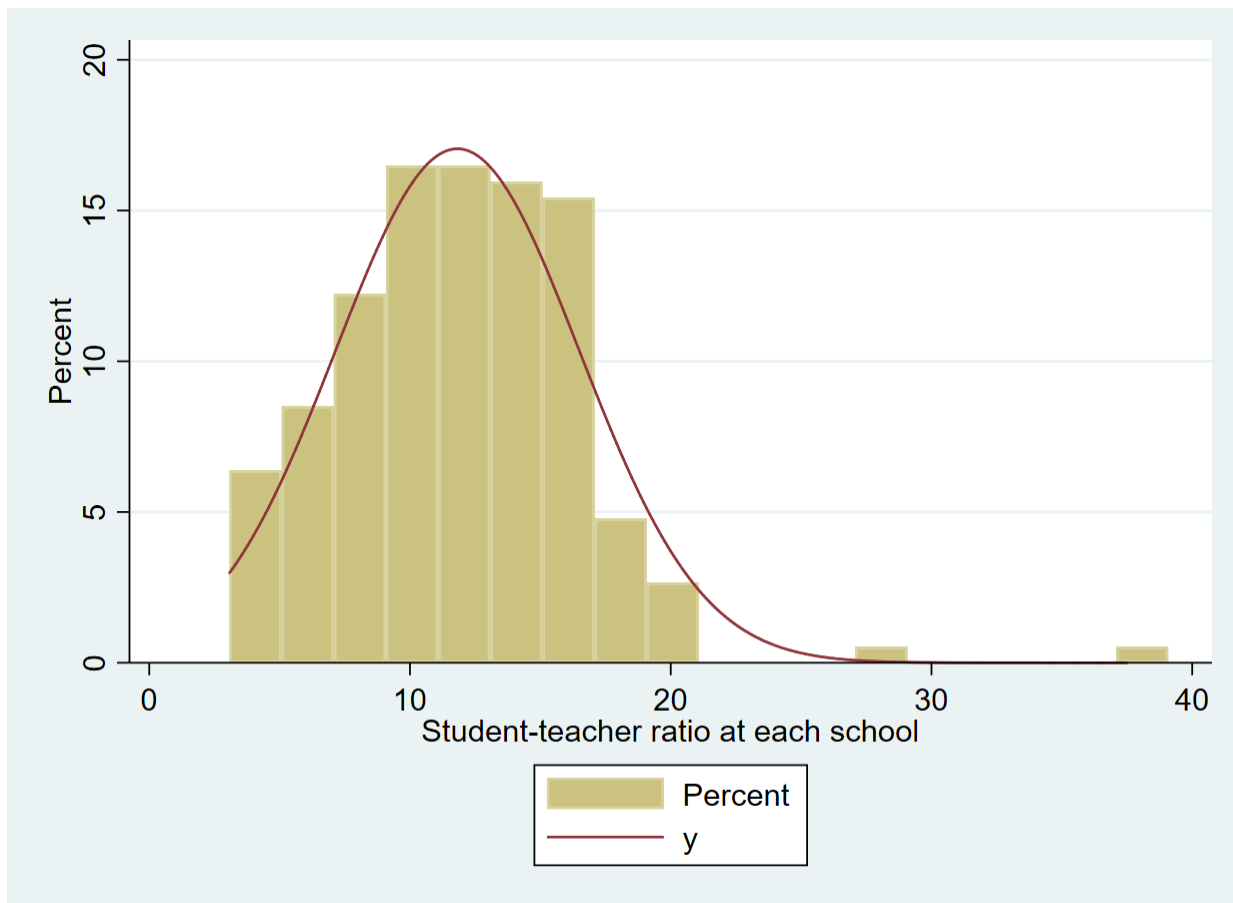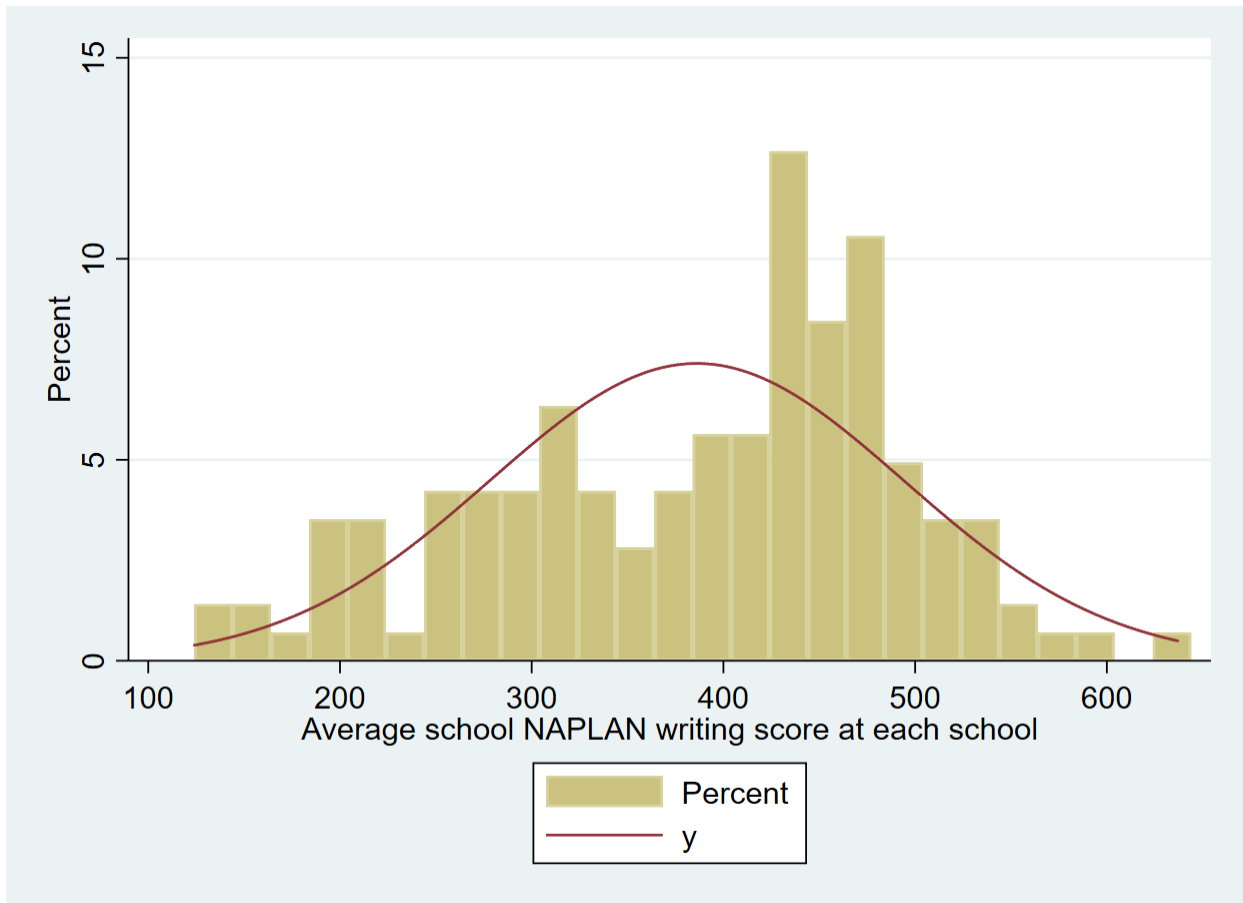   *Neuropsychology* 29(4), 649-657. doi: 10.1037/neu0000141.
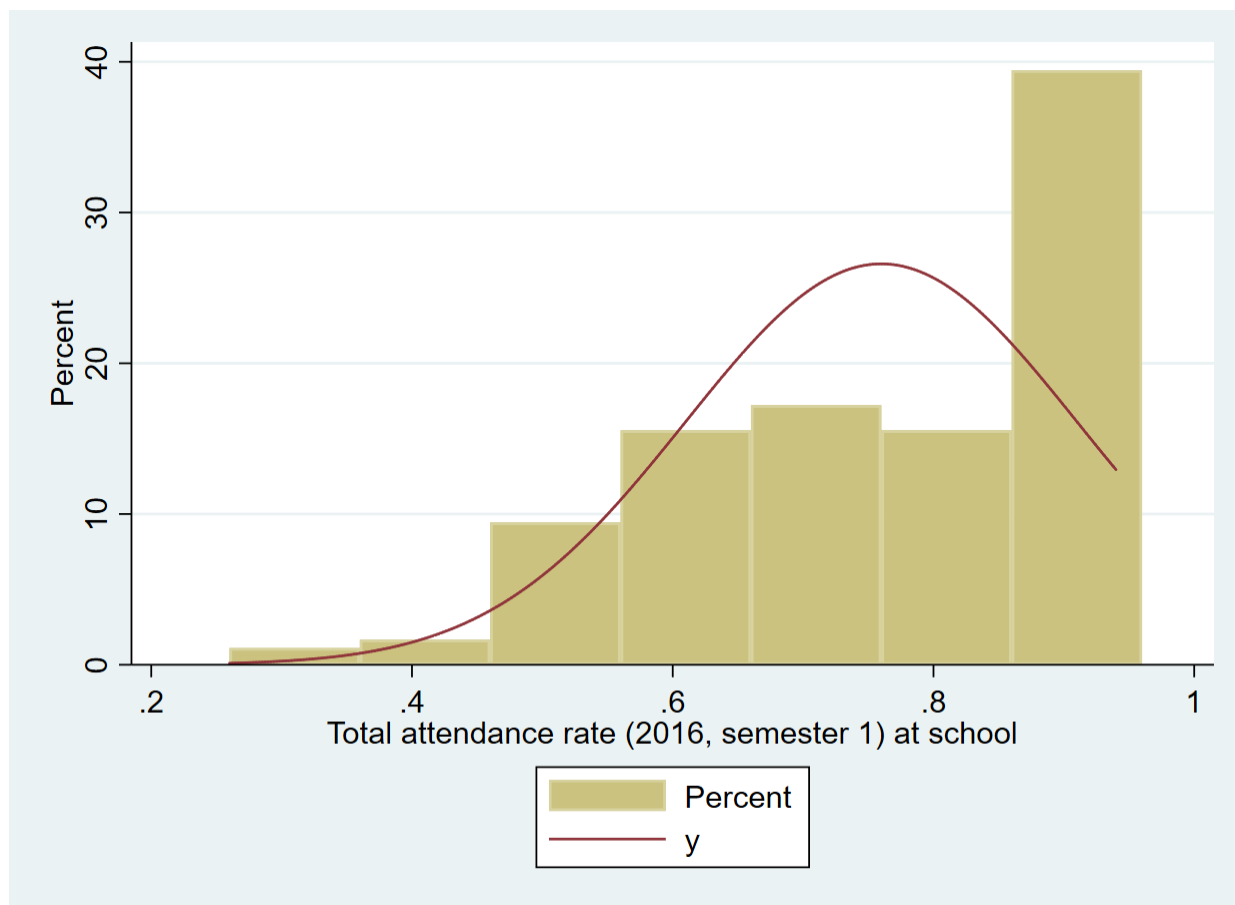
APPENDIX A

