

Are neighbourhood characteristics important in predicting the post-school destinations of young Australians?

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### **RESEARCH REPORT**

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About the research

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Are neighbourhood characteristics important in predicting the post-school destinations of young Australians?

### David W Johnston, Monash University; Wang-Sheng Lee, Deakin University; Chandra Shah, Michael A Shields and Jean Spinks, Monash University

While much research has been conducted on the influence of individual and family characteristics on social exclusion, very little has examined the role of community and neighbourhood factors. This project is considering the differences in education and training outcomes in areas of social advantage by comparison with areas of social disadvantage, taking the contribution of these neighbourhood factors into account. This report contains the results of the quantitative aspect of the study, using data on individuals and their families from the Longitudinal Surveys of Australian Youth (LSAY) and the 2006 census. A second part to the project is a qualitative study exploring the influence of access to high-quality education and training and other community infrastructure on education and training outcomes. The results of this study, in which regions in Victoria and South Australia are compared, will be available in 2014. This work is one of three projects undertaken by the Centre for the Economics of Education and Training (CEET) at Monash University, as part of its three-year (2011—13) research partnership with the National Centre for Vocational Education Research (NCVER) exploring the geographical dimensions of social inclusion and vocational education and training (VET) in Australia.

Key messages

* The socioeconomic status of a neighbourhood is an important characteristic in explaining variations in student outcomes, but residential turnover, the composition of households and the multicultural nature of the neighbourhood also play a role.
* The characteristics of schools make an important difference, but in reality data for many of these (for example, school leadership and teacher quality) are either not readily available or the characteristics are not easily measurable. The effects of a neighbourhood are sometimes difficult to separate from the impacts of schooling because of the correlation between the two.

The authors argue for caution when inferring the significance of the relationship between neighbourhood characteristics and student outcomes if the model estimating such a relationship does not contain the appropriate controls for school effects.

Prior aspirations are important in predicting the final post-school destinations of young people. The results suggest that mentoring efforts that help to shape the aspirations of young people at an early age could have a high payoff, in terms of their post-school outcomes.

Rod Camm
Managing Director, NCVER

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# Executive summary

Understanding the factors that drive socioeconomic inequalities in educational and training outcomes in Australia is important for designing appropriate policy responses. One key aspect is being able to identify the importance of neighbourhood socioeconomic characteristics in accounting for observed differences in outcomes.

In this study we investigate the following two questions:

* Whether post-school outcomes (in terms of early school leaving and participation in further education and training) for students from disadvantaged areas are similar to those for their counterparts from advantaged areas?
* Which socioeconomic characteristics of the local area contribute most to inequality in students’ post-school outcomes?

The study uses data from the 2003 cohort of the Longitudinal Surveys of Australian Youth (LSAY), which includes rich information on the characteristics of young people who were 15 years old in 2003, the school they attended and their experience of transition from school to post-school destinations. The 2003 cohort was drawn from the same sample of 15-year-olds in Australian schools who participated in the 2003 Programme for International Student Assessment (PISA), conducted by the Organisation for Economic Cooperation and Development (OECD), which means a much richer dataset is available for analysis. These data are augmented by the characteristics of neighbourhoods at the postcode level derived from the 2006 Australian Census to enable investigation of the effects of neighbourhood characteristics on young people’s schooling outcomes.

The data enable us to determine whether neighbourhood characteristics are important for student outcomes, after controlling for individual, parental and school effects.

The report focuses on the effects of four neighbourhood characteristics — neighbourhood socioeconomic status, residential stability, household type and ethnic diversity — measured at the postcode level on student outcomes at ages 15, 17 and 19 years.

Various models are estimated to provide detail in the way neighbourhood characteristics affect student outcomes. In the first set of models, only neighbourhood characteristics are included as control variables. The second set includes controls for individual characteristics (for example, sex, place of birth, Indigenous status, whether only child in family etc.) and parental characteristics (labour force status, occupation and education level of father and mother, family ethnicity etc.). The third set includes school fixed effects to control for the average observed and unobserved differences in the quality of schools (for example, class sizes, quality of teachers, facilities and peers etc.) and in the differences in the ‘quality’ of the student intake (for example, student ability, parental background etc.). It is uncommon in the literature to find studies that have simultaneously controlled for neighbourhood and school effects in the same model. The fourth set of models, which are estimated only for student outcomes at age 17 and 19 years, includes controls for the prior attributes of a student (achievement, attitude, aspirations and application) measured at age 15 years.

## Outcomes at age 15 years

The determinants of four student outcomes at age 15 years are investigated: achievement; attitudes (towards schooling); aspiration (to complete a vocational education and training (VET) or university qualification); and application for school (time spent on homework).

The neighbourhood characteristics generally have significant effects on all student outcomes, except student attitudes, even after individual and parental factors are controlled for. The results suggest that students living in less prosperous neighbourhoods are more likely to have aspirations for undertaking vocational education and training.

When school fixed effects are introduced into the model to control for the variation in the characteristics of the school that students attend, the neighbourhood effects are generally no longer significant. This suggests a strong correlation in the observed characteristics of the neighbourhood where the student lives and the observed and unobserved characteristics of the school the student attends.

Neighbourhood stability exerts an independent positive influence on students’ achievement, even after controlling for school fixed effects. A neighbourhood with low residential stability signifies a high transient population and a low level of home ownership. In a neighbourhood with high residential stability, the turnover among the students’ peer group in the neighbourhood as well as in the school is likely to be less, which will mean students will have a less disruptive social life and will be able to focus more on learning tasks.

Many individual and parental factors have significant independent influences on student outcomes after controlling for neighbourhood and school fixed effects, many of which have also been reported elsewhere.

## Outcomes at age 17 years

The study also investigates the factors that affect whether a student at age 17 years continues to be engaged with some type of education and training (school, vocational education and training or university) or not. In the full model, which includes observed individual and family characteristics, school fixed effects and student attributes measured at age 15 years, neighbourhood characteristics have little influence on outcomes. Any positive effect from living in an advantaged area appears to work through the fact that these areas generally have ‘better’ schools, which promote further education and training. All student attributes measured at age 15 years however exert significant independent effects on the outcome.

## Outcomes at age 19 years

Finally, the study considers the factors that affect student outcomes at age 19 years — VET outcome, university outcome or non-study outcome. As at age 17 years, neighbourhood characteristics are not significant in predicting outcomes at age 19 years in the full model.

Prior aspirations are important in predicting the final post-school destinations of young people, with VET aspirations significant in predicting a VET outcome and university aspirations for a university outcome. The results suggest that mentoring efforts, which help to shape the aspirations of young people at an early age, could have major implications later in terms of better post-school outcomes. The result is of particular relevance for young Indigenous children, who often lack appropriate adult role models. Prior achievement scores and attitude to school have positive independent effects on university outcomes but negative effects on VET outcomes.

## Summary

After controlling for individual and parental influences, the study found that four neighbourhood characteristics have small but significant effects on student outcomes. While neighbourhood socioeconomic status is probably the most important of these characteristics, the other three also have a role in explaining the variations in student outcomes.

The effects of neighbourhood characteristics almost all disappear when school fixed effects are introduced into the model. The results underline the difficulty in inferring the significance of neighbourhood characteristics in predicting student outcomes when the model estimating the relationship does not contain appropriate controls for the school context.

The school effects in our models are fixed and capture all the differences, observed and unobserved, in school characteristics. But because the characteristics of neighbourhoods where students live are generally mirrored in the composition of schools, these are also captured by the school fixed effects. In the models reported here neighbourhood characteristics are, therefore, probably mediated through school fixed effects. Separating the neighbourhood effects from school effects is thus complicated and requires detailed measures of both the school and neighbourhood contexts. School-level measures, including school leadership and teacher quality, that provide information on the quality of the school could be useful in this respect, but are not always available or readily measurable.

The school fixed effects, however, allow for the identification of neighbourhood effects from differences in outcomes between students at the same school who live in different neighbourhoods. The results thus indicate that outcomes are unlikely to be significantly different for two students with similar individual and parental characteristics attending the same school, but living in neighbourhoods with different levels of socioeconomic status.

A possible conclusion from this research is that the inequalities in student outcomes may be reduced by a better allocation of resources to schools. The evidence for this is, however, indirect and does not provide guidance on what aspects of school quality and resources are most likely to make a difference. Changing the ways principals and teachers are allocated to schools and ensuring a school’s student intake is not disadvantaged through the selection practices of other schools could also help to reduce disparity in student outcomes.

The analysis provides information for the average case. A closer examination of the data shows that a number of neighbourhoods with below-average socioeconomic status have above average student outcomes, and vice versa. While the current data allow us to identify these neighbourhoods, they are inadequate for identifying factors that may explain student outcomes in these neighbourhoods. In the second part of this research project we use qualitative methods to identify possible critical factors that may be responsible for such divergent results in a selected number of neighbourhoods in Victoria and South Australia.

# Introduction

This paper reports on one of three topics that comprise a three-year program of work: *Geographical dimensions of* *social inclusion and VET in Australia.* The aim of the program is to provide an understanding of the geographical aspects of social exclusion and the role that education and training can have in reducing its risk and in improving labour force participation in Australia.

The first key to designing effective policies for reducing inequalities and improving social inclusion is to have a good understanding of the socioeconomic factors that drive educational outcomes for young people, including the pathways through which these factors operate (Bjorklund & Salvanes 2011; Shah et al. 2012). This paper investigates the absolute and relative importance of the individual, parental, school and neighbourhood factors that account for the observed differences in the post-school destinations of a cohort of young Australians who were 15 years old in 2003. The main focus is on understanding the neighbourhood effects.

A number of studies, which we will review in this paper, have investigated this issue in the Australian context. Although there are differences in the findings, the overall evidence suggests that children growing up in more economically disadvantaged neighbourhoods, even after taking into account key family characteristics such as parental education and ethnic background, are more likely to leave school early and consequently less likely to attend university or undertake vocational education and training. This result is important because early life educational and training differentials are key factors in understanding lifetime income inequalities and the extent of intergenerational socioeconomic mobility (Black & Devereux 2011). When social disadvantage becomes entrenched in a neighbourhood, the restorative potential of services such as health and education can diminish and costs escalate (Vinson 2007).

The review by Jencks and Mayer (1990) identified a number of key pathways through which local area (or neighbourhood) factors might have an impact on educational outcomes for young people. The first, and perhaps most obvious, pathway is that more affluent neighbourhoods typically have ‘better’ schools, which aid in the achievement of better educational outcomes for students living in these neighbourhoods. We explore this pathway in detail in this study.

A second pathway by which neighbourhoods (and schools) might influence educational outcomes is through peer effects. (See Sacerdote 2011 for a recent review of this topic.) Children gain information about other children of the same age in their neighbourhood by observing them or interacting with them through play and other activities. Not only can they be directly influenced by the educational aspirations and attitudes of their peers, but also by the attitudes of adults, other than their parents, in their neighbourhood.

This leads to the potential for the ‘contagion’ (or an ‘endogenous effect’) of educational attitudes and aspirations in a local area. It also raises the important issue of ‘selection’, where individuals (or families) with similar observable characteristics (for example, education, income and ethnicity) and potentially unobservable characteristics (for example, beliefs, aspirations and preferences) choose to reside in the same neighbourhood. Parents with high aspirations for their children’s academic achievement tend to choose to live in areas with good schools (and possibly peers) and other amenities, if their budget allows. A number of studies have shown a positive relationship between house prices and the quality of schools in a neighbourhood, which suggests that it is the more wealthy households who generally are able to buy into neighbourhoods with quality schools. (See, for example, Davidoff & Leigh 2008; Gibbons & Machin, 2003, 2006; Rosenthal 2003; Kane, Staiger & Riegg 2005; Black 1999; Bayer, Ferreira & McMillan 2007). As a result, a strong correlation in educational outcomes for young people living in the same neighbourhood may be observed. This however does not by itself guarantee that children from randomly selected disadvantaged families who are placed in an affluent neighbourhood will achieve, on average, similar educational outcomes as children of families who self-select to live in the same neighbourhood.

The third pathway, over and above any schooling effect (the ‘correlated effect’), through which neighbourhoods might affect young people’s educational aspirations, attitudes and outcomes is through the presence of education-related amenities, such as libraries, and the general culture of learning in the neighbourhood.

Overall, these pathways and complexities mean that it is difficult to determine whether policies aimed at improving the socioeconomic environment of an area will causally improve educational outcomes. This is the well-known ‘reflection’ problem noted by Manski (1993, 1995). The reflection problem arises when a researcher observing the distribution of behaviour in a population tries to infer whether the average behaviour in some group influences the behaviour of the individuals who comprise the group.

Importantly, though, because of self-selection by parents into neighbourhoods and the subsequent non-random allocation of young people into neighbourhoods, empirically distinguishing between alternative explanations of student outcomes is difficult. Self-selection has the potential to overestimate the importance of neighbourhood characteristics in predicting student outcomes because neighbourhood measures which are socioeconomically related will also capture the unobserved parental selection preferences that are not captured by characteristics such as parents’ education, occupation and ethnicity.

This study addresses the following two broad questions:

* Whether post-school outcomes (in terms of early school leaving and participation in further education and training) of students from disadvantaged areas are similar to those of their counterparts from advantaged areas?
* Which socioeconomic characteristics of the local area contribute most to inequality in students’ post-school outcomes?

The report uses data from the 2003 cohort of the Longitudinal Surveys of Australian Youth and postcode-level data derived from the 2006 census for the investigation. It focuses on the effects of four neighbourhood characteristics — neighbourhood socioeconomic status, stability, household type and ethnic diversity — on student outcomes at ages 15, 17 and 19 years.

The next section provides a review of the Australian and international literature on neighbourhood effects on various socioeconomic outcomes. The third section provides a description of the data and the methods used for the analyses. This section also contains definitions of student outcomes and neighbourhood characteristics. The results are discussed in the fourth section. The fifth section includes outcomes of conducting robustness checks of the results. Finally, in the last section we draw some conclusions.

# Review of the literature

The last few decades have seen the development of an extensive literature on the neighbourhood effects on a range of socioeconomic outcomes for individuals. The outcomes include health and subjective wellbeing, transition from welfare to work, social and occupational mobility and education outcomes. Although the main theoretical foundation of neighbourhood effects research is in sociology, research on the topic is also undertaken in other disciplines such as psychology and economics. In this section, we provide a brief review of the Australian and international literature on this subject, mainly focusing on the studies which have investigated neighbourhood effects on educational outcomes.

## Australian studies

A number of studies have investigated the extent to which parental characteristics, and to some extent neighbourhood characteristics, are associated with the educational outcomes of young people in Australia. While not all studies focus on identifying the importance of neighbourhood characteristics per se, each provides relevant finding(s) for this research.

