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Do peer effects mediate the association between family socioeconomic status and educational achievement?

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Abstract

Differences in levels of academic achievement according to socio-economic status, and parental education in particular, have been a persistent feature of Australian education systems. Young people with highly-educated parents are more likely than their peers with low-educated parents to attain high levels of achievement at school. Students with low levels of achievement are less likely than their high achieving peers to complete Year 12 and are more likely to experience negative post-school outcomes. The socio-economic status of the neighbourhood, and in particular, the school attended, has also been found to have an effect on levels of both academic achievement and attainment. For

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this paper, we conduct analyses of NAPLAN test scores for four cohorts of secondary school students attending government schools in the ACT to examine the associations between parental education, school attended, and levels of educational achievement. Our findings show that students with university-educated parents achieve at much higher levels than their peers with low-educated parents and that attending a school with a higher proportion of students from educationally disadvantaged families has a negative effect on educational achievement.

Key words: educational achievement; NAPLAN; socio-economic status

Introduction

The determinants of educational achievement in secondary school are significant for a number of reasons. Firstly, an understanding of these factors facilitates the identification of the broad characteristics of students who may need additional assistance with particular aspects of the curriculum or perhaps are likely to fall behind in general. These groups may change at different levels of schooling. Secondly, there is an established link between performance in international and national tests at the age of 15 years (Year 9) and the probability of completing secondary education (Curtis & McMillan 2008; Mahuteau and Mavromaras 2014; Marks 2007; Marks 2014a), which in turn is correlated with more favourable labour market outcomes as an adult in terms of employment and income. The role of schools in mediating the effects of family socio-economic status (SES) on academic achievement is of particular interest to policy makers.

This paper uses a unique opportunity of access to de-identified administrative data from one Australian jurisdiction, the Australian Capital Territory (ACT) to examine the determinants of academic achievement in the National Assessment Program- Literacy and Numeracy (NAPLAN) tests