Histograms

Average school NAPLAN numeracy score at each school
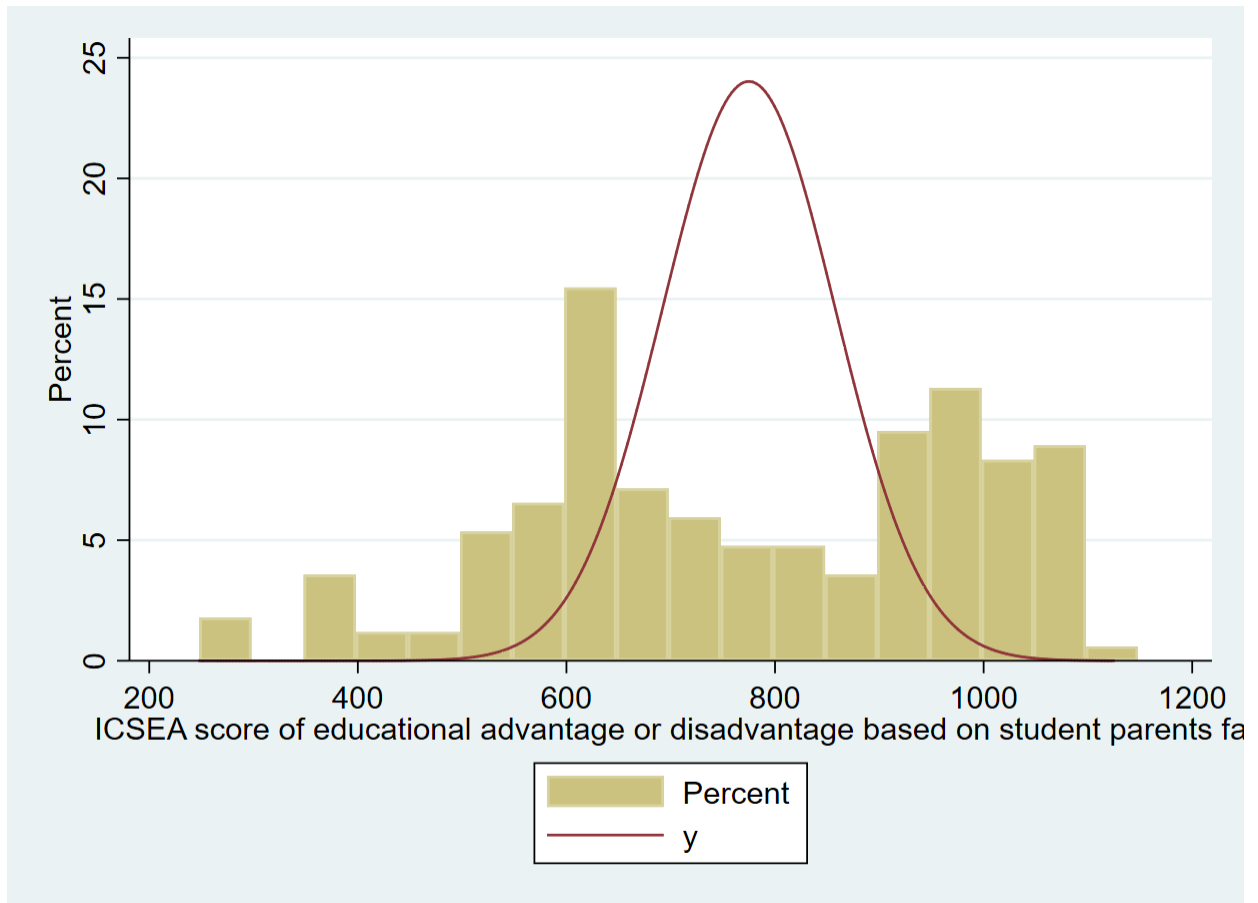