The studies have used a variety of datasets; outcome measures; geographical definitions of ‘neighbourhoods’; explanatory variables; and modelling techniques in the investigations. Rather than ‘neighbourhoods’ being defined by any clear theory promoting a particular economic or social construct, the definition by necessity is usually on the basis of spatial boundaries or localities, the precise nature of which has often depended on the availability of appropriate data (for example, data at the postcode level from the census).

The overall findings from these studies suggest neighbourhood effects to be significant in explaining educational outcomes even after controlling for individual and parental effects, although the size of the effects has varied.

Within this literature, three broad outcomes have been studied: ex-ante expectations of educational attainment or employment; educational attainment (for example, high school completion, university entrance etc.); and youth (un)employment.

Jensen and Seltzer (2000) studied the neighbourhood effects on the expectations for post-school study among a sample of Year 12 students from a small number of Melbourne high schools. The neighbourhood was defined as the postcode of the school the student attended, rather than the postcode where they lived. Jensen and Seltzer modelled the effect of four neighbourhood characteristics on students’ post-school study expectations. They estimated four models, each with a different neighbourhood characteristic and a set of control variables measuring individual and parental characteristics. Only one neighbourhood characteristic was included in each specification, possibly because of multicollinearity among the neighbourhood characteristics. The four neighbourhood characteristics were: mean income; unemployment rate; index of educational attainment and occupation; and percentage employed in professional occupations. The study found the first three neighbourhood characteristics significant in explaining the variation in student expectations. With only 171 students from ten schools participating in the study means that there are limits to how far the results can be generalised to the whole population.

In a follow-up study, Jensen and Harris (2008) investigated the neighbourhood effects on the post-school education expectations of Year 10 students in greater Melbourne. The study in this instance included 1207 students from 40 secondary schools from the government, Catholic and independent sectors, thus providing a firmer basis for generalising the results. Their results indicate significant neighbourhood effects on the outcome being investigated. Of the four neighbourhood measures included in their models, only occupational status and education were found to produce significant and reliable results. The two non-significant neighbourhood measures were unemployment and income. The results from this study suggest that neighbourhood measures that are proximate to the outcome measure are generally more significant, which is also what Manski (1993) and Ginther, Haveman and Wolfe (2000) found.

Overman (2002) investigated the effects of neighbourhood characteristics, at two different spatial levels, on young Australians’ decisions to leave school before completing the final year of school. Unlike Jensen and Harris (2008), he included several ‘large’ neighbourhood and ‘small’ neighbourhood variables, sometimes measuring the same characteristic of the population, in the model. The large neighbourhood was defined by the postcode boundary and the small neighbourhood by the collector district. The results from the study showed that the probability of dropping out of school early, after controlling for individual and parental effects, increased with the proportion of the population in the larger neighbourhood who held vocational qualifications, which can be interpreted as reflecting the structure of the local labour market. Classical labour market theory suggests that the high employment of people with vocational skills in an area is usually complemented by a high demand for unskilled labour, which may partly explain why young people (at least males) in these neighbourhoods have a higher tendency to leave school early. The study also showed that the socioeconomic status of the small neighbourhood had a significant but small negative effect on leaving school early. Relative to individual and parental effects, the neighbourhood effects were again generally smaller in size.

Cardak and McDonald (2004) investigated ethnic-specific neighbourhood effects on first- and second-generation immigrant youths’ probability of completing school in Australia and also on their probability of then enrolling in university. The ethnic-specific neighbourhood variables considered were, first, the particular ethnic group’s population density in the neighbourhood and, second, the proportion of the ethnic group in the neighbourhood holding higher education qualifications. The results showed positive neighbourhood effects on the two types of outcomes, although the effect on university enrolment was weaker for some immigrant groups (for example, first- and second-generation immigrants from Asia) than for the Australian-born.

Using a framework that took account of the influence of earlier school leaving decisions, Le and Miller (2005) investigated the determinants of participation in higher education by young Australians. The model included two neighbourhood effects, the local area (postcode level) unemployment rate, and the Index of Economic Resources, which captures the profile of the economic resources of families within the local area. Both neighbourhood variables were found to be insignificant in explaining the variation in participation in higher education by young people, although the individual’s place of residence (rural/metropolitan) was found to be a significant influence. The results indicate that young people from rural areas are less likely to attend university, mainly because they are less likely to stay at school beyond Year 10. The results also underscore the importance of the size of the spatial unit when investigating neighbourhood effects.

In contrast to Le and Miller’s findings, Cardak and Ryan (2009) found the Socioeconomic Indexes for Areas (SEIFA) index of education and occupation at the postcode level had a large and positive effect in predicting Year 12 completion, although its effect on predicting participation in higher education was largely insignificant.

Andrews, Green and Mangan (2004) considered the effects of three neighbourhood factors — income, the proportion of the working-age population with vocational qualifications and the proportion of the working-age population with degree or higher-level qualifications — on youth unemployment at age 18 years and 21 years. The first two neighbourhood factors were found to be small and negative in size but highly significant. This shows that the disadvantage, in terms of labour market outcomes, that young people endure growing up in low-income neighbourhoods, and to a slightly lesser extent in neighbourhoods with relatively few people with vocational qualifications, persists until they are at least 21 years old. The study also found the importance of family background on youth unemployment and the risk of the intergenerational transfer of joblessness spilling over to other proximate family units.

Finally, Edwards and Bromfield (2009) reported the neighbourhood effects on the conduct (emotional and behaviour) problems of children aged four to five years. They found neighbourhood socioeconomic status, neighbourhood safety and neighbourhood sense of belonging were significant in explaining the variation in conduct. The neighbourhood socioeconomic status was found to be mediated through the other two neighbourhood variables. The same study also investigated the neighbourhood effects on the pro-social behaviour of children. In this case, neighbourhood cleanliness and neighbourhood belonging were found to be positive and significant but neighbourhood socioeconomic status was insignificant. The study showed that neighbourhood influences can be significant even on the behavioural outcomes of very young children. It also demonstrated the mediating role of some variables in the modelling.

Overall, the findings from the Australian literature on neighbourhood effects are mixed. Most studies however find some evidence of an association between neighbourhood characteristics and young people’s developmental, educational and labour market outcomes, and only a few do not. The size of the effect generally tends to be small compared with the size of the effects of individual and parental characteristics.

## Selected international studies

Many of the key references in the international literature on neighbourhood effects have emanated from the United States, although interest in this area of research in the United Kingdom and Europe has increased recently. In the United States neighbourhood diversity is generally greater than in Australia, with larger geographical pockets of tangible disadvantage. As such, some of the initiatives in the United States addressing place-based relative disadvantage, while informative, may not be transferable to Australia. Notwithstanding this limitation, the initiatives attempted in the United States, some of which include randomised experimental designs, provide a means for addressing some of the key methodological issues that plague neighbourhood effects research, such as that of isolating neighbourhood effects from hard-to-measure individual and family factors, which affect both neighbourhood sorting and key outcomes.

An early influential study in this area was Jencks and Mayer (1990). Alongside a detailed review of the literature, the authors described the theoretical pathways through which neighbourhood characteristics can affect individual outcomes by way of behavioural change. Others have expanded on this work (Ellen & Turner 1997; Leventhal & Brooks-Gunn 2000; Dietz 2002; Sampson, Morenoff & Gannon-Rowley 2002). Proposed mechanisms by which neighbourhoods might exert influence include:

* peer effects
* socialisation with adults (other than parents) either within or outside the neighbourhood
* the quality of local services
* exposure to crime and violence
* spatial isolation and barriers to wider opportunities.

Most Australian studies (reviewed above) have used theoretical frameworks similar to those described in these key reviews and, thus, do not differ substantially in terms of the proposed mechanisms through which neighbourhoods may exert influence on outcomes. As in Australia, some of the key outcomes for young people investigated in the United States are: school test scores (Brooks-Gunn et al. 1993); behavioural problems (Case & Katz 1991; Elliott et al. 1996); dropping out of high school (Aaronson 1998; Crowder & South 2003); aspirations for college attendance (Stewart, Stewart & Simons 2007); and obtaining a post-school qualification (Plotnick & Hoffman 1999).

Where the United States literature deviates significantly is in the methods used to account for selection issues. Apart from using observational data, data from randomised experiments and quasi-experiments have also been used to study neighbourhood effects. This has led to the development of different methods of analysis and understanding of the possible causal pathways through which neighbourhood factors may affect outcomes. Some of these are discussed briefly below. (See Burdick-Will et al. 2011 for a more detailed discussion.)

In 1976, the Chicago Housing Authority, in response to a racial discrimination suit, began to provide housing vouchers to African-American residents to be used in neighbourhoods that were not predominantly black. The program, known as the ‘Gautreaux mobilityprogram’, provided a quasi-experimental dataset to investigate neighbourhood effects on social and educational outcomes. A 1988 follow-up of families who were involved in the program provided evidence that young adults who moved out of high-poverty areas in the city and into the suburbs were more likely to have finished high school and attended college than those who had stayed in the city, although improvements in their grade-point average were not significantly better (Rubinowitz & Rosenbaum 2000). In other words neighbourhood factors seemed to make a difference. As families had a choice to accept the offer to move or not, issues of selection bias remain.

Further evidence of the influence of neighbourhood characteristics on outcomes comes from records of the demolition of high-rise public housing in Chicago in the 1990s. People affected by the demolitions were offered the option to relocate to another unit in their current development; relocate to another public housing development; or accept a voucher to enable them to rent in the private sector. Jacob (2004) compared the school achievements of children whose families lived in units slated for closure with the achievements of peers living in units in the same project that were not closed to determine whether the neighbourhood had an effect. Jacob (2004) argued that selection was less of an issue in his model because the timing and nature of the closures were random. Unlike Rubinowitz and Rosenbaum (2000), however, Jacob did not find significant differences between the school achievements of children who moved away from high-rise public housing, but who still lived in high-poverty areas, and children who stayed in the high-rise housing.

The (positive) findings from the Gautreaux program motivated the US Department of Housing and Urban Development to implement a large-scale randomised mobility experiment called ‘Moving to Opportunity’ (MTO) in five cities (Baltimore, Boston, Chicago, Los Angeles and New York). Volunteer families were randomly assigned to one of three groups: the control group (no special MTO funding); a ‘housing voucher group’ (vouchers that were not restricted geographically); and an ‘experimental group’ (vouchers that were restricted for use in less poor areas). Results pertaining to the educational outcomes of children whose families moved have so far been mixed, with Sanbonmatsu et al. (2006) finding no significant difference on reading or maths scores four to seven years after the study began, and Kling, Liebman and Katz (2007) finding some improvement in high school graduation, but only for females. In contrast, improvements in other outcomes (such as involvement in crime and other behavioural problems) were significantly better among families who moved to less-poor areas. Most recently, Ludwig et al. (2013) examined the long-term impact (10—15 years after the start) of the Moving to Opportunity program. They found the program helped to improve several key adult mental and physical health outcomes, but still had no consistent detectable impact on children’s educational achievement, even for children who were of preschool age at the beginning of the study. For the latter, as the program led to very large changes in their neighbourhood conditions at a life stage when they may be most developmentally malleable, the conclusions reached by Ludwig et al. are that neighbourhood effects are of secondary importance. For educational outcomes, they argue that the long-term results of the Moving to Opportunity program do not provide support for the view that the high rates of school failure and non-employment in central city neighbourhoods are due to the direct adverse effects of living in a poor neighbourhood.

Harlem Children’s Zone (HCZ) is an ambitious social experiment which combines community programs with charter schools.[[1]](#footnote-1) In 2007, this experimental program was expanded to include a 97-block area in Harlem, New York, which combines ‘No Excuses’ charter schools with neighbourhood services designed to ensure that the social environment outside school is positive and supportive for children, from birth to college graduation. The program design was based on the assumption that both neighbourhoods and schools must be improved to affect student achievement. Dobbie and Fryer (2011) showed the causal impacts of HCZ charters on educational outcomes and suggested that the effects of attending an HCZ middle school were enough to close the black-white achievement gap in mathematics. They concluded that high-quality schools were enough to significantly increase academic achievement among the poor. They also argued that community programs appeared neither necessary nor sufficient.

In order to distil the independent effects of the ‘Harlem Children’s Zone’ neighbourhood supports from improvements in school quality, Dobbie and Fryer (2012) examined the differential treatment effects based upon how far from the boundaries of a Harlem Children’s Zone a child lived. Comparing lottery winners inside the zone to lottery winners outside the zone provided an estimate of the pure school quality effect. The results showed large positive treatment effects on an index of human capital outcomes. In contrast, comparing lottery losers outside the zone to lottery losers inside the zone provided an estimate of the neighbourhood effect, which turned out to be insignificant.

Based on evidence from the Moving to Opportunity program, Project STAR (an experimental class size reduction study in Tennessee held from 1985 until 1989), the Harlem Children’s Zone study and several other high-quality quasi-experimental studies, Fryer and Katz (2013) concluded that investments in school quality are more effective in decreasing persistent economic and educational inequalities. Neighbourhood improvements do matter but appear to be more relevant in reducing mental and physical health inequalities.

Previous empirical studies examining school outcomes have tended to consider the effects of schools or neighbourhoods but seldom the simultaneous effects of both in the same model. Owens (2010) and Jargowsky and El Komi (2011) are two studies that include both neighbourhood and school characteristics in the same model.

Using data from the US National Longitudinal Study of Adolescent Health, Owens (2010) analysed how school and neighbourhood contexts jointly affected high school and college graduation. She found that

some neighbourhood characteristics were significant in predicting both outcomes even after controlling for specific school factors. Several models were estimated, but each included only a single neighbourhood and a single school variable. The main conclusion from the paper was that changing the school that students attend while ignoring the characteristics of their neighbourhood does not eliminate (and may even exacerbate) the disadvantages of living in lower socioeconomic neighbourhoods. The study underscored the importance of jointly considering neighbourhood and school contexts in the research on student outcomes.

Jargowsky and El Komi (2011) investigated the effects of neighbourhood and school factors on the achievement in the maths and reading scores of more than 800 000 children from fifth to eighth grades in Texas. The findings from the study indicate that the school context was much more important in predicting achievement scores, even though neighbourhood characteristics, while not significant individually, were significant as a group. While the school context explained a greater degree of the variance in test scores than the neighbourhood context, different estimates were obtained if the school context variables were omitted or introduced as fixed effects. The neighbourhood characteristics in this study were based on where the student attended school and not on where the student lived. This means that the neighbourhood variables are less precisely measured and the estimates for the neighbourhood variables are biased towards zero. The authors concluded that, despite neighbourhood effects being less important than school effects, there was justification for concern about neighbourhood effects. They argued that the characteristics of families in the neighbourhood were a driving force in shaping the school environment and context even though other factors may also be influential in this respect. Furthermore, and at least in the United States, as schools are largely formed as a geographic overlay on residential segregation, reducing the concentration of poverty and economic segregation can only help to reduce the inequalities in outcomes for students.

Research on neighbourhood effects on educational outcomes has also been conducted in other countries. Recent examples include Gibbons (2002), McCulloch (2006), Gibbons, Silva and Weinhardt (2011), Weinhardt (2013) in the UK; Goux and Maurin (2006) in France; Andersson and Subramanian (2006) and Brannstrom (2008) in Sweden; Kauppinen (2007) in Finland; and Sykes and Kuyper (2009) in the Netherlands. Again, the results are somewhat mixed. While all studies found some evidence for a link between relative deprivation and poorer education outcomes, Brannstrom (2008) and Kauppinen (2007) argued that this was mainly mediated through school effects, while McCulloch (2006) found varying effects by age groups. All these studies are observational, although two are longitudinal cohorts (McCulloch 2006; Sykes & Kuyper 2009), and are, therefore, prone to the selection problem discussed throughout this review. To date, no large experimental studies, such as those from the United States, have been undertaken in Australia.

# Data, definitions and method

This section provides a brief description of the data used for this study; the definitions of the student outcome measures and neighbourhood characteristics; and an outline of the method for estimating the effects of the neighbourhood characteristics on student outcomes.

## Data

We use data from the first five waves of the 2003 cohort of LSAY. In these data the same students are interviewed each year. Unlike previous LSAY cohorts, a unique feature of this cohort is that it was drawn from the same sample of 15-year-olds in Australian schools who participated in the Programme for International Student Assessment (PISA), conducted by the Organisation for Economic Co-operation and Development (OECD), in 2003. This provides a unique opportunity to link data collected in PISA to LSAY and thus increase the richness of the information available for analysis. In particular, the PISA data enable us to investigate student outcomes at age 15 years, such as achievement in standardised tests, school attitudes, educational aspirations and application to study. The data also contain a randomised identifier for each school attended by students. This enables us to group students according to the school they attend and allows us to investigate fixed school effects on student outcomes.

The initial sample for the 2003 cohort of LSAY consisted of 10 370 individuals, from 1286 postcodes and 314 schools. Data were collected on the individual characteristics of students, their experience of school and also on the characteristics of their parents. Rothman (2007) provides more details on the sampling design employed for LSAY 2003.

Survey attrition is an issue in the reporting of longitudinal survey results such as from the LSAY data and can lead to biased population estimates. In LSAY, survey attrition is addressed by maximising the year-on-year response rate and through the application of attrition weights. Unfortunately, the students we are most interested in (for example, students with low academic achievement, early school leavers and students from low socioeconomic backgrounds) have the highest propensity to drop out of the survey. The attrition from the 2003 cohort of LSAY varied from year to year but by 2007 35.8% of the original sample had dropped out.

### Student characteristics

The sample included about equal numbers of males and females (see table 1). Most students were born in Australia; spoke English only at home; have a room of their own; have a place to study; and have a computer at home. Judging by the number of books available in the home, the degree of cultural capital is high among the student families.

Table 1 Percentage of students in sample by selected characteristics

|  |  |
| --- | --- |
| Variable | % in sample |
| Male | 49.7 |
| Australian-born | 89.0 |
| Indigenous | 5.7 |
| Only child in family | 6.5 |
| Youngest child in family | 40.8 |
| Speak English only at home | 92.5 |
| Living with both parents | 70.2 |
| Have own room | 91.5 |
| Have a place to study | 83.4 |
| Have a computer | 94.0 |
| Number of books in home |  |
| 0−10 | 4.4 |
| 11−25 | 8.6 |
| 26−100 | 27.9 |
| More than 100 | 59.1 |

Notes: Some values in this table may not match the published frequencies in Underwood and Sheldon (2005)
because of the differences in the way the variables are constructed for the purposes of this report.

Source: LSAY 2003 cohort.

### Parental characteristics

A little less than 43% of students lived in families with at least one parent who was born overseas (see table 2). In spite of this, the proportion of students who spoke a language other than English at home is relatively small. A high proportion of both mothers and fathers worked, with four out of every five mothers in white-collar jobs compared with three out of every five fathers. Furthermore, both parents have similar levels of education.

Table 2 Percentage of parents of students in sample by selected characteristics

|  |  |
| --- | --- |
| Variable | % in sample |
| Ethnicity (at least one parent born in) |  |
| New Zealand/UK | 16.6 |
| Asia | 9.3 |
| Other overseas country | 16.7 |
| Mother works | 72.0 |
| Father works | 90.0 |
| Mother’s job white collar | 78.9 |
| Father’s job white collar | 58.9 |
| Mother’s highest education level1 |  |
| Level 0−2 | 24.5 |
| Level 3−4 | 34.8 |
| Level 5−6 | 40.7 |
| Father’s highest education level1 |  |
| Level 0−2 | 23.4 |
| Level 3−4 | 34.6 |
| Level 5−6 | 42.0 |

Notes: 1 Levels are based on International Standard Classification of Education 1997 (ISCED97).
Level 0−2 includes pre-primary, primary and lower secondary and certificate I/II; level 3−4 includes
upper secondary and certificate III/IV; and level 5−6 includes diploma, advanced diploma, associate
degree and higher education qualifications.

 Some values in this table may not match the published frequencies in Underwood and Sheldon (2005)
because of the differences in the way the variables are constructed for the purposes of this report.

Source: LSAY 2003 cohort.

## Outcome measures

The student outcomes can be divided into two distinct groups. The first group is based on information collected from the PISA survey and includes:

* achievement (measured as standardised test score — average PISA score in reading, mathematics and science)
* attitudes (towards schooling)
* aspirations (expectation to complete a VET or a university-level qualification)
* application (time spent doing homework).[[2]](#footnote-2)

There are two advantages of using these outcome measures. First, we have information on them for the full sample and, therefore, do not have the problem of sample attrition. Second, they could be important determinants of young people’s future educational outcomes.

The achievement outcome is defined as the student’s standardised average PISA score in mathematics, reading and science.

The school attitude index is constructed using student responses, ranging from strongly agree (= 1) to strongly disagree (= 4), to four statements concerning the importance and benefits of school attendance. These statements are:

* School has done little to prepare me for adult life when I leave school.
* School has been a waste of time.
* School has helped give me confidence to make decisions.
* School has taught me things which could be useful in a job.

The index is constructed in such a way that its value increases with more positive attitudes toward school; in other words the coding for the responses for questions 3 and 4 was reversed before calculating the index.

Students’ aspirations are defined on the basis of their expectation to complete post-school qualifications. The information for it is derived from answers to a question in the PISA survey about the level of qualification students expected to complete. Two types of aspirations are identified for the purpose of this study — VET aspirations and university aspirations.[[3]](#footnote-3)

Students’ application is defined as the average hours per week spent completing homework or other learning tasks set by their teachers.

The second group of outcomes relates to students’ educational attainment at age 17 and 19 years. The first one is an indicator of whether a student continues to be engaged in some type of education and training (school, vocational education and training or university) or not past the minimum school leaving age. The second outcome is a three-level indicator of the educational status of the student at age 19 years. The three levels are:

1 not studying and have not completed any qualification (= 0)

2 completing or have completed a VET qualification (= 1)

3 completing or have completed a university qualification (= 2).

Level three can include individuals who have completed a VET qualification prior to enrolling in higher education. Data from multiple waves of the survey are used to construct the second group of outcomes. For instance, because some students turned 17 years in 2004 and others in 2005, data from Waves 2 and 3 are required to construct the educational attainment outcome at age 17 years.

The proportions of students in the sample with various outcomes at age 15, 17 and 19 years are shown in table 3. The achievement outcome is a standardised average PISA score and, therefore, by definition it is zero. The index of attitude is constructed from student responses to a number of questions and the table shows the average for all students in the sample. With the maximum value of four, the average of 3.2 indicates most students having a positive attitude to school.

At age 15 years, most students expect to complete a post-school qualification, but a much higher proportion has aspirations to complete a university rather than a VET qualification. These aspirations are not dissimilar to the aspirations of young people in some other countries. For instance, Kintrea, St Clair and Houston (2011) found that young people in the UK also have high aspirations for education as well as for work. They found that most young people aspired to go to university, and to find professional and managerial jobs in proportions far in excess of the availability of such jobs in the labour market. Their aspirations seem unaffected by the depressed labour markets at the time the survey was conducted. Young people’s aspirations however wane as they get older. While most students in the LSAY sample were still attached to some form of formal education and training at age 17 years, about a third was disengaged from any such activity by age 19 years.

Table 3 Percentage of students by outcomes at age 15, 17 and 19 years

|  |  |
| --- | --- |
| Outcome measure | % in sample |
| Outcomes at age 15 years |  |
| Achievement (standardised average PISA scores) | 0.01 |
| Index of attitude toward school (average) | 3.21 |
| VET aspirations | 18.6 |
| University aspirations | 62.8 |
| Application (average hours per week spent doing homework) | 5.6 |
| Outcome at age 17 years |  |
| At school or undertaking post-school qualification | 88.1 |
| Outcome at age 19 years |  |
| Not studying2 | 32.7 |
| Undertaking or completed a VET qualification | 31.3 |
| Undertaking or completed a university qualification | 35.9 |

Notes: 1 Average.

 2 Includes those who have not completed a qualification but excludes those who are still at school.

Source: LSAY 2003 cohort.

## Neighbourhood characteristics

The 2006 census and 2003 cohort of LSAY data both include postcode-level information. This means that we can link the average neighbourhood characteristics derived from the census data to the LSAY data.

About 20 neighbourhood characteristics were constructed from the 2006 census. Not all variables are usable because many are highly correlated with each other. For example, the proportion of individuals in a neighbourhood who had completed Year 12 is highly correlated (0.85) with weekly family income, and the proportion who speak only English at home is highly correlated (-0.83) with the proportion who were born in Asia. Including highly correlated variables in a multiple regression model is not recommended.[[4]](#footnote-4) This study uses a data reduction technique,[[5]](#footnote-5) which collapses the information from all the neighbourhood characteristics into four factors with very little loss of information, but at the same time overcoming the problem of the high correlation among some of the original variables. The four factors are:

* *Socioeconomic status*: this factor reflects the socioeconomic status of the neighbourhood. It is positively correlated with mean family income, mean weekly rent, the proportion of residents with post-school education and the proportion of residents in professional occupations.
* *Residential stability*: this factor is the converse of spatial mobility and residential turnover. It is positively correlated with the proportion of residents who lived at the same address one year ago as now, the proportion of residents who lived at the same address five years ago as now and the proportion of residents who own their home.
* *Household type*: this factor reflects the average household composition in the neighbourhood. It is positively correlated with the proportion of residents who are aged 65 years or older and the proportion of ‘lone’ person households. It is negatively correlated with the proportion of residents who are children. A high value for the factor reflects ‘old established’ neighbourhoods and a low-value new neighbourhoods.
* *Ethnic diversity*: this factor reflects the multicultural nature of the neighbourhood. It is highly correlated with the proportion of households in the neighbourhood of Asian descent and the proportion of households who do not speak English at home.

The strength of the bivariate relationship between a student outcome and a neighbourhood characteristic can be illustrated using a scatter plot and a line of best fit. For example, figures 1 and 2 show the relationships between each of the four neighbourhood factors and student achievement and VET aspirations, respectively. Clearly, neighbourhood socioeconomic status is positively associated with achievement and negatively associated with VET aspirations. This means that higher-achieving students are more likely to be living in more prosperous neighbourhoods and students with VET aspirations are more likely to be living in less prosperous neighbourhoods. In comparison, the other neighbourhood characteristics are only weakly associated with the outcomes for students at age 15. In the following sections we investigate whether these relationships change when we control for individual, parental and school characteristics.

Figure 1 Relationship between achievement at age 15 years and neighbourhood characteristics



Figure 2 Relationship between VET aspirations at age 15 years and neighbourhood characteristics

## Method

The previous section showed some neighbourhood characteristics (for example, neighbourhood socioeconomic status) to be strongly correlated with young people’s educational outcomes. Many earlier studies have reported similar results. Drawing conclusions about the importance of neighbourhood effects based on such bivariate relationships can however be misleading because these relationships may be driven by other factors (confounders) associated with both neighbourhood characteristics and student outcomes.

The confounders may exist at the household or school level. An example of a household level confounder is parental education. Parents with high levels of education generally earn higher wages, which in turn enables them to in live in more prosperous neighbourhoods. The same parents are also likely to have children with higher educational attainment because they are able to invest more in their children’s educational development. An example of a school-level confounder is high-quality resources (for example, teachers, principal, pupil—teacher ratio etc.) available to a school relative to the composition of its student population.[[6]](#footnote-6) While some cast doubt on the impact that resources, particularly more expenditure, may have on student outcomes (for example, Hanushek 1997, 2008), others tend to suggest a positive impact (for example, Cobb-Clark & Jha 2013; Gibbons, McNally & Viarengo 2012; Machin, McNally & Meghir 2007; Krueger & Whitmore 2001; Vignoles et al. 2000). At the same time there is evidence to suggest that schools with high levels of quality resources are often located in high socioeconomic neighbourhoods (Lamb 2007).

To control for the presence of confounding variables, each student outcome is modelled in a multiple regression[[7]](#footnote-7) framework, in which individual, parental, school and neighbourhood characteristics are simultaneously controlled. The control variables are sequentially introduced in the model to allow us to assess the robustness of any neighbourhood effects on outcomes.

In the first model (Model 1) only four neighbourhood characteristics are included as covariates. Individual- and parental-level covariates are added in the second specification of the model (Model 2) and school fixed effects in the third (Model 3). The third model is our preferred specification. The inclusion of school fixed effects effectively controls for all school-level confounding variables that are fixed across students. This means that the neighbourhood effects are identified from differences in the neighbourhoods and outcomes between students attending the same school. This then allows us to determine whether outcomes are different for two students in the same school, one living in a high socioeconomic neighbourhood and the other in a disadvantaged neighbourhood.

# Results

A large number of models of varying complexity were estimated in order to study the effects of neighbourhood[[8]](#footnote-8) characteristics on young people’s outcomes at age 15, 17 and 19 years. The full results for each model are included in the appendix. The student, parental and neighbourhood characteristics in the models are defined in the previous section of this report. The discussion below will focus mainly on the neighbourhood effects on student outcomes.

## Student outcomes at age 15 years

Three models were estimated for each outcome at age 15 years.[[9]](#footnote-9) In the first model, neighbourhood characteristics only are included. Individual and parental characteristics are added in the second model, and school fixed effects, which capture all observed and unobserved characteristics of the school context, in the third. Table 4 shows the estimates of the neighbourhood effects only for this set of models (see tables A2—A6 in the appendix for the full set of results).

Some significant results from Model 1 are:

* Neighbourhood socioeconomic status (socioeconomic status) is significant and positive for all outcomes except VET aspirations, for which it is negative. This means that students living in more prosperous neighbourhoods are less likely to have VET aspirations.
* Neighbourhood stability is positively related to students’ achievement. It is also positively related to students’ application to homework, although this relationship is slightly weaker.
* Household type is strongly related to students’ achievement and to their university aspirations. This means that students living in more ‘established’ neighbourhoods are more likely to have higher achievement scores and higher university aspirations.
* Ethnic diversity is positively related to university aspirations and to application to homework. This result is unsurprising and has been shown in previous research.