Average school NAPLAN spelling score at each school
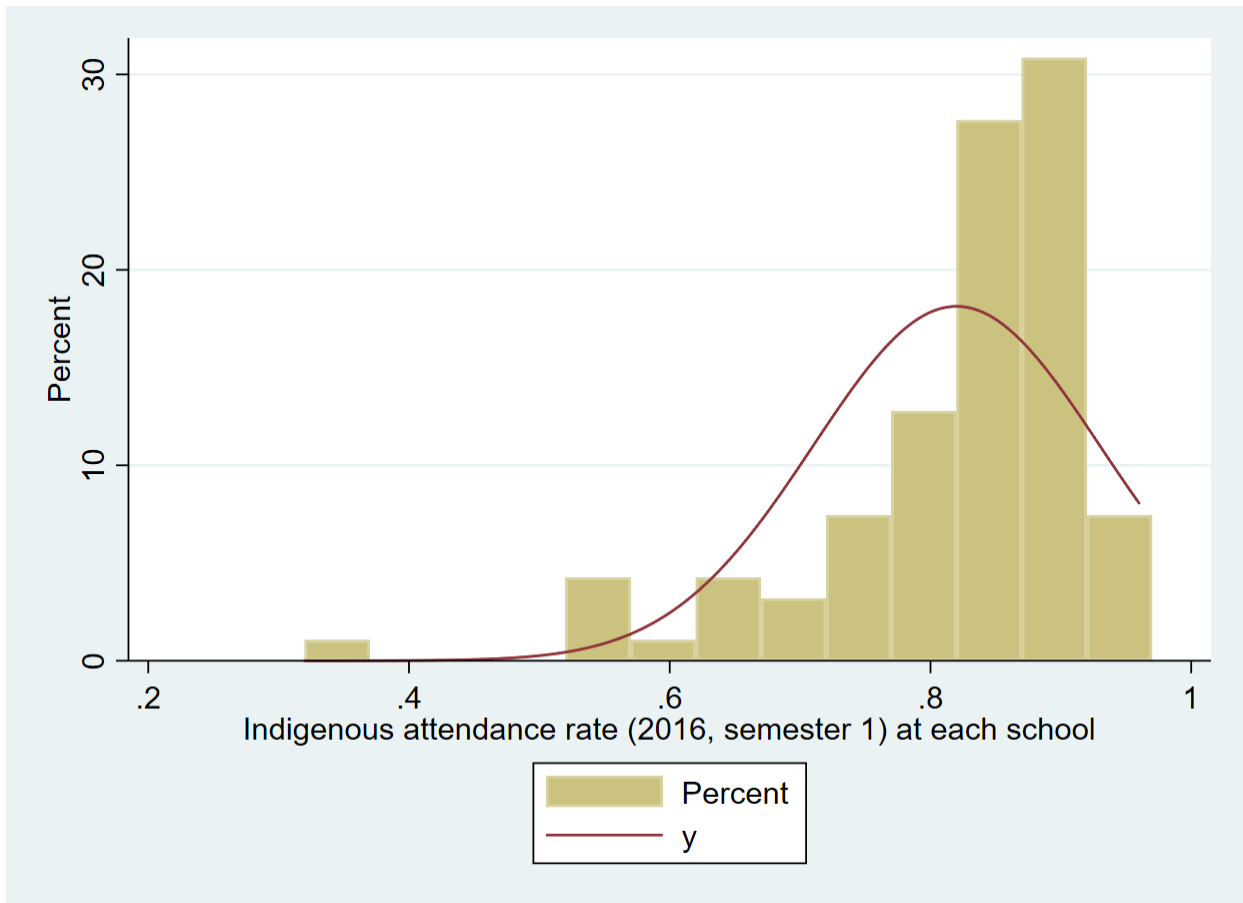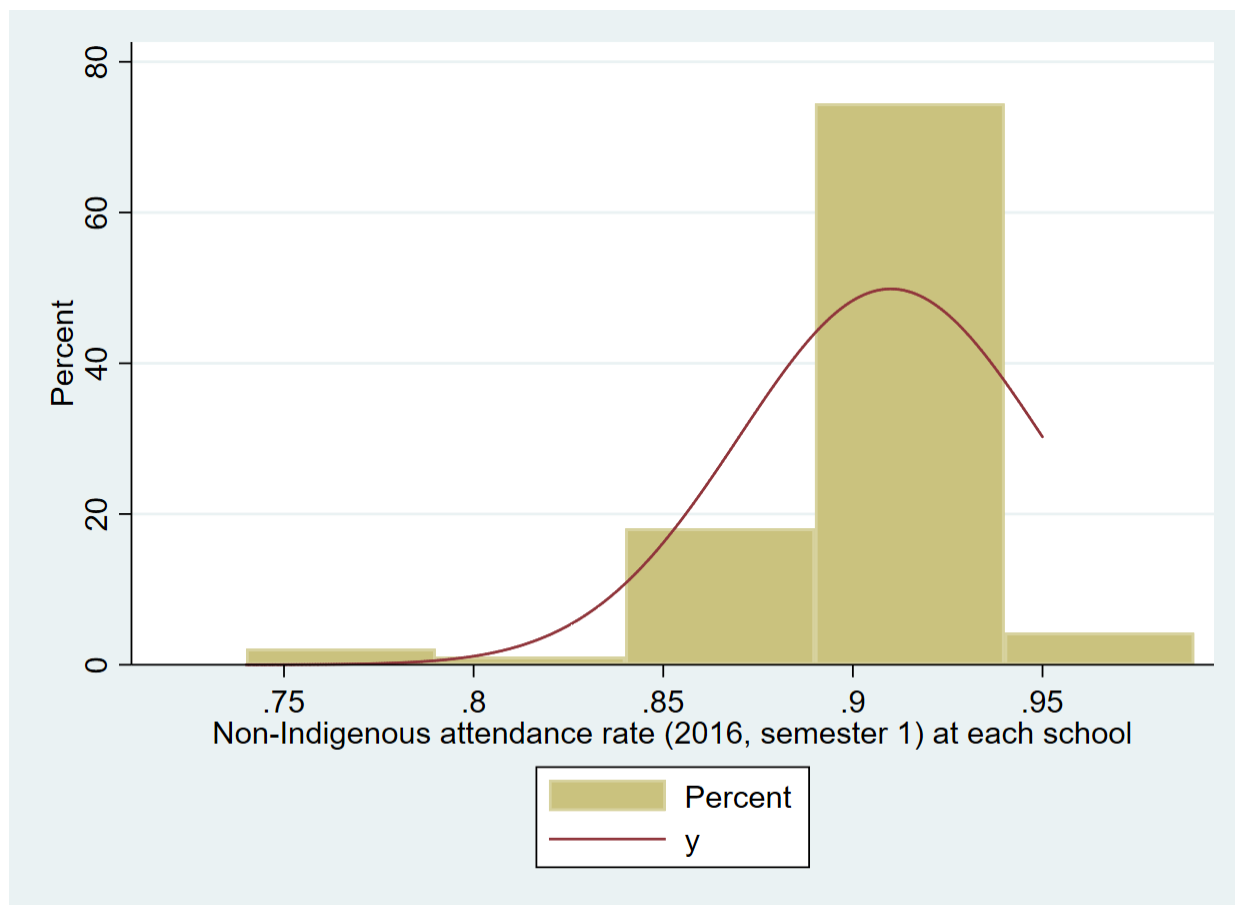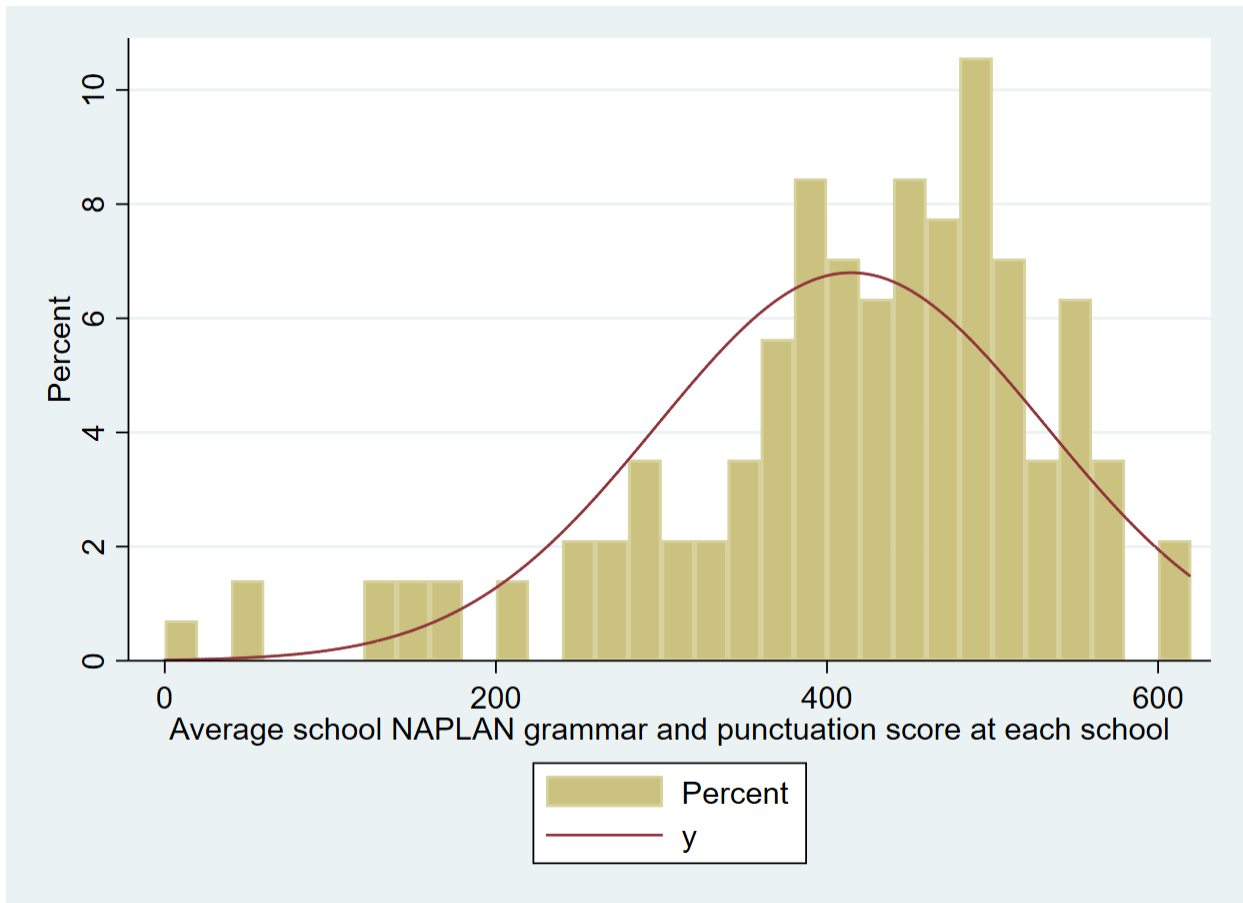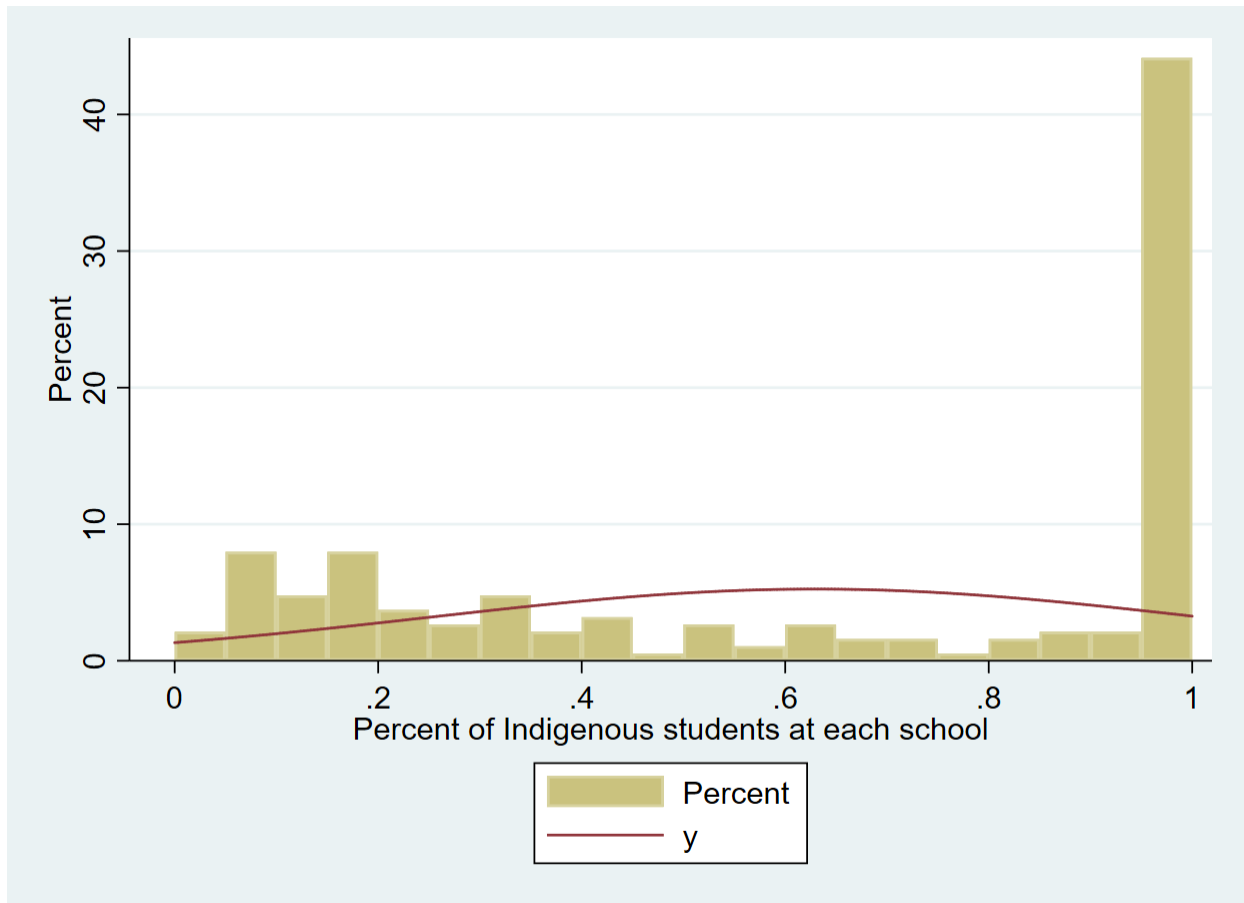