When individual and parental characteristics are introduced into the model, as in Model 2, the neighbourhood effects generally have the same signs as in Model 1, and where the sign is reversed the effect is not significant. However some neighbourhood characteristics continue to be significant predictors — over and above individual and parental characteristics — of student achievement, aspirations and application, but not attitudes to school. Unsurprisingly, the estimates of the effects are generally smaller in size. The change in the size of the model fit (R-squared value) from Model 1 to 2 also indicates that the individual and parental characteristics account for a substantially higher proportion of the explained component of the model than neighbourhood characteristics.

School fixed effects are introduced in Model 3 to control for the variation in the characteristics of schools. The statistical importance of the neighbourhood characteristics almost all disappear in this model, thus demonstrating that school characteristics are indeed important confounding factors. What this means is that neighbourhood characteristics, particularly neighbourhood socioeconomic status, are correlated with the characteristics of the school and their influence is mediated through the school fixed effects.

The school fixed effects control for the differences in all observable or unobservable characteristics across schools, such as the differences in the quality of schools and their student intake.[[10]](#footnote-10) Examples of indicators of school quality may include better facilities, higher-quality teachers and principals, smaller class sizes, and ‘quality’ peers. (For example, see Krueger & Whitmore 2001; Branch, Hanushek & Rivkin 2012; Coelli & Green 2012; Angrist & Lavy 1999; Lee & Barro 2001.) The ‘quality’ of schools is also affected by the selection of students into schools. The intake of students into most non-government schools depends on the ability of parents to pay the school fees and, therefore, indirectly on the characteristics of parents. In most government schools, priority of entry is given first to students living in the neighbourhood of the school, but in a number of states there are some selective government schools with ability-based entry and these draw students from across many neighbourhoods. Although only students who sit for the selective schools entry exams and do well in them are selected for these schools, students who do not sit these exams are also by default ‘selected’, but into other schools. New South Wales has the highest number of selective schools of any state or territory.

As all the across-school variation is accounted for by the school fixed effects, what remains is the within-school variation. This means that the estimated neighbourhood effects are identified from differences in the outcomes between students at the same school who live in different neighbourhoods.

Neighbourhood stability exerts a significant independent positive influence on students’ achievement even after controlling for school fixed effects. High neighbourhood stability means lower turnover in students’ peer groups in the neighbourhood where they live but also within the school they attend. This then provides for a more stable social environment for students, which in turn helps them to focus more attention on learning tasks.

Neighbourhood socioeconomic status has a significant effect on students’ application, but contrary to expectation the effect is negative. This suggests that students living in high socioeconomic neighbourhoods spend, on average, less time doing homework than similar students living in low socioeconomic neighbourhoods.

Table 4 Effects of neighbourhood characteristics on student outcomes at age 15 years

|  |  |  |  |
| --- | --- | --- | --- |
|  | Model 1 | Model 2 | Model 3 |
| Covariate | Achievement |
| Neighbourhood characteristic |  |  |  |
| Socioeconomic status | 0.280\*\*\* | 0.130\*\*\* | 0.009 |
| Stability | 0.065\*\*\* | 0.064\*\*\* | 0.033\*\*\* |
| Household type | 0.078\*\*\* | 0.087\*\*\* | 0.016 |
| Ethnic diversity | -0.033\*\* | -0.008 | -0.004 |
| *Individual and parental characteristics* | Excluded | Included | Included |
| *School fixed effects* | Excluded | Excluded | Included |
| R-squared | 0.081 | 0.321 | 0.411 |
|  | Attitude |
| Neighbourhood characteristic |  |  |  |
| Socioeconomic status | 0.033\*\*\* | 0.008 | -0.011 |
| Stability | 0.005 | -0.005 | 0.004 |
| Household type | 0.012\*\* | 0.008 | 0.005 |
| Ethnic diversity | 0.011 | 0.007 | 0.009 |
| *Individual and parental characteristics* | Excluded | Included | Included |
| *School fixed effects* | Excluded | Excluded | Included |
| R-squared | 0.006 | 0.055 | 0.106 |
|  | VET aspirations |
| Neighbourhood characteristic |  |  |  |
| Socioeconomic status | -0.038\*\*\* | -0.020\*\*\* | -0.003 |
| Stability | -0.002 | 0.002 | -0.001 |
| Household type | -0.008\* | -0.007 | -0.001 |
| Ethnic diversity | -0.009\* | 0.001 | 0.001 |
| *Individual and parental characteristics* | Excluded | Included | Included |
| *School fixed effects* | Excluded | Excluded | Included |
| R-squared | 0.011 | 0.036 | 0.083 |
|  | University aspirations |
| Neighbourhood characteristic |  |  |  |
| Socioeconomic status | 0.093\*\*\* | 0.030\*\*\* | 0.002 |
| Stability | 0.006 | -0.007 | -0.008 |
| Household type | 0.018\*\*\* | 0.010\*\* | -0.004 |
| Ethnic diversity | 0.039\*\*\* | 0.017\*\*\* | -0.001 |
| *Individual and parental characteristics* | Excluded | Included | Included |
| *School fixed effects* | Excluded | Excluded | Included |
| R-squared | 0.051 | 0.195 | 0.244 |
|  | Application |
| Neighbourhood characteristic |  |  |  |
| Socioeconomic status | 0.616\*\*\* | 0.283\*\*\* | -0.233\*\* |
| Stability | 0.146\*\* | 0.184\*\*\* | 0.049 |
| Household type | 0.178\*\* | 0.254\*\*\* | 0.061 |
| Ethnic diversity | 0.603\*\*\* | 0.354\*\*\* | 0.003 |
| *Individual and parental characteristics* | Excluded | Included | Included |
| *School fixed effects* | Excluded | Excluded | Included |
| R-squared | 0.038 | 0.144 | 0.233 |

Notes: \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

Source: LSAY 2003 cohort.

We now briefly discuss the effects of individual and parental characteristics on outcomes from Model 3. A summary of the results is in table 5. In general, the results are consistent with what has been reported in the literature (for example, see Jensen & Harris 2008.)

The results show girls have higher achievement scores, better attitudes to schooling, higher university aspirations and they spend more time doing homework than boys, but there is no gender difference in terms of VET aspirations. Students who were born in Australia have higher achievement scores than students who were born overseas.

Indigenous Australians do less well against all measures, with the exception of VET aspirations. Data on VET enrolments from the National VET Provider Collection also show the participation rate in vocational education and training for young Indigenous Australians to be significantly higher than for non-Indigenous Australians of the same age.[[11]](#footnote-11) Young people’s aspirations are often developed through adult role models in the community they live in. What these results perhaps indicate is that, while young Indigenous Australians may have positive role models in adults with VET qualifications, they lack role models who hold higher education qualifications.

Students who speak only English at home are more likely to have VET aspirations and less likely to have university aspirations than other students. They also have a poorer attitude to school and for doing homework.

Students with at least one parent born in Asia have higher achievement scores; higher university aspirations; lower VET aspirations; and spend more time doing schoolwork than other students. Similarly, students living with both parents generally have better outcomes, particularly with respect to time spent doing homework.

While having their own room in the home generally has little influence on most student outcomes, having a place to study seems important for all outcomes except VET aspirations. However, the possibility of reverse causation, whereby children who want to study look for a place where they can study, makes this effect difficult to interpret.

Few studies have investigated the effects of computers in the home on educational outcomes for young people, although many studies have investigated the effects of computers in the classroom on outcomes. (See Noll et al. 2000 for review of this literature.) Educational theory is not developed enough to predict whether computers in the home have a positive or negative effect on educational outcomes (Fairlie, Beltran & Das 2010). Computers in the home are useful for completing assignments and may facilitate learning through research and educational software. On the other hand, video games, the negative use, or overuse, of social media and the internet can be distractions from more active and focused forms of learning. Consistent with results from a number of previous studies (for example, Attewell & Battle 1999; Fairlie 2005; Schmitt & Wadsworth 2006), our results suggest having a computer at home has a positive effect on students’ achievement, school attitudes and university aspirations. Interestingly, using data from PISA 2000, Fuchs and Woessmann (2004) show a negative relationship between student achievement and computers at home, which suggests that perhaps the way computers in the home are used has changed.

Having books in the home is often considered a sign of cultural capital. Our results show the more books there are in the home the better are all student outcomes except VET aspirations. Crook (1997) also finds parental reading habits and having a climate in the home in which reading is emphasised are positively related to educational outcomes for students. Bourdieu’s cultural capital theory (Bourdieu & Passeron 1990) also postulates such a result, but only if the measure of cultural capital is widened to include parental reading behaviour (De Graaf, De Graaf & Kraaykamp 2000; De Graaf & De Graaf 2000).

The effects of parental characteristics on student outcomes are mixed. While having both parents working has a negative impact on the amount of time a student spends doing homework, students with parents in white-collar jobs achieve higher test scores. On the other hand, only father’s occupation appears to have a significant effect on student aspirations. Parents’ education is a strong predictor of a student’s achievement and university aspirations but the father’s education is significant for predicting the time a student spends on homework.

Table 5 Effects of individual and parental characteristics on student outcomes at age 15 years

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Covariate | Achievement | Attitude | VET aspirations | University aspirations | Application |
| Individual level |  |  |  |  |  |
| Male | -0.044\*\* | -0.061\*\*\* | 0.009 | -0.130\*\*\* | -1.308\*\*\* |
| Australian-born | 0.071\*\* | 0.013 | 0.007 | -0.010 | -0.117 |
| Indigenous | -0.486\*\*\* | 0.006 | 0.046\*\* | -0.049\*\* | -0.594\*\*\* |
| Only child in family | 0.082\*\* | -0.040\* | -0.033\*\* | 0.052\*\*\* | 0.266 |
| Youngest child in family | -0.071\*\*\* | -0.010 | 0.023\*\*\* | -0.041\*\*\* | -0.440\*\*\* |
| Speak English only at home | 0.036 | -0.069\*\*\* | 0.053\*\*\* | -0.119\*\*\* | -1.215\*\*\* |
| Grade level in 2003 | 0.406\*\*\* | 0.001 | -0.013 | 0.018\* | 1.422\*\*\* |
| Live with both parents | 0.027 | 0.029\*\* | -0.029\*\*\* | 0.020\* | 0.296\*\*\* |
| Have own room | 0.023 | -0.054\*\*\* | 0.009 | 0.003 | -0.232 |
| Have study place | 0.140\*\*\* | 0.199\*\*\* | -0.006 | 0.091\*\*\* | 0.472\*\*\* |
| Have computer | 0.318\*\*\* | 0.055\*\* | -0.029 | 0.112\*\*\* | -0.035 |
|  Number of books in home1 |  |  |  |  |  |
|  0−10 books in home | -0.457\*\*\* | -0.103\*\*\* | 0.007 | -0.135\*\*\* | -1.665\*\*\* |
|  11−25 book in home | -0.408\*\*\* | -0.062\*\*\* | 0.045\*\*\* | -0.158\*\*\* | -1.099\*\*\* |
|  26−100 books in home | -0.257\*\*\* | 0.001 | 0.026\*\*\* | -0.091\*\*\* | -0.475\*\*\* |
| Parental level |  |  |  |  |  |
| Ethnicity (either parent born in) |  |  |  |  |
|  New Zealand/UK | 0.000 | -0.003 | -0.004 | -0.010 | -0.280\*\* |
|  Asia | 0.117\*\*\* | 0.022 | -0.042\*\*\* | 0.126\*\*\* | 1.606\*\*\* |
|  Other overseas country | -0.074\*\*\* | 0.012 | -0.034\*\*\* | 0.072\*\*\* | 0.124 |
|  Mother works | -0.019 | -0.008 | 0.013 | -0.004 | -0.262\*\* |
|  Father works | -0.054\* | -0.010 | -0.011 | -0.020 | -0.399\*\* |
|  Mother’s job white collar | 0.144\*\*\* | 0.003 | -0.006 | 0.033\*\* | -0.087 |
|  Father’s job white collar | 0.136\*\*\* | 0.021\* | -0.025\*\*\* | 0.061\*\*\* | 0.168 |
|  Mother’s highest education2 |  |  |  |  |  |
|  Level 0−2 | -0.027 | -0.018 | 0.039\*\*\* | -0.072\*\*\* | -0.083 |
|  Level 3−4 | -0.081\*\*\* | -0.008 | 0.040\*\*\* | -0.066\*\*\* | 0.070 |
|  Father’s highest education2 |  |  |  |  |  |
|  Level 0−2 | -0.100\*\*\* | -0.029\* | -0.007 | -0.119\*\*\* | -0.665\*\*\* |
|  Level 3−4 | -0.084\*\*\* | -0.025\* | 0.026\*\* | -0.082\*\*\* | -0.447\*\*\* |

Notes:1 Omitted reference category is ‘More than 100 books’.

2 Levels are based on ISCED97. Levels 0−2 includes pre-primary, primary and lower secondary and certificate I/II; level 3−4 includes upper secondary and certificate III/IV, diploma and advanced diploma; and level 5−6 includes higher education qualifications. Omitted reference category is level 5−6.

\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

Source: LSAY 2003 cohort.

## Student outcomes at age 17 years

The student outcomes at age 17 years relate to whether the student continues to be engaged with some type of education and training (school, vocational education and training or university) or not after the compulsory school leaving age. Four models with varying sets of covariates were estimated to study the effects of neighbourhood characteristics on the outcome. In all cases a linear probability model was fitted to the data. Table 6 gives a summary of the results relating to only neighbourhood effects. (The full results from the modelling are in table A7 in the appendix.)

As before, Model 1 includes neighbourhood characteristics only as explanatory variables in the specification. Apart from household type, all neighbourhood characteristics are significant for predicting the student outcome. In other words, students living in prosperous neighbourhoods, with high residential stability or high ethnic diversity, are more likely to continue with education and training past the minimum school leaving age.

When individual and parental characteristics are included in the model, as in Model 2, the fit of the model improves substantially (R-squared increases from .014 to .067), but the impact of neighbourhood characteristics is much less now. There is further improvement in the model fit and a reduction in the impact of neighbourhood characteristics when school fixed effects are included in the model (see results for Model 3). Any positive effect of living in an advantaged area is mediated through the fixed school effects. The results lend further support to the notion that prosperous neighbourhoods have ‘better’ schools which promote further education and training.

In the final model (Model 4) prior student attributes measured at age 15 years (that is, achievement, attitude, university aspirations, VET aspirations and application) are added to the model specification. The prior student attributes implicitly capture the influence of unobserved individual factors from previous years that may be relevant to student outcomes. As in Model 3, the influence of neighbourhood characteristics on student outcome is minimal. The student attributes measured at age 15 years are, however, highly significant in predicting outcomes. All attributes, apart from VET aspirations, have a positive influence on a student continuing with education and training. This means that having VET aspirations at age 15 does not necessarily translate into a VET course pathway. The reason for this could be a lack of information on VET options or poor career guidance for students as they go through school.