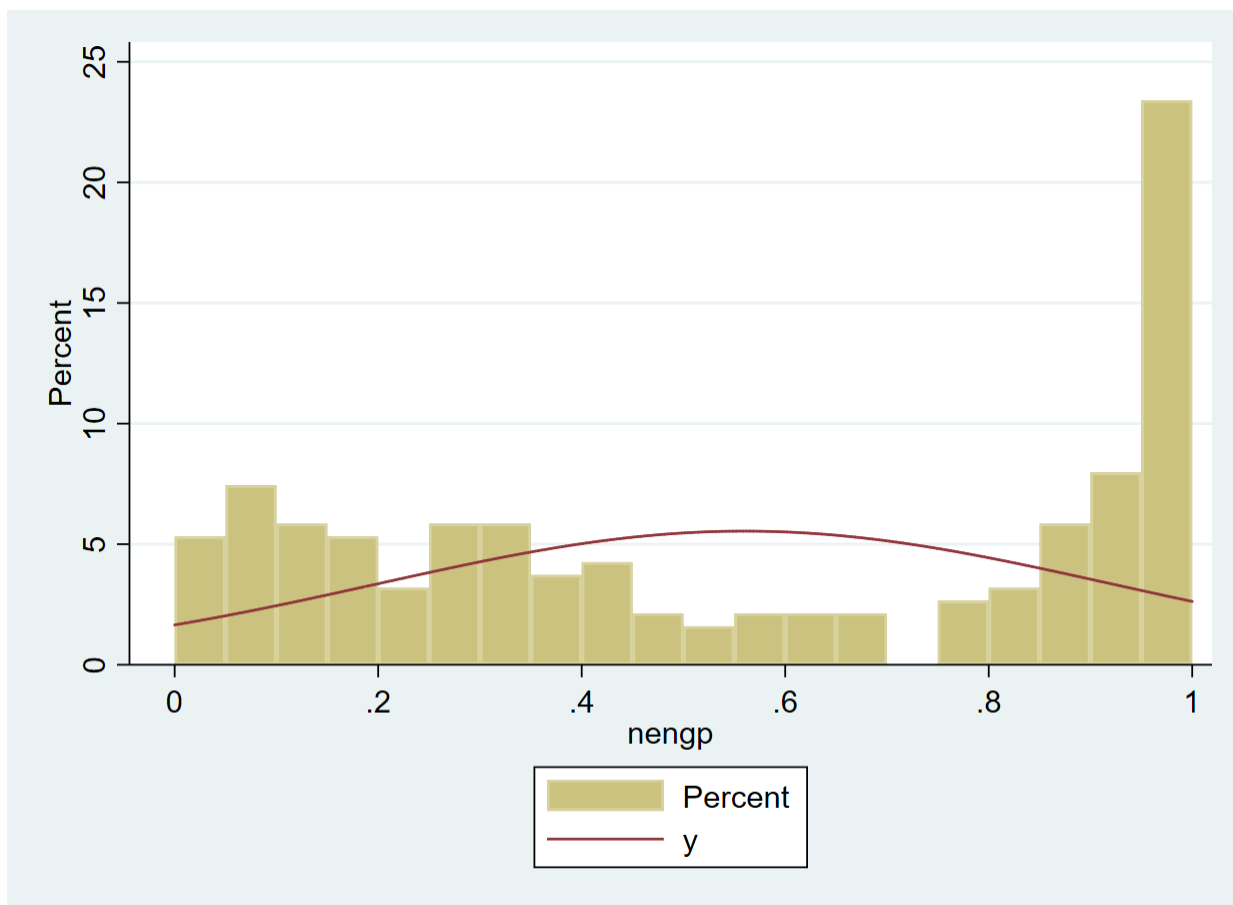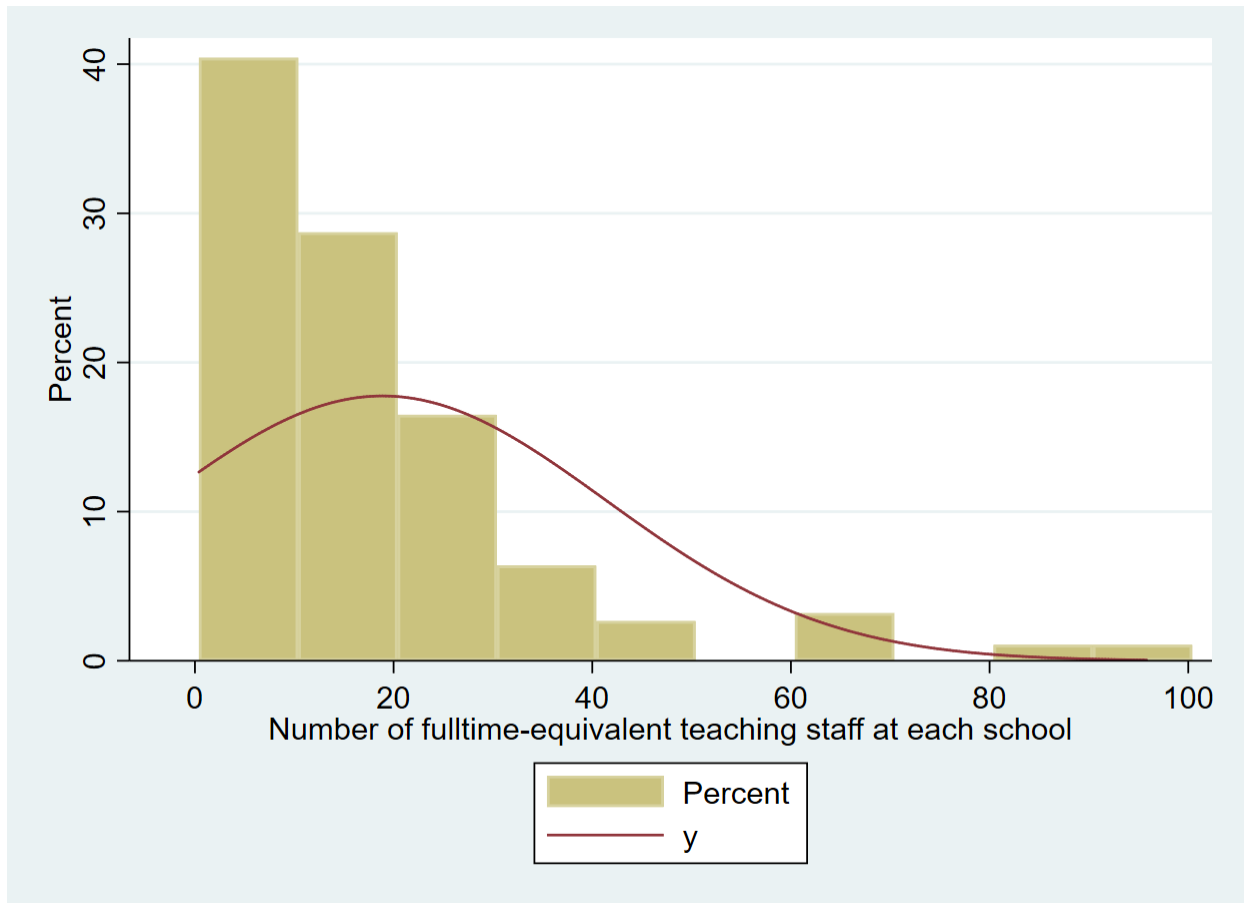
Skewness-kurtosis table