The full results in table A7 in the appendix show that the effects of many individual and parental characteristics are smaller in magnitude in Model 4. What this indicates is that some aspects of individual and parental effects are mediated through student attributes.

The individual-level variables still exerting independent influence on the student outcome are: whether a student has a computer at home; whether the student is an only child; and whether the student is living with both parents. Being an only child or living with both parents increases the attention, care and other resources for the student, which in turn influences the student’s decision to continue with further education and training past the compulsory school leaving age. Access to a computer at home is essential for students’ learning. In 2003, 94% of students had a computer at home for schoolwork. This percentage is likely to be even higher now.

Table 6 Effects of neighbourhood characteristics on student outcomes at age 17 years

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Covariate | Model 1 | Model 2 | Model 3 | Model 4 |
| Neighbourhood characteristic |  |  |  |  |
| Socioeconomic status | 0.031\*\*\* | 0.015\*\*\* | 0.002 | 0.002 |
| Stability | 0.017\*\*\* | 0.004 | 0.004 | 0.003 |
| Household type | 0.011\*\* | 0.004 | 0.001 | 0.000 |
| Ethnic diversity | 0.013\*\*\* | 0.007\*\* | 0.004 | 0.003 |
| Individual and parental characteristics | Excluded | Included | Included | Included |
| *School fixed effects* | Excluded | Excluded | Included | Included |
| *Attributes at age 15 years1* | Excluded | Excluded | Excluded | Included |
| R-squared | 0.014 | 0.067 | 0.116 | 0.141 |

Notes: 1 The attributes are 1) achievement 2) attitude 3) VET aspirations 4) university aspirations 5) application.\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

Source: LSAY 2003 cohort.

## Student outcomes at age 19 years

By age 19 years, most students will have left school. Their post-school outcomes could be one of:

* VET outcome (completed or completing a VET qualification)
* university outcome (completed or completing a university qualification)
* non-study outcome (not completed or not completing any post-school qualification).

As previously, we estimated four models to investigate the neighbourhood effects on these outcomes. Because the outcome is categorical and unordered, a multinomial logit model was fitted to the data in each case. Table 7 shows a summary of the results relating to only the neighbourhood effects. (The full results for Model 4 are in table A8 in the appendix.[[12]](#footnote-12)) For ease of interpretation, the table includes the mean marginal effects[[13]](#footnote-13) on the probability of a VET outcome and the mean marginal effects on the probability of a university outcome.[[14]](#footnote-14)

The results from Model 1, which includes neighbourhood characteristics only in the specification, show neighbourhood characteristics are once again significant in predicting university and VET outcomes, although the effects are weaker for the latter.

In the model which includes individual and parental characteristics as control variables (see Model 2), the effects of neighbourhood characteristics are still significant although the size of the effects is generally smaller. The neighbourhood effects almost all disappear when school fixed effects and student attributes at age 15 years are included in the model (see Models 3 and 4). These results are consistent with the earlier results and once again show that school fixed effects are important confounding variables.

The full results for Model 4 in table A8 in the appendix show that student attributes at age 15 years are generally significant in predicting outcomes at age 19 years. The results relating to aspirations underscore the importance of motivating young people at an early age. Mentoring through appropriate adult role models can help students to aspire for particular education and training outcomes. The importance of mentoring at an early age, especially for Indigenous children, cannot be underestimated.

Prior achievement and attitude to school are also important factors in predicting the student outcomes at age 19 years. While the effects of these are positive for the university outcome, their effects for the VET outcome are negative.

Only gender, among all individual and parental characteristics, has an independent effect on the VET outcome in Model 4. The probability of a VET outcome for a male is 6.3% higher than for a female. On the other hand the probability of a university outcome for a female is 6.5% higher.

In contrast, the following individual and parental characteristics exert significant, positive, independent influence on the university outcome:

* speaking a language other than English at home
* living with both parents
* at least one parent born in Asia
* father’s education.

Interestingly, none of the student outcomes at age 19 years are influenced by whether the student has access to a computer at home or not.

Table 7 Mean marginal effects of neighbourhood characteristics on student outcomes at age 19 years

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Covariate | Model 1 | Model 2 | Model 3 | Model 4 |
|  | VET outcome |
| Neighbourhood characteristic |  |  |  |  |
| Socioeconomic status | -0.073\*\*\* | -0.048\*\*\* | -0.011 | -0.012 |
| Stability | 0.007 | 0.009 | 0.004 | 0.005 |
| Household type | -0.019\*\*\* | -0.019\*\*\* | 0.005 | 0.006 |
| Ethnic diversity | -0.012\* | -0.001 | 0.011 | 0.013 |
| *Individual and parental characteristics* | Excluded | Included | Included | Included |
| *School fixed effects* | Excluded | Excluded | Included | Included |
| *Outcomes at age 15 years1* | Excluded | Excluded | Excluded | Included |
|  | University outcome |
| Neighbourhood characteristic |  |  |  |  |
| Socioeconomic status | 0.089\*\*\* | 0.045\*\*\* | 0.004 | 0.007 |
| Stability | 0.014\*\* | 0.014\* | -0.007 | -0.010 |
| Household type | 0.027\*\*\* | 0.033\*\*\* | -0.018 | -0.021\* |
| Ethnic diversity | 0.048\*\*\* | 0.023\*\*\* | 0.009 | 0.006 |
| *Individual and parental characteristics* | Excluded | Included | Included | Included |
| *School fixed effects* | Excluded | Excluded | Included | Included |
| *Attributes at age 15 years1* | Excluded | Excluded | Excluded | Included |
| Pseudo R-squared | 0.027 | 0.096 | 0.121 | 0.211 |

Notes: 1 The attributes at age 15 years are 1) achievement; 2) attitude; 3) aspirations to complete a VET qualification; 4) aspirations to complete a university qualification; 5) application.

 The marginal effects in this table are the average marginal effects calculated by computing the marginal effect for each person and then averaging the effects.

\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

Source: LSAY 2003 cohort.

# How robust are the results?

The models that we estimated to study the effects of neighbourhood characteristics on student outcomes make a number of assumptions. In this section we test a selected number of these assumptions to check whether the results change significantly when these assumptions are relaxed.

First, we check whether the definition of the neighbourhood makes a difference to the results, because, as Overman (2002) has shown, neighbourhood effects can manifest differently at different spatial levels. In the analysis above, the neighbourhood characteristics have been defined at the postcode level. This is because the lowest geographical level at which individuals are coded in the LSAY data is at the residential postcode. In the following we check whether the results obtained for student outcomes at age 19 years change materially when the neighbourhood is defined at the state electoral division (SED) level rather than at the postcode level.

Table 8 shows the results from estimating such a model. While the state electoral division level neighbourhood effects are consistent with postcode-level neighbourhood effects, they are generally smaller in magnitude. The reduction in the size of the effects may be because the state electoral division is a poor proxy for the ‘true’ geographical spatial unit for defining a neighbourhood and, therefore, includes measurement error.[[15]](#footnote-15) It follows, although not with certainty, that if the definition of a neighbourhood is over a smaller geographical area (for example, Census Statistical Area Level 1), then neighbourhood effects are likely to be larger in magnitude.

All models estimated until now assume that the neighbourhood characteristics have a linear effect on outcomes.[[16]](#footnote-16) We relax this assumption in Model 3 for student outcomes at age 19 years by replacing the continuous neighbourhood socioeconomic status variable with neighbourhood status deciles. The approach allows us a larger degree of flexibility in terms of capturing the underlying pattern in the relationships. The marginal effects of neighbourhood socioeconomic status are shown in table 9. As none of the deciles has a significant effect relative to the first decile (the reference category), we can conclude that the original assumption about linearity is robust.

Table 8 Mean marginal effects of neighbourhood (state electoral division) characteristics on student outcomes at age 19 years

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Covariate | Model 1 | Model 2 | Model 3 | Model 4 |
|  | VET outcome |
| Neighbourhood characteristic |  |  |  |  |
| Socioeconomic status | -0.062\*\*\* | -0.038\*\*\* | -0.006 | -0.012 |
| Stability | 0.015\*\* | 0.016\*\* | 0.006 | 0.009 |
| Household type | -0.023\*\*\* | -0.023\*\*\* | -0.006 | -0.007 |
| Ethnic diversity | -0.022\*\*\* | -0.012\* | -0.001 | 0.004 |
| *Individual and parental characteristics* | Excluded | Included | Included | Included |
| *School fixed effects* | Excluded | Excluded | Included | Included |
| *Attributes at age 15 years1* | Excluded | Excluded | Excluded | Included |
|  | University outcome |
| Neighbourhood characteristic |  |  |  |  |
| Socioeconomic status | 0.075\*\*\* | 0.032\*\*\* | -0.001 | 0.004 |
| Stability | 0.013\* | 0.013\* | 0.019\*\* | 0.017\* |
| Household type | 0.036\*\*\* | 0.043\*\*\* | 0.012 | 0.014 |
| Ethnic diversity | 0.064\*\*\* | 0.040\*\*\* | 0.022\* | 0.015 |
| *Individual and parental characteristics* | Excluded | Included | Included | Included |
| *School fixed effects* | Excluded | Excluded | Included | Included |
| *Attributes at age 15 years1* | Excluded | Excluded | Excluded | Included |
| Pseudo R-squared  | 0.0274 | 0.0971 | 0.1214 | 0.2110 |

Notes: 1 The attributes are 1) achievement; 2) attitude; 3) aspirations to complete a VET qualification; 4) aspirations to complete a university qualification; 5) application.

\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

Source: LSAY 2003 cohort.

Table 9 Mean marginal effects of neighbourhood socioeconomic status by deciles on student outcomes at age 19 years (Model 3)

|  |  |  |
| --- | --- | --- |
| Decile | VET outcome | University outcome |
| Second | 0.027 | 0.001 |
| Third | -0.012 | 0.003 |
| Fourth | 0.012 | -0.016 |
| Fifth | 0.015 | 0.002 |
| Sixth | 0.012 | 0.031 |
| Seventh | -0.004 | 0.028 |
| Eighth | -0.020 | 0.018 |
| Ninth | -0.032 | 0.014 |
| Tenth | -0.029 | 0.013 |

Notes: \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%. Results based on Model 3 in table 6.

Source: LSAY 2003 cohort.

Parents select to send their children to government or non-government schools (Catholic or independent). They may also select to send their children to the local school or to a school outside the neighbourhood. For example, most students attending selective state schools would travel from outside their neighbourhood to attend the school. We check the importance of such selection on student outcomes at age 19 years. We do this by estimating Model 3 separately for each group. The results are included in table 10.

There is insufficient evidence to suggest that neighbourhood factors affect VET or university outcomes for students in government schools. Only weak evidence exists to suggest that the VET outcome of students in non-government schools is (negatively) affected by the neighbourhood socioeconomic status.

Similarly, little evidence exists to suggest that the outcomes for students attending non-local schools are affected by neighbourhood factors. In contrast, household type (neighbourhoods with a high proportion of established households) does have a significant impact on outcomes for students who attend local schools.

Table 10 Mean marginal effects of neighbourhood characteristics on student outcomes at age 19 years by sub-sample

|  |  |
| --- | --- |
|  | Marginal effects |
| Neighbourhood characteristic | Government schools | Non-government schools | Local schools | Non-local schools |
|  | VET outcome |
| Neighbourhood characteristic |  |  |  |  |
| Socioeconomic status | 0.012 | -0.028\* | 0.022 | -0.021 |
| Stability | 0.003 | 0.003 | -0.007 | 0.008 |
| Household type | 0.012 | 0.002 | 0.039\*\* | -0.008 |
| Ethnic diversity | 0.017 | 0.007 | 0.026 | 0.006 |
| *Individual and parental characteristics* | Included | Included | Included | Included |
| *School fixed effects* | Included | Included | Included | Included |
| *Attributes at age 15 years1* | Excluded | Excluded | Excluded | Excluded |
|  | University outcome |
| Neighbourhood characteristic |  |  |  |  |
| Socioeconomic status | -0.010 | 0.014 | 0.003 | 0.001 |
| Stability | -0.006 | -0.009 | -0.010 | -0.006 |
| Household type | -0.014 | -0.025 | -0.043\*\*\* | -0.008 |
| Ethnic diversity | 0.002 | 0.017 | -0.004 | 0.015 |
| *Individual and parental characteristics* | Included | Included | Included | Included |
| *School fixed effects* | Included | Included | Included | Included |
| *Attributes at age 15 years1* | Excluded | Excluded | Excluded | Excluded |
| Pseudo R-squared  | 0.213 | 0.217 | 0.1214 | 0.2110 |

Notes: 1 The attributes are 1) achievement; 2) attitude; 3) aspirations to complete a VET qualification; 4) aspirations to complete a university qualification; 5) application.

\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

Source: LSAY 2003 cohort.

Finally, we examine the robustness of our results with respect to the chosen characterisation of neighbourhoods. Up to now, neighbourhoods have been described using four factors (socioeconomic status, stability, household type and ethnic diversity) derived from the 2006 Australian Census. It is however possible that these factors fail to capture the neighbourhood conditions that are important for student outcomes. To investigate this possibility we again model the student outcomes at age 19 years, but with neighbourhood factors derived using the Victorian and New South Wales postcode-level data from Vinson (2007) and representing approximately 20 measures of disadvantage, many of which are not captured in the census data (for example, domestic violence, psychiatric admissions, court convictions). Again, we use the principal component method to collapse the Vinson data into four factors, which are broadly representative of education, mental stability/violence, household type and income, with higher scores generally representing ‘better’ neighbourhoods (apart from household type, which has an ambiguous interpretation). The results of the analysis, in table 11, show that using a different characterisation of neighbourhoods does not alter our main conclusions; namely, that once school fixed effects are included in the model, the predictive power of neighbourhood factors are substantially reduced.

Overall, the analyses in this section provide evidence for the robustness of our main results and suggest that the relationship between neighbourhood characteristics and student outcomes operates through the pathway where ‘better’ neighbourhoods have ‘better’ schools.

Table 11 Mean marginal effects of alternative neighbourhood characteristics on student outcomes at age 19 years

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Covariate | Model 1 | Model 2 | Model 3 | Model 4 |
|  | VET outcome |
| Neighbourhood characteristic |  |  |  |  |
| Education | -0.050\*\*\* | -0.026\*\* | 0.007 | 0.005 |
| Mental stability/violence | 0.011 | 0.008 | 0.004 | 0.009 |
| Household type | -0.013 | -0.026\*\* | -0.018 | -0.016 |
| Income | -0.038\*\*\* | -0.036\*\*\* | -0.032 | -0.035 |
| *Individual and parental characteristics* | Excluded | Included | Included | Included |
| *School fixed effects* | Excluded | Excluded | Included | Included |
| *Attributes at age 15 years1* | Excluded | Excluded | Excluded | Included |
|  | University outcome |
| Neighbourhood characteristic |  |  |  |  |
| Education | 0.076\*\*\* | 0.043\*\*\* | 0.004 | 0.020 |
| Mental stability/violence | 0.015 | 0.020\* | 0.020 | 0.017 |
| Household type | 0.003 | 0.029\*\* | 0.011 | 0.014 |
| Income | 0.002 | -0.001 | 0.002 | -0.006 |
| *Individual and parental characteristics* | Excluded | Included | Included | Included |
| *School fixed effects* | Excluded | Excluded | Included | Included |
| *Attributes at age 15 years1* | Excluded | Excluded | Excluded | Included |
| Pseudo R-squared  | 0.0274 | 0.0971 | 0.1214 | 0.2110 |

Notes: 1 The attributes are 1) achievement; 2) attitude; 3) aspirations to complete a VET qualification; 4) aspirations to complete a university qualification; 5) application.

\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

Source: LSAY 2003 cohort.

# Conclusions

This report has investigated the effects of neighbourhood characteristics on young Australians’ educational outcomes at age 15, 17 and 19 years. It uses the 2003 cohort of LSAY as the primary data source, to which postcode-level neighbourhood characteristics, derived from the 2006 census, are linked. The 2003 cohort of LSAY is a sub-sample of the PISA 2003 survey, which means that much richer data are available for analysis.

The study considered the effects of a number of neighbourhood characteristics on student outcomes — neighbourhood socioeconomic status, stability, household type and ethnic diversity — measured at the postcode level.

As the relationships between neighbourhood characteristics and student outcomes are often driven by other factors (confounders) that are correlated with both the neighbourhood characteristics and student outcomes, each student outcome was modelled in a multiple regression framework with controls for individual, parental, school and neighbourhood characteristics. The control variables were sequentially introduced into the model, thus allowing us to assess in detail the influence of any neighbourhood effects on student outcomes.

The neighbourhood characteristics were found to have small but significant effects on student outcomes in models that included individual and parental characteristics as controls. The most important neighbourhood characteristic was socioeconomic status, but the other three characteristics also had a role in explaining the variation in the student outcomes.

Neighbourhood characteristics were generally found to be statistically insignificant in explaining the student outcomes in models with school fixed effects. However, school fixed effects capture all the differences, observed and unobserved, in the characteristics of schools, including teaching quality, financial and other resources, culture, quality of the student intake etc. But because the characteristics of neighbourhoods where students live are generally mirrored in the composition of schools, these are also captured by the school fixed effects. In the models analysed in this report, neighbourhood characteristics are, therefore, probably mediated through school fixed effects. Separating the neighbourhood effects from school effects is thus complicated and requires detailed measures of both the school and neighbourhood contexts. Some of the most empirically important characteristics of schools may be difficult to measure.

The school fixed effects allow for the identification of neighbourhood effects from differences in outcomes between students at the same school who live in different neighbourhoods. The results thus indicate that outcomes are unlikely to be significantly different for two students with similar individual and parental characteristics, attending the same school, but living in neighbourhoods with different levels of socioeconomic status.

A possible conclusion from this research is that inequalities in student outcomes may be reduced by a better allocation of resources to schools. The evidence for this, however, is indirect and this research does not provide guidance on the aspects of school quality and resources that are most likely to make a difference. Ways other than increased funding to address the disparity in student outcomes between schools could include different ways of allocating principals and teachers to schools and perhaps also students to schools.

Student attributes measured at age 15 years, such as achievement, attitudes towards schooling, aspiration and application to school work, are particularly important for explaining student outcomes. Many individual and parental influences are probably mediated through these attributes. Hence, in models with these attributes, fewer individual and parental characteristics have an independent influence on student outcomes.

Student aspirations developed at an early age are important in predicting the post-school destinations of young people, with VET aspirations significant in predicting a VET outcome and university aspirations for predicting a university outcome. Mentoring efforts that help to shape the aspirations of children at an early age are likely to return a positive payoff later in terms of improved post-school outcomes. The result is of particular relevance for young Indigenous children who often lack appropriate role models. Achievement scores at age 15 years reflect the innate ability of students and thus has a strong positive influence on a university outcome. Attitude to school at age 15 years also has a positive influence on a university outcome. This is probably because attitudes formed at an early age either persist or are reinforced by the action of others such as parents and schools.

The analysis provides information for the average case. A closer examination of the data shows that some neighbourhoods with below-average socioeconomic status have above-average student outcomes, and vice versa. While the current data allow us to identify these neighbourhoods, they are inadequate for identifying factors that may explain student outcomes in these neighbourhoods. In the second part of this research project, we use qualitative methods to identify the critical factors that may be responsible for such divergent results in a selected number of neighbourhoods in Victoria and South Australia.

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# Appendix

Table A1 Rotated factor loadings of census-level covariates

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
| Per cent with post-school qualifications | 0.851 | -0.062 | 0.048 | 0.230 |
| Per cent working full-time | -0.073 | 0.008 | -0.100 | 0.138 |
| Per cent with same address as 1 year ago | -0.093 | 0.966 | 0.089 | 0.141 |
| Per cent with same address as 5 years ago | -0.098 | 0.935 | 0.256 | 0.181 |
| Mean family income | 0.947 | -0.014 | -0.069 | -0.026 |
| Inequality in family income1 | 0.928 | 0.017 | 0.103 | 0.036 |
| Mean weekly rent | 0.793 | -0.094 | -0.139 | 0.185 |
| Inequality in weekly rent2 | 0.789 | -0.111 | 0.102 | 0.040 |
| Per cent unemployed | -0.278 | -0.046 | 0.072 | 0.284 |
| Per cent do not speak English at home | -0.024 | 0.088 | -0.038 | 0.935 |
| Per cent with no internet connection | -0.839 | -0.079 | 0.451 | -0.015 |
| Per cent in professional occupations | 0.871 | 0.106 | 0.324 | -0.128 |
| Per cent Australian citizen | -0.207 | 0.104 | 0.067 | -0.656 |
| Per cent aged 65 years or older | -0.083 | 0.259 | 0.806 | -0.139 |
| Per cent aged 0 to 14 years | -0.346 | -0.015 | -0.872 | -0.105 |
| Per cent own or buying property | 0.182 | 0.787 | -0.262 | -0.172 |
| Per cent born in Asia | 0.073 | 0.125 | -0.046 | 0.919 |
| Per cent living in lone-person households | -0.060 | -0.267 | 0.868 | -0.141 |
| Per cent married | 0.146 | 0.626 | -0.425 | -0.159 |
| Per cent living in a detached house | -0.255 | 0.507 | -0.426 | -0.303 |

Notes: 1 Standard deviation in family income computed from the categorical income variable.

2 Standard deviation in weekly rent computed from the categorical weekly rent variable.

Data source: Australian Census 2006.

Table A2 Determinants of student achievement at age 15 years

|  |  |  |  |
| --- | --- | --- | --- |
| Covariate | Model 1 | Model 2 | Model 3 |
| Coef. | t-stat | Coef. | t-stat | Coef. | t-stat |
| Neighbourhood level |  |  |  |  |  |  |
| Socioeconomic status | 0.280\*\*\* | 20.85 | 0.130\*\*\* | 12.21 | 0.009 | 0.58 |
| Stability | 0.065\*\*\* | 4.59 | 0.064\*\*\* | 6.07 | 0.033\*\*\* | 2.71 |
| Household type | 0.078\*\*\* | 5.70 | 0.087\*\*\* | 8.06 | 0.016 | 1.35 |
| Ethnic diversity | -0.033\*\* | -2.20 | -0.008 | -0.70 | -0.004 | -0.32 |
| Individual level |  |  |  |  |  |  |
| Male |  |  | -0.037\*\* | -2.11 | -0.044\*\* | -2.41 |
| Australian-born |  |  | 0.092\*\*\* | 2.72 | 0.071\*\* | 2.18 |
| Indigenous |  |  | -0.482\*\*\* | -11.89 | -0.486\*\*\* | -12.01 |
| Only child in family |  |  | 0.120\*\*\* | 3.11 | 0.082\*\* | 2.19 |
| Youngest child in family |  |  | -0.072\*\*\* | -4.20 | -0.071\*\*\* | -4.32 |
| Speak English only at home |  |  | 0.052 | 1.31 | 0.036 | 1.02 |
| Grade level in 2003 |  |  | 0.409\*\*\* | 23.71 | 0.406\*\*\* | 22.80 |
| Live with both parents |  |  | 0.074\*\*\* | 3.65 | 0.027 | 1.42 |
| Have own room |  |  | 0.044 | 1.35 | 0.023 | 0.71 |
| Have study place |  |  | 0.161\*\*\* | 7.27 | 0.140\*\*\* | 6.46 |
| Have computer |  |  | 0.336\*\*\* | 8.61 | 0.318\*\*\* | 8.52 |
|  Number of books in home1 |  |  |  |  |  |  |
|  0−10 books in home |  |  | -0.529\*\*\* | -12.65 | -0.457\*\*\* | -11.58 |
|  11−25 books in home |  |  | -0.458\*\*\* | -13.55 | -0.408\*\*\* | -12.72 |
|  26−100 books in home |  |  | -0.300\*\*\* | -14.10 | -0.257\*\*\* | -12.56 |
| Parental level |  |  |  |  |  |  |
|  Ethnicity (either parent born in) |  |  |  |  |  |  |
|  New Zealand/UK |  |  | -0.006 | -0.24 | 0.000 | 0.01 |
|  Asia |  |  | 0.262\*\*\* | 7.10 | 0.117\*\*\* | 3.70 |
|  Other overseas country |  |  | -0.104\*\*\* | -3.98 | -0.074\*\*\* | -3.00 |
| Mother works |  |  | -0.010 | -0.54 | -0.019 | -1.02 |
| Father works |  |  | -0.023 | -0.74 | -0.054\* | -1.78 |
| Mother’s job white collar |  |  | 0.189\*\*\* | 8.05 | 0.144\*\*\* | 6.29 |
| Father’s job white collar |  |  | 0.177\*\*\* | 8.74 | 0.136\*\*\* | 6.56 |
|  Mother’s highest education2 |  |  |  |  |  |  |
|  Level 0−2 |  |  | -0.083\*\*\* | -3.56 | -0.027 | -1.19 |
|  Level 3−4 |  |  | -0.123\*\*\* | -5.60 | -0.081\*\*\* | -3.87 |
|  Father’s highest education2 |  |  |  |  |  |  |
|  Level 0−2 |  |  | -0.158\*\*\* | -6.02 | -0.100\*\*\* | -3.95 |
|  Level 3−4 |  |  | -0.134\*\*\* | -6.24 | -0.084\*\*\* | -4.09 |
| School level |  |  |  |  |  |  |
| School fixed effects | Excluded |  | Excluded |  | Included |  |
| Sample size | 10142 |  | 10142 |  | 10142 |  |
| R-squared | 0.081 |  | 0.321 |  | 0.411 |  |
| Adjusted R-squared | 0.080 |  | 0.318 |  | 0.390 |  |

Notes: 1 Omitted reference category is ‘More than 100 books’.

 2 Levels are based on ISCED97. Level 0−2 includes pre-primary, primary and lower secondary and certificate I/II; level 3−4 includes upper secondary and certificate III/IV, diploma and advanced diploma; and level 5−6 includes higher education qualifications. Omitted reference category is level 5−6.

\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

Source: LSAY 2003 cohort.

Table A3 Determinants of student attitude to school at age 15 years

|  |  |  |  |
| --- | --- | --- | --- |
| Covariate | Model 1 | Model 2 | Model 3 |
| Coef. | t-stat | Coef. | t-stat | Coef. | t-stat |
| Neighbourhood level |  |  |  |  |  |  |
| Socioeconomic status | 0.033\*\*\* | 5.78 | 0.008 | 1.43 | -0.011 | -1.10 |
| Stability | 0.005 | 0.77 | -0.005 | -0.94 | 0.004 | 0.47 |
| Household type | 0.012\*\* | 2.21 | 0.008 | 1.44 | 0.005 | 0.62 |
| Ethnic diversity | 0.011 | 1.60 | 0.007 | 0.99 | 0.009 | 1.02 |
| Individual level |  |  |  |  |  |  |
| Male |  |  | -0.058\*\*\* | -5.90 | -0.061\*\*\* | -5.45 |
| Australian-born |  |  | 0.013 | 0.65 | 0.013 | 0.61 |
| Indigenous |  |  | 0.010 | 0.39 | 0.006 | 0.23 |
| Only child in family |  |  | -0.025 | -1.16 | -0.040\* | -1.85 |
| Youngest child in family |  |  | -0.012 | -1.08 | -0.010 | -0.94 |
| Speak English only at home |  |  | -0.056\*\* | -2.32 | -0.069\*\*\* | -2.73 |
| Grade level in 2003 |  |  | -0.007 | -0.75 | 0.001 | 0.12 |
| Live with both parents |  |  | 0.042\*\*\* | 3.60 | 0.029\*\* | 2.51 |
| Have own room |  |  | -0.068\*\*\* | -3.55 | -0.054\*\*\* | -2.77 |
| Have study place |  |  | 0.201\*\*\* | 13.35 | 0.199\*\*\* | 13.17 |
| Have computer |  |  | 0.054\*\* | 2.33 | 0.055\*\* | 2.31 |
|  Number of books in home1 |  |  |  |  |  |  |
|  0−10 books in home |  |  | -0.095\*\*\* | -3.37 | -0.103\*\*\* | -3.70 |
|  11−25 books in home |  |  | -0.061\*\*\* | -3.32 | -0.062\*\*\* | -3.29 |
|  26−100 books in home |  |  | -0.004 | -0.38 | 0.001 | 0.10 |
| Parental level |  |  |  |  |  |  |
|  Ethnicity (either parent born in) |  |  |  |  |  |  |
|  New Zealand/UK |  |  | -0.009 | -0.66 | -0.003 | -0.22 |
|  Asia |  |  | 0.027 | 1.28 | 0.022 | 1.03 |
|  Other overseas country |  |  | 0.016 | 1.05 | 0.012 | 0.77 |
| Mother works |  |  | -0.014 | -1.21 | -0.008 | -0.65 |
| Father works |  |  | -0.017 | -0.90 | -0.010 | -0.54 |
| Mother’s job white collar |  |  | 0.013 | 0.91 | 0.003 | 0.19 |
| Father’s job white collar |  |  | 0.030\*\*\* | 2.59 | 0.021\* | 1.80 |
|  Mother’s highest education2 |  |  |  |  |  |  |
|  Level 0−2 |  |  | -0.024 | -1.64 | -0.018 | -1.20 |
|  Level 3−4 |  |  | -0.014 | -1.06 | -0.008 | -0.58 |
|  Father’s highest education2 |  |  |  |  |  |  |
|  Level 0−2 |  |  | -0.038\*\* | -2.47 | -0.029\* | -1.91 |
|  Level 3−4 |  |  | -0.028\*\* | -2.19 | -0.025\* | -1.91 |
| School level |  |  |  |  |  |  |
| School fixed effects | Excluded |  | Excluded |  | Included |  |
| Sample size | 9828 |  | 9828 |  | 9828 |  |
| R-squared | 0.006 |  | 0.055 |  | 0.106 |  |
| Adjusted R-squared | 0.006 |  | 0.050 |  | 0.072 |  |

Notes: 1 Omitted reference category is ‘More than 100 books’.