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
reading	137	0.0013	0.41	9.63	0.0081
writing	142	0.0353	0.1515	6.19	0.0452
spelling	142	0.2505	0.9453	1.35	0.5102
grampunct	142	0	0.0132	21.73	0
numeracy	142	0.0123	0.0787	8.41	0.0149
indigp	188	0	0	.	0
nonenglishp	188	0.7038	.	.	.
nftestaff	188	0	0	.	0
stratio	188	0	0	36.47	0
icsea	168	0.193	0	16.21	0.0003
nstudents	188	0	0	65.22	0
attrt	180	0.0003	0.4612	11.96	0.0025
attrtindig	94	0	0.0001	35.45	0
attrtnonin~g	94	0	0	46.15	0
outerregio~l	187	0	0	.	0
remote	187	0	0.9292	30.54	0
veryremote	187	0.4965	.	.	.
post	189	0	0	.	0

APPENDIX B

Correlation table (continued on next page)

	reading	writing	spelling	grampu~t	numeracy	indigp	nengp	stratio
reading	1							
writing	0.8429	1						
spelling	0.9277	0.8887	1					
grampunct	0.934	0.8633	0.8848	1				
numeracy	0.948	0.8064	0.9234	0.8846	1			
indigp	-0.6756	-0.8096	-0.6596	-0.7365	-0.5597	1		
nengp	-0.4388	-0.6067	-0.4402	-0.5335	-0.3538	0.738	1	
stratio	-0.0647	-0.1051	-0.0993	0.0722	-0.1771	0.4268	0.3319	1
icsea	0.7294	0.8228	0.7067	0.7731	0.6107	-0.9662	-0.7088	0.4158
attrt	0.4088	0.6767	0.4266	0.5385	0.2596	-0.8418	-0.7205	0.4646
attrtindig	0.3371	0.5667	0.314	0.4773	0.19	-0.7488	-0.6465	0.4682
attrtnonin~g	0.1047	0.2801	0.1416	0.1456	0.0025	-0.5227	-0.4536	0.3061
outerregio~l	0.1546	0.3016	0.1695	0.265	0.1002	-0.5242	-0.2778	0.4087
remote	-0.0597	-0.1026	-0.0746	-0.132	-0.0687	0.2318	0.0431	-0.212
veryremote	-0.1387	-0.2875	-0.141	-0.2018	-0.0534	0.4348	0.4322	-0.3009
post	-0.0455	-0.1322	-0.0327	-0.1807	-0.0253	0.2894	0.0297	-0.3559

Correlation table (continued)

	icsea	attrt	attrti~g	attrtn~g	outerr~l	remote	veryre~e	post
reading								
writing								
spelling								
grampunct								
numeracy								
indigp								
nengp								
stratio								
icsea	1							
attrt	0.8053	1						
attrtindig	0.7203	0.922	1					
attrtnonin~g	0.5038	0.6637	0.5822	1				
outerregio~l	0.3893	0.4862	0.4658	0.2879	1			
remote	0.1375	-0.0662	-0.0144	-0.0209	-0.7063	1		
veryremote	-0.365	-0.5843	-0.6194	-0.3683	-0.5079	0.2511	1	
post	0.2031	-0.2773	-0.3086	-0.1286	-0.8417	0.6352	0.3779	1

Variance inflation factors of all predictor variables

Variable	VIF	1/VIF
indigpct	33.66	0.02971
icsea	24.34	0.041084
attrt	12.59	0.079449
outerregio~l	9.02	0.110885
attrtindig	7.62	0.131232
post	4.61	0.216932
remote	2.88	0.347218
nengp	2.76	0.361865
attrtnonin~g	1.84	0.543308
stratio	1.43	0.700842
Mean VIF	10.07	

Variance inflation factors with post, icsea, attrt removed

Variable	VIF	1/VIF
indigpct	3.78	0.26441
attrtindig	3.47	0.288367
outerregio~l	3.45	0.289592
remote	2.86	0.349885
nengp	2.51	0.397636
attrtnonin~g	1.56	0.64097
stratio	1.37	0.727463
Mean VIF	2.72	