2 Levels are based on ISCED97. Level 0−2 includes pre-primary, primary and lower secondary and certificate I/II; level 3–4 includes upper secondary and certificate III/IV, diploma and advanced diploma; and level 5−6 includes higher education qualifications. Omitted reference category is level 5–6. \*Significant at 10%; \*\*Significant at 5%; \*\*\*significant at 1%.

Source: LSAY 2003 cohort.

Table A4 Determinants of student aspirations at age 15 years – to complete a VET qualification

|  |  |  |  |
| --- | --- | --- | --- |
| Covariate | Model 1 | Model 2 | Model 3 |
| Coef. | t-stat | Coef. | t-stat | Coef. | t-stat |
| Neighbourhood level |  |  |  |  |  |  |
| Socioeconomic status | -0.038\*\*\* | -9.52 | -0.020\*\*\* | -4.74 | -0.003 | -0.41 |
| Stability | -0.002 | -0.43 | 0.002 | 0.37 | -0.001 | -0.09 |
| Household type | -0.008\* | -1.86 | -0.007 | -1.58 | -0.001 | -0.12 |
| Ethnic diversity | -0.009\* | -1.75 | 0.001 | 0.19 | 0.001 | 0.11 |
| Individual level |  |  |  |  |  |  |
| Male |  |  | 0.008 | 1.02 | 0.009 | 1.01 |
| Australian-born |  |  | -0.004 | -0.27 | 0.007 | 0.52 |
| Indigenous |  |  | 0.054\*\* | 2.43 | 0.046\*\* | 2.02 |
| Only child in family |  |  | -0.041\*\* | -2.51 | -0.033\*\* | -2.01 |
| Youngest child in family |  |  | 0.024\*\*\* | 2.77 | 0.023\*\*\* | 2.60 |
| Speak English only at home |  |  | 0.048\*\*\* | 3.10 | 0.053\*\*\* | 3.34 |
| Grade level in 2003 |  |  | -0.012 | -1.47 | -0.013 | -1.42 |
| Live with both parents |  |  | -0.032\*\*\* | -3.45 | -0.029\*\*\* | -3.05 |
| Have own room |  |  | 0.014 | 0.99 | 0.009 | 0.63 |
| Have study place |  |  | -0.011 | -0.97 | -0.006 | -0.47 |
| Have computer |  |  | -0.031 | -1.60 | -0.029 | -1.51 |
|  Number of books in home1 |  |  |  |  |  |  |
|  0−10 books in home |  |  | 0.009 | 0.41 | 0.007 | 0.30 |
|  11−25 books in home |  |  | 0.052\*\*\* | 3.45 | 0.045\*\*\* | 3.02 |
|  26−100 books in home |  |  | 0.031\*\*\* | 3.48 | 0.026\*\*\* | 2.90 |
| Parental level |  |  |  |  |  |  |
|  Ethnicity (either parent born in) |  |  |  |  |  |  |
|  New Zealand/UK |  |  | 0.000 | 0.01 | -0.004 | -0.35 |
|  Asia |  |  | -0.057\*\*\* | -4.31 | -0.042\*\*\* | -3.14 |
|  Other overseas country |  |  | -0.036\*\*\* | -3.44 | -0.034\*\*\* | -3.09 |
| Mother works |  |  | 0.013 | 1.33 | 0.013 | 1.36 |
| Father works |  |  | -0.011 | -0.75 | -0.011 | -0.77 |
| Mother’s job white collar |  |  | -0.009 | -0.78 | -0.006 | -0.52 |
| Father’s job white collar |  |  | -0.032\*\*\* | -3.49 | -0.025\*\*\* | -2.68 |
|  Mother’s highest education2 |  |  |  |  |  |  |
|  Level 0−2 |  |  | 0.039\*\*\* | 3.40 | 0.039\*\*\* | 3.37 |
|  Level 3−4 |  |  | 0.043\*\*\* | 4.50 | 0.040\*\*\* | 4.20 |
|  Father’s highest education2 |  |  |  |  |  |  |
|  Level 0−2 |  |  | 0.005 | 0.37 | -0.007 | -0.57 |
|  Level 3−4 |  |  | 0.031\*\*\* | 2.88 | 0.026\*\* | 2.35 |
| School level |  |  |  |  |  |  |
| School fixed effects | Excluded |  | Excluded |  | Included |  |
| Sample size | 10135 |  | 10135 |  | 10135 |  |
| R-squared | 0.011 |  | 0.036 |  | 0.083 |  |
| Adjusted R-squared | 0.011 |  | 0.032 |  | 0.049 |  |

Notes: 1 Omitted reference category is ‘More than 100 books’.

2 Levels are based on ISCED97. Level 0−2 includes pre-primary, primary and lower secondary and certificate I/II; level 3–4 includes upper secondary and certificate III/IV, diploma and advanced diploma; and level 5−6 includes higher education qualifications. Omitted reference category is level 5–6.

 \*Significant at 10%; \*\*Significant at 5%; \*\*\*significant at 1%.

Source: LSAY 2003 cohort.

Table A5 Determinants of student aspirations at age 15 years – to complete a university qualification

|  |  |  |  |
| --- | --- | --- | --- |
| Covariate | Model 1 | Model 2 | Model 3 |
| Coef. | t-stat | Coef. | t-stat | Coef. | t-stat |
| Neighbourhood level |  |  |  |  |  |  |
| Socioeconomic status | 0.093\*\*\* | 16.44 | 0.030\*\*\* | 5.83 | 0.002 | 0.21 |
| Stability | 0.006 | 1.16 | -0.007 | -1.46 | -0.008 | -1.27 |
| Household type | 0.018\*\*\* | 2.95 | 0.010\*\* | 2.04 | -0.004 | -0.58 |
| Ethnic diversity | 0.039\*\*\* | 5.47 | 0.017\*\*\* | 2.76 | -0.001 | -0.12 |
| Individual level |  |  |  |  |  |  |
| Male |  |  | -0.117\*\*\* | -12.80 | -0.130\*\*\* | -12.41 |
| Australian-born |  |  | -0.004 | -0.28 | -0.010 | -0.67 |
| Indigenous |  |  | -0.061\*\*\* | -2.77 | -0.049\*\* | -2.28 |
| Only child in family |  |  | 0.063\*\*\* | 3.47 | 0.052\*\*\* | 2.80 |
| Youngest child in family |  |  | -0.041\*\*\* | -4.28 | -0.041\*\*\* | -4.28 |
| Speak English only at home |  |  | -0.129\*\*\* | -7.62 | -0.119\*\*\* | -6.78 |
| Grade level in 2003 |  |  | 0.010 | 1.09 | 0.018\* | 1.82 |
| Live with both parents |  |  | 0.036\*\*\* | 3.44 | 0.020\* | 1.90 |
| Have own room |  |  | -0.004 | -0.21 | 0.003 | 0.14 |
| Have study place |  |  | 0.100\*\*\* | 7.83 | 0.091\*\*\* | 7.02 |
| Have computer |  |  | 0.122\*\*\* | 5.95 | 0.112\*\*\* | 5.66 |
|  Number of books in home1 |  |  |  |  |  |  |
|  0−10 books in home |  |  | -0.143\*\*\* | -6.08 | -0.135\*\*\* | -5.79 |
|  11−25 books in home |  |  | -0.175\*\*\* | -9.99 | -0.158\*\*\* | -8.92 |
|  26−100 books in home |  |  | -0.100\*\*\* | -8.81 | -0.091\*\*\* | -7.89 |
| Parental level |  |  |  |  |  |  |
|  Ethnicity (either parent born in) |  |  |  |  |  |  |
|  New Zealand/UK |  |  | -0.019 | -1.50 | -0.010 | -0.77 |
|  Asia |  |  | 0.156\*\*\* | 9.80 | 0.126\*\*\* | 7.72 |
|  Other overseas country |  |  | 0.083\*\*\* | 6.43 | 0.072\*\*\* | 5.44 |
| Mother works |  |  | -0.006 | -0.58 | -0.004 | -0.38 |
| Father works |  |  | -0.022 | -1.33 | -0.020 | -1.19 |
| Mother’s job white collar |  |  | 0.043\*\*\* | 3.33 | 0.033\*\* | 2.48 |
| Father’s job white collar |  |  | 0.075\*\*\* | 6.80 | 0.061\*\*\* | 5.39 |
|  Mother’s highest education2 |  |  |  |  |  |  |
|  Level 0−2 |  |  | -0.085\*\*\* | -6.18 | -0.072\*\*\* | -5.19 |
|  Level 3−4 |  |  | -0.076\*\*\* | -6.69 | -0.066\*\*\* | -5.81 |
|  Father’s highest education2 |  |  |  |  |  |  |
|  Level 0−2 |  |  | -0.137\*\*\* | -9.31 | -0.119\*\*\* | -8.03 |
|  Level 3−4 |  |  | -0.093\*\*\* | -7.91 | -0.082\*\*\* | -6.90 |
| School level |  |  |  |  |  |  |
| School fixed effects | Excluded |  | Excluded |  | Included |  |
| Sample size | 10132 |  | 10132 |  | 10132 |  |
| R-squared | 0.051 |  | 0.195 |  | 0.244 |  |
| Adjusted R-squared | 0.051 |  | 0.192 |  | 0.216 |  |

Notes: 1 Omitted reference category is ‘More than 100 books’.

2 Levels are based on ISCED97. Level 0−2 includes pre-primary, primary and lower secondary and certificate I/II; level 3–4 includes upper secondary and certificate III/IV, diploma and advanced diploma; and level 5−6 includes higher education qualifications. Omitted reference category is level 5–6.

\*Significant at 10%; \*\*Significant at 5%; \*\*\*significant at 1%.

Source: LSAY 2003 cohort.

Table A6 Determinants of student application to schoolwork at age 15 years

|  |  |  |  |
| --- | --- | --- | --- |
| Covariate | Model 1 | Model 2 | Model 3 |
| Coef. | t-stat | Coef. | t-stat | Coef. | t-stat |
| Neighbourhood level |  |  |  |  |  |  |
| Socioeconomic status | 0.616\*\*\* | 8.66 | 0.283\*\*\* | 4.32 | -0.233\*\* | -2.47 |
| Stability | 0.146\*\* | 2.30 | 0.184\*\*\* | 3.27 | 0.049 | 0.66 |
| Household type | 0.178\*\* | 2.57 | 0.254\*\*\* | 4.21 | 0.061 | 0.79 |
| Ethnic diversity | 0.603\*\*\* | 6.82 | 0.354\*\*\* | 4.72 | 0.003 | 0.03 |
| Individual level |  |  |  |  |  |  |
| Male |  |  | -1.359\*\*\* | -13.75 | -1.308\*\*\* | -12.42 |
| Australian-born |  |  | 0.112 | 0.59 | -0.117 | -0.61 |
| Indigenous |  |  | -0.828\*\*\* | -4.54 | -0.594\*\*\* | -3.28 |
| Only child in family |  |  | 0.522\*\* | 2.37 | 0.266 | 1.23 |
| Youngest child in family |  |  | -0.439\*\*\* | -4.51 | -0.440\*\*\* | -4.65 |
| Speak English only at home |  |  | -1.337\*\*\* | -5.29 | -1.215\*\*\* | -4.63 |
| Grade level in 2003 |  |  | 1.411\*\*\* | 14.83 | 1.422\*\*\* | 13.82 |
| Live with both parents |  |  | 0.594\*\*\* | 5.26 | 0.296\*\*\* | 2.63 |
| Have own room |  |  | -0.281 | -1.53 | -0.232 | -1.30 |
| Have study place |  |  | 0.602\*\*\* | 4.72 | 0.472\*\*\* | 3.67 |
| Have computer |  |  | 0.088 | 0.43 | -0.035 | -0.17 |
|  Number of books in home1 |  |  |  |  |  |  |
|  0−10 books in home |  |  | -1.835\*\*\* | -8.77 | -1.665\*\*\* | -7.88 |
|  11−25 books in home |  |  | -1.237\*\*\* | -7.77 | -1.099\*\*\* | -6.93 |
|  26−100 books in home |  |  | -0.551\*\*\* | -4.82 | -0.475\*\*\* | -4.29 |
| Parental level |  |  |  |  |  |  |
|  Ethnicity (either parent born in) |  |  |  |  |  |  |
|  New Zealand/UK |  |  | -0.321\*\* | -2.51 | -0.280\*\* | -2.23 |
|  Asia |  |  | 2.035\*\*\* | 9.29 | 1.606\*\*\* | 7.18 |
|  Other overseas country |  |  | 0.392\*\* | 2.57 | 0.124 | 0.83 |
| Mother works |  |  | -0.263\*\* | -2.32 | -0.262\*\* | -2.34 |
| Father works |  |  | -0.248 | -1.30 | -0.399\*\* | -2.09 |
| Mother’s job white collar |  |  | 0.019 | 0.15 | -0.087 | -0.71 |
| Father’s job white collar |  |  | 0.345\*\*\* | 3.03 | 0.168 | 1.44 |
|  Mother’s highest education2 |  |  |  |  |  |  |
|  Level 0−2 |  |  | -0.266\* | -1.80 | -0.083 | -0.57 |
|  Level 3−4 |  |  | -0.106 | -0.82 | 0.070 | 0.57 |
|  Father’s highest education2 |  |  |  |  |  |  |
|  Level 0−2 |  |  | -0.869\*\*\* | -6.03 | -0.665\*\*\* | -4.72 |
|  Level 3−4 |  |  | -0.543\*\*\* | -4.14 | -0.447\*\*\* | -3.49 |
| School level |  |  |  |  |  |  |
| School fixed effects | Excluded |  | Excluded |  | Included |  |
| Sample size | 9331 |  | 9331 |  | 9331 |  |
| R-squared | 0.038 |  | 0.144 |  | 0.233 |  |
| Adjusted R-squared | 0.038 |  | 0.139 |  | 0.202 |  |

Notes: 1 Omitted reference category is ‘More than 100 books’.

2 Levels are based on ISCED97. Level 0−2 includes pre-primary, primary and lower secondary and certificate I/II; level 3–4 includes upper secondary and certificate III/IV, diploma and advanced diploma; and level 5−6 includes higher education qualifications. Omitted reference category is level 5–6.