Scatter matrices

Scatterplot matrix of: Percent of Indigenous students at each school; nengp; Number of fulltime-equivalent teaching staff at each school; Student-teacher ratio at each school; ICSEA score of educational advantage or disadvantage based on student parents fa...; Total attendance rate (2016, semester 1) at school; Indigenous attendance rate (2016, semester 1) at each school; Non-Indigenous attendance rate (2016, semester 1) at each school; Average school NAPLAN grammar and punctuation score at each school.
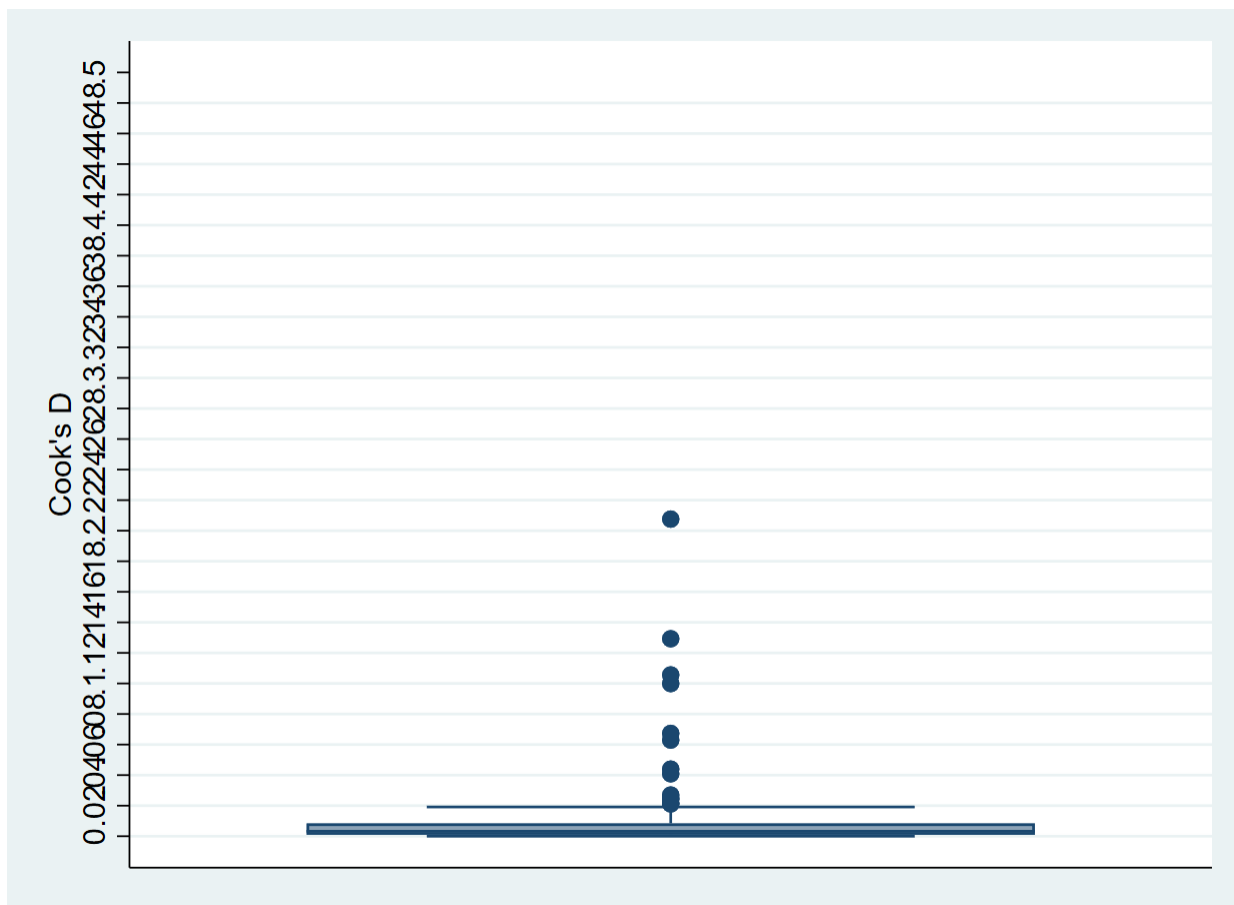
APPENDIX C

Reading – Cook's D box plot
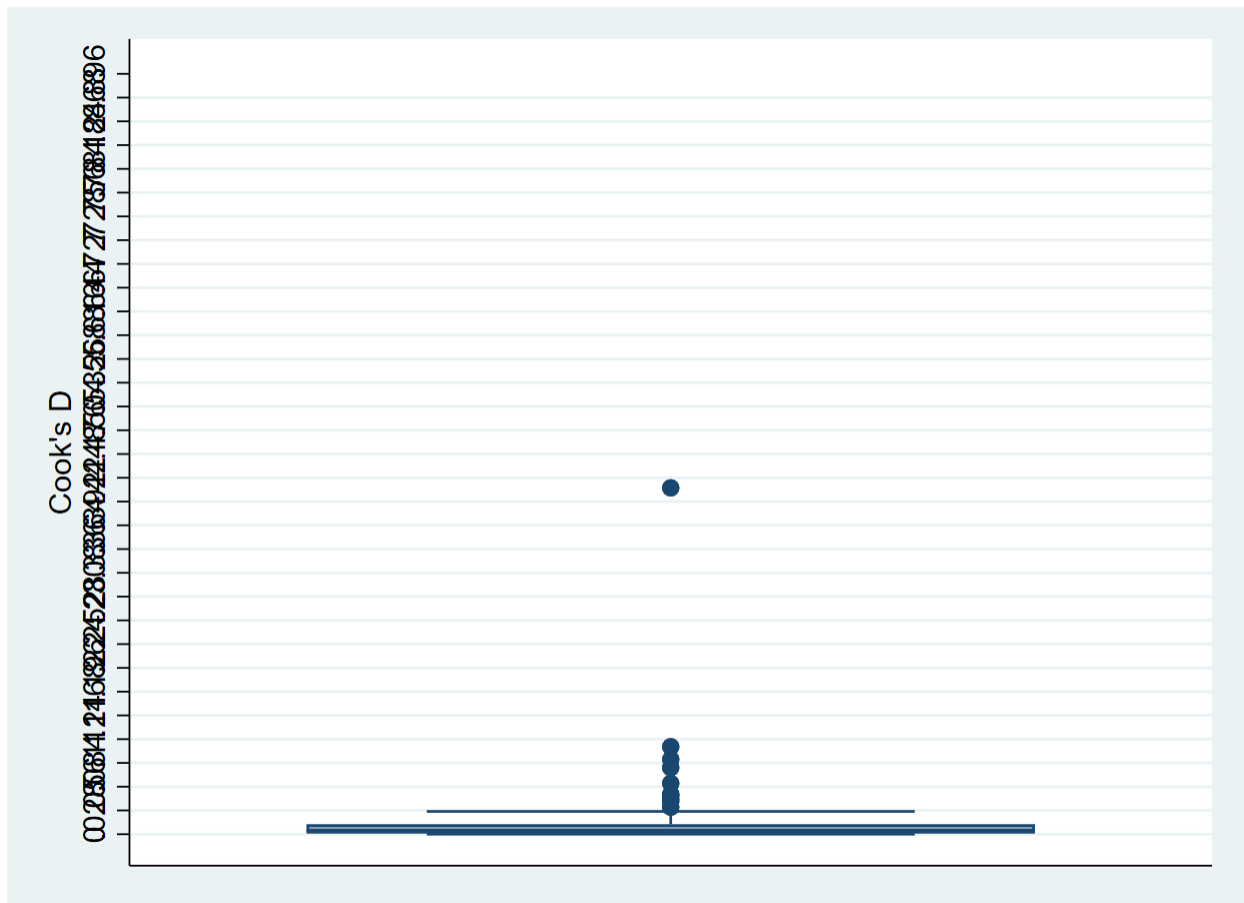
Writing – Cook's D box plot
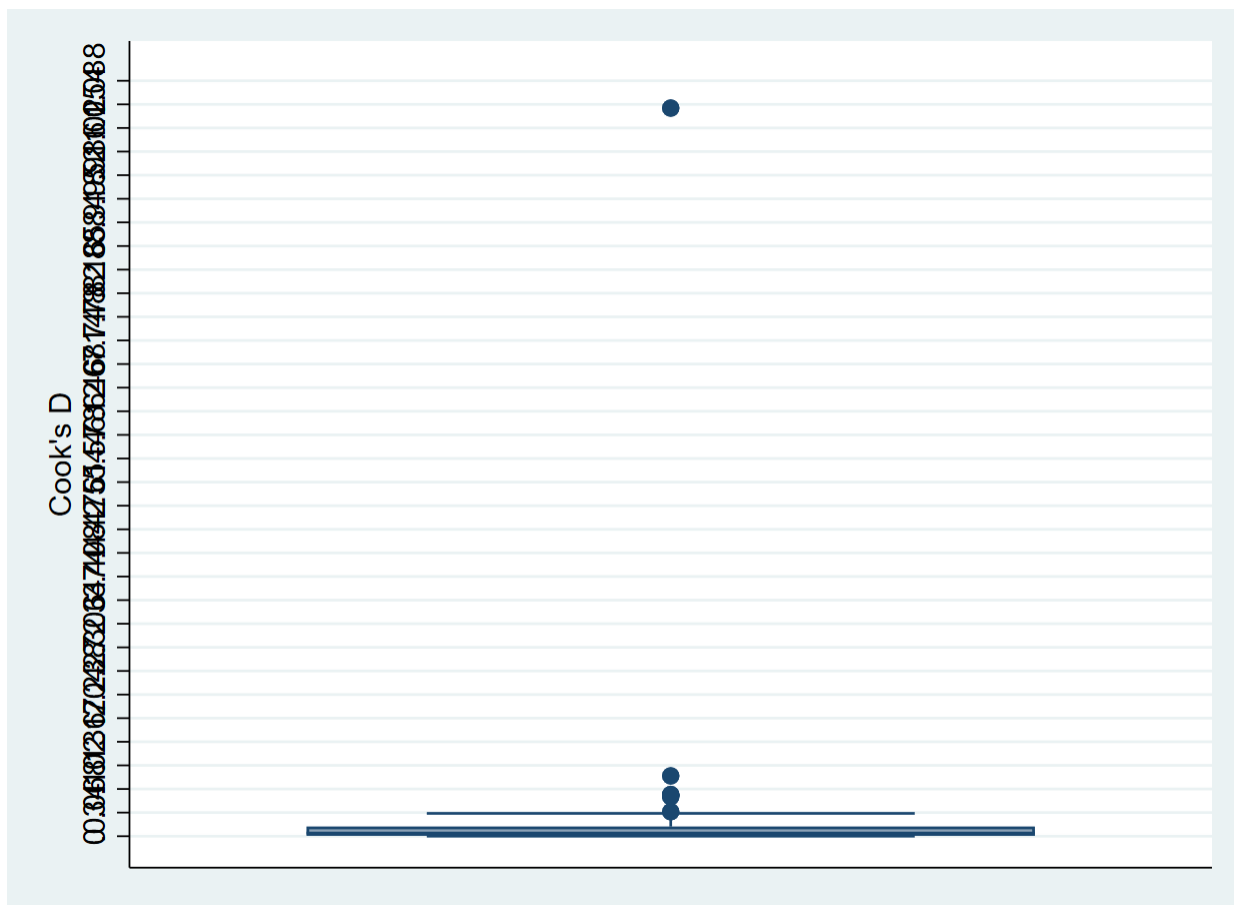
Spelling – Cook's D box plot