\*Significant at 10%; \*\*Significant at 5%; \*\*\*significant at 1%.

Source: LSAY 2003 cohort.

Table A7 Determinants of student outcomes at age 17 years

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Covariate | Model 1 |  | Model 2 |  | Model 3 |  | Model 4 |  |
| Coef. | t-stat | Coef. | t-stat | Coef. | t-stat | Coef. | t-stat |
| Neighbourhood level |  |  |  |  |  |  |  |  |
| Socioeconomic status | 0.031\*\*\* | 8.52 | 0.015\*\*\* | 4.31 | 0.002 | 0.42 | 0.002 | 0.38 |
| Stability | 0.017\*\*\* | 5.16 | 0.004 | 1.10 | 0.004 | 0.79 | 0.003 | 0.59 |
| Household type | 0.011\*\* | 2.56 | 0.004 | 0.88 | 0.001 | 0.15 | 0.000 | 0.02 |
| Ethnic diversity | 0.013\*\*\* | 4.26 | 0.007\*\* | 2.13 | 0.004 | 0.82 | 0.003 | 0.61 |
| Individual level |  |  |  |  |  |  |  |  |
| Male |  |  | 0.006 | 0.94 | 0.004 | 0.56 | 0.017\*\* | 2.15 |
| Australian-born |  |  | 0.012 | 0.95 | 0.008 | 0.59 | 0.006 | 0.45 |
| Indigenous |  |  | -0.073\*\*\* | -3.19 | -0.055\*\* | -2.43 | -0.036 | -1.55 |
| Only child in family |  |  | 0.052\*\*\* | 4.12 | 0.045\*\*\* | 3.51 | 0.037\*\*\* | 2.90 |
| Youngest child |  |  | -0.010 | -1.28 | -0.009 | -1.14 | -0.002 | -0.28 |
| Speak English only |  |  | -0.034\*\*\* | -2.65 | -0.030\*\* | -2.24 | -0.021 | -1.55 |
| Grade level in 2003 |  |  | -0.065\*\*\* | -8.44 | -0.052\*\*\* | -6.31 | -0.070\*\*\* | -8.14 |
|  Live with both parents |  | 0.055\*\*\* | 6.08 | 0.050\*\*\* | 5.64 | 0.046\*\*\* | 5.36 |
|  Have own room |  |  | -0.038\*\*\* | -2.88 | -0.033\*\* | -2.47 | -0.031\*\* | -2.29 |
|  Have study place |  |  | 0.029\*\*\* | 2.86 | 0.025\*\* | 2.35 | 0.010 | 0.91 |
|  Have computer |  |  | 0.105\*\*\* | 4.67 | 0.097\*\*\* | 4.37 | 0.074\*\*\* | 3.30 |
|  No. of books in home1 |  |  |  |  |  |  |  |  |
|  0−10 books in home |  |  | -0.037\* | -1.69 | -0.042\* | -1.91 | -0.012 | -0.53 |
|  11−25 books in home |  | -0.042\*\*\* | -2.65 | -0.038\*\* | -2.39 | -0.009 | -0.60 |
|  26−100 books in home |  | -0.020\*\* | -2.36 | -0.017\* | -1.89 | 0.000 | 0.01 |
| Parental level |  |  |  |  |  |  |  |  |
|  Ethnicity (either parent born in) |  |  |  |  |  |  |  |
|  New Zealand/UK |  |  | -0.027\*\*\* | -2.68 | -0.025\*\* | -2.47 | -0.023\*\* | -2.35 |
|  Asia |  |  | 0.038\*\*\* | 3.42 | 0.038\*\*\* | 3.27 | 0.021\* | 1.79 |
|  Other o/s country |  |  | 0.011 | 1.18 | 0.008 | 0.87 | 0.006 | 0.61 |
| Mother works |  |  | 0.017\*\* | 2.04 | 0.018\*\* | 2.09 | 0.019\*\* | 2.25 |
| Father works |  |  | -0.003 | -0.19 | -0.008 | -0.59 | -0.006 | -0.41 |
|  Mother’s job white collar |  | 0.018\* | 1.72 | 0.014 | 1.34 | 0.007 | 0.65 |
|  Father’s job white collar |  | 0.019\*\* | 2.32 | 0.016\*\* | 2.02 | 0.008 | 0.95 |
|  Mother’s education2 |  |  |  |  |  |  |  |  |
|  Level 0−2 |  |  | -0.016 | -1.50 | -0.011 | -0.97 | -0.004 | -0.39 |
|  Level 3−4 |  |  | -0.012 | -1.51 | -0.009 | -1.12 | -0.002 | -0.25 |
|  Father’s education2 |  |  |  |  |  |  |  |  |
|  Level 0−2 |  |  | -0.034\*\*\* | -3.02 | -0.031\*\*\* | -2.79 | -0.018 | -1.62 |
|  Level 3−4 |  |  | -0.000 | -0.03 | 0.002 | 0.25 | 0.013 | 1.50 |
| Attribute at age 15 |  |  |  |  |  |  |  |  |
| Achievement |  |  |  |  |  |  | 0.036\*\*\* | 7.15 |
| Attitude |  |  |  |  |  |  | 0.062\*\*\* | 6.17 |
| VET aspirations |  |  |  |  |  |  | -0.024\*\* | -2.18 |
| University aspirations |  |  |  |  |  |  | 0.019\*\*\* | 2.60 |
| Application |  |  |  |  |  |  | 0.002\*\*\* | 2.66 |
| School fixed effects | Excluded |  | Excluded |  | Included |  | Included |  |
| Sample size | 8816 |  | 8816 |  | 8816 |  | 8816 |  |
| R-squared | 0.014 |  | 0.067 |  | 0.116 |  | 0.141 |  |
| Adjusted R-squared | 0.014 |  | 0.063 |  | 0.078 |  | 0.104 |  |

Notes: 1 Omitted reference category is ‘More than 100 books’.

2 Levels are based on ISCED97. Level 0−2 includes pre-primary, primary and lower secondary and certificate I/II; level 3–4 includes upper secondary and certificate III/IV, diploma and advanced diploma; and level 5−6 includes higher education qualifications. Omitted reference category is level 5–6.

 \*Significant at 10%; \*\*Significant at 5%; \*\*\*significant at 1%.

Source: LSAY 2003 cohort.

Table A8 Mean marginal effects of neighbourhood individual, parental and school factors on student outcomes at age 19 years

|  |  |  |
| --- | --- | --- |
| Covariate | VET outcome | University outcome |
| Marginal effect | t-stat | Marginal effect | t-stat |
| Neighbourhood level |  |  |  |  |
| Socioeconomic status | -0.012 | -0.87 | 0.007 | 0.58 |
| Stability | 0.005 | 0.43 | -0.010 | -0.93 |
| Household type | 0.006 | 0.53 | -0.021\* | -1.95 |
| Ethnic diversity | 0.013 | 1.08 | 0.006 | 0.54 |
| Individual level |  |  |  |  |
| Male | 0.063\*\*\* | 3.93 | -0.065\*\*\* | -4.08 |
| Australian-born | -0.007 | -0.25 | -0.048\*\* | -2.18 |
| Indigenous | -0.039 | -1.06 | 0.008 | 0.19 |
| Only child in family | -0.005 | -0.17 | 0.009 | 0.35 |
| Youngest child in family | 0.025\* | 1.74 | -0.004 | -0.27 |
| Speak English only at home | 0.052 | 1.53 | -0.119\*\*\* | -3.82 |
| Grade level in 2003 | 0.051\*\*\* | 3.10 | 0.006 | 0.38 |
| Live with both parents | -0.010 | -0.67 | 0.074\*\*\* | 4.54 |
| Have own room | -0.011 | -0.46 | -0.028 | -1.14 |
| Have study place | 0.005 | 0.25 | 0.035 | 1.61 |
| Have computer | 0.058\* | 1.74 | 0.048 | 1.01 |
|  No. of books in home1 |  |  |  |  |
|  0−10 books in home | 0.016 | 0.44 | -0.096\*\* | -2.11 |
|  11−25 books in home | 0.032 | 1.11 | -0.026 | -0.89 |
|  26−100 books in home | 0.004 | 0.25 | 0.020 | 1.31 |
| Parental level |  |  |  |  |
|  Ethnicity (either parent born in) |  |  |  |  |
|  New Zealand/UK | -0.029 | -1.49 | -0.009 | -0.46 |
|  Asia | -0.058\* | -1.83 | 0.125\*\*\* | 4.86 |
|  Other overseas | -0.003 | -0.14 | 0.015 | 0.80 |
| Mother works | 0.016 | 0.89 | 0.009 | 0.57 |
| Father works | -0.046\* | -1.93 | 0.012 | 0.46 |
| Mother’s job white collar | -0.005 | -0.24 | -0.015 | -0.73 |
| Father’s job white collar | -0.006 | -0.38 | 0.009 | 0.59 |
|  Mother’s highest education2 |  |  |  |  |
|  Level 0−2 | -0.009 | -0.45 | -0.004 | -0.21 |
|  Level 3−4 | 0.008 | 0.52 | 0.001 | 0.05 |
|  Father’s highest education2 |  |  |  |  |
|  Level 0−2 | 0.032 | 1.54 | -0.055\*\* | -2.56 |
|  Level 3−4 | 0.032\* | 1.76 | -0.047\*\*\* | -2.88 |
| School fixed effects | Included |  | Included |  |
| Attribute at age 15 years |  |  |  |  |
| Achievement | -0.124\*\*\* | -13.06 | 0.190\*\*\* | 19.00 |
| Attitude | -0.037\*\*\* | -2.60 | 0.073\*\*\* | 4.65 |
| VET aspirations | 0.140\*\*\* | 7.18 | -0.181\*\*\* | -7.29 |
| University aspirations | -0.133\*\*\* | -7.90 | 0.263\*\*\* | 13.61 |
| Application | -0.003 | -1.56 | 0.008\*\*\* | 5.56 |
| Sample size | 6515 |  |  |  |
| Pseudo R-squared | 0.211 |  |  |  |

Notes: 1 Omitted reference category is ‘More than 100 books’.

2 Levels are based on ISCED97. Level 0−2 includes pre-primary, primary and lower secondary and certificate I/II; level 3–4 includes upper secondary and certificate III/IV, diploma and advanced diploma; and level 5−6 includes higher education qualifications. Omitted reference category is level 5−6. The marginal effects in this table are the average marginal effects calculated by computing marginal effect of each case and then averaging the effects.

\*Significant at 10%; \*\*Significant at 5%; \*\*\*significant at 1%.

Source: LSAY 2003 cohort.

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The NVETR Program aims to improve policy and practice in the VET sector. The research effort itself is collaborative and requires strong relationships with the research community in Australia’s universities and beyond. NCVER may also involve various stakeholders, including state and territory governments, industry and practitioners, to inform the commissioned research and use a variety of mechanisms such as project roundtables and forums.

For further information about the program go to the NCVER website <www.ncver.edu.au>.

1. Charter schools are public schools subject to some of the rules, regulations, and statutes that apply to other public schools, but generally have more flexibility than traditional public schools. They are expected to produce certain results, set forth in each school’s charter, and are attended by choice. [↑](#footnote-ref-1)
2. In a way these outcomes are student attributes and will be referred to as such when investigating the determinants of other student outcomes. [↑](#footnote-ref-2)
3. VET aspirations are defined as a student’s expectation to complete a qualification at ISCED level 4; and university aspirations as a student’s expectation to complete a university qualification at ISCED level 5A or 6. The questions relating to the expectation of completing qualifications are not mutually exclusive. [↑](#footnote-ref-3)
4. In a multiple regression model, multicollinearity is present when two or more of the explanatory variables are highly correlated with each other. As a consequence, the affected explanatory variables may have large standard errors. [↑](#footnote-ref-4)
5. The method used is called principal component analysis. The factor loadings associated with the variables are included in table A1 in the appendix. [↑](#footnote-ref-5)
6. In the review of school funding for schooling (Gonski review), the [Australian Government (2011](#_ENREF_3)) recognises the important influence of (quality) resources relative to the composition of the school student population, for improved student outcomes. [↑](#footnote-ref-6)
7. We use a variety of specifications for the multiple regression frameworks, depending on the nature of the dependent variable — continuous (ability), ordered (attitudes), binary (aspirations and outcomes at age 17 years) and categorical with more than two levels (outcome at age 19 years). A linear specification is specified when the dependent variable is continuous, ordered or binary, as it allows for a consistent estimation of neighbourhood effects when school fixed effects are included in the model. A multinomial logit model is estimated when the dependent variable is categorical. The advantage of this model is that it accommodates the unordered nature of the dependent variable. Its limitation is that it is not possible to directly include school fixed effects (due to the ‘incidental parameter problem’). Instead, we follow the [Mundlak (1978](#_ENREF_21)) approach, which under certain conditions approximates a model with fixed effects. This approach involves estimating a multinomial logit model with additional covariates for school effects. The additional variables are the school-level averages of parental characteristics. For example, in addition to maternal and paternal education, we include variables that represent average maternal and average paternal education within the student’s school. [↑](#footnote-ref-7)
8. Neighbourhoods are based on postcodes. The number of postcodes per school ranges from 1 to 35, with an average of 9.3. Five schools had all students from the same postcode. This means there is sufficient variation in neighbourhoods across students within the same school, which is important for models that include school fixed effects. [↑](#footnote-ref-8)
9. All models estimated for this report use standard errors that are robust to heteroskedascity and to error correlation between students living within the same postcode. [↑](#footnote-ref-9)
10. The school fixed effects also greatly reduce the problems associated with omitted variable bias. [↑](#footnote-ref-10)
11. The rate of participation in VET for 15 to 19-year-old Indigenous Australians is 39.6% and for 20 to 24-year-olds 25.8% compared with 26.6% and 15%, respectively, for non-Indigenous Australians. The calculations are based on data from the National VET Provider Collection and the Australian Bureau of Statistics ([2012](#_ENREF_2)). [↑](#footnote-ref-11)
12. The full results for the other models are available from the authors on request. [↑](#footnote-ref-12)
13. For a categorical variable, the marginal effects show the change in the predicted probability of an outcome for a person in a particular category compared with a person in the base category. Marginal effects for continuous variables represent the instantaneous rate of change in the probability. While the marginal effect can be interpreted in this instance as the change in the probability when the variable increases by one unit, this very much depends on the scale used for measuring the variable. [↑](#footnote-ref-13)
14. The mean marginal effects of the non-study outcome is relatively easy to calculate as the sum of the marginal effects for all three outcomes sum to zero. [↑](#footnote-ref-14)
15. Measurement error is known to cause attenuation bias or the reduction in the size of effects. [↑](#footnote-ref-15)
16. In other words, moving from the bottom to the middle of each neighbourhood measure (for example, socioeconomic status) has the same effect on student outcomes as moving from the top to the middle of the measure. [↑](#footnote-ref-16)