Grammar and Punctuation – Cook's D box plot
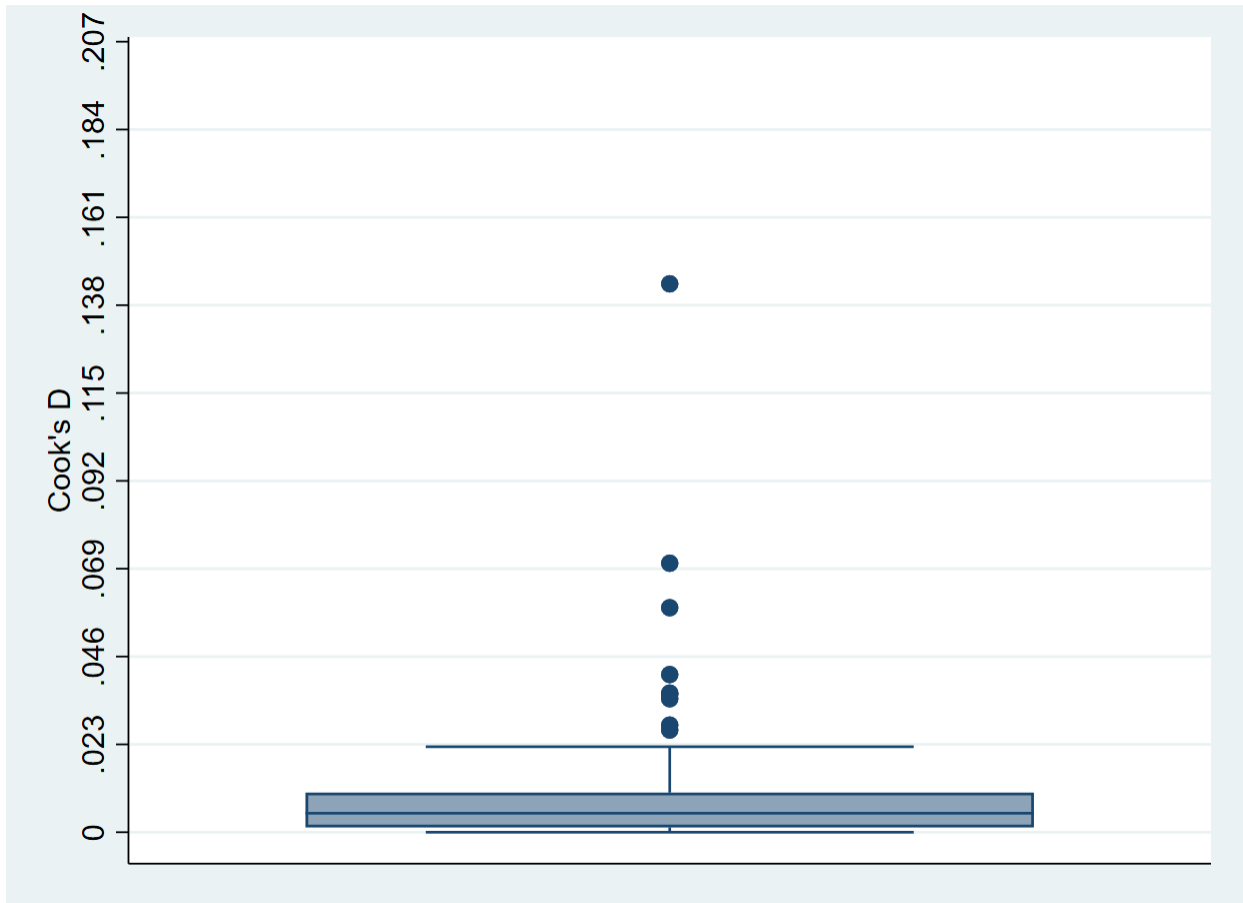
Numeracy – Cook's D box plot

Indigenous Attendance Rate – Cook's D box plot

Non-Indigenous Attendance Rate – Cook's D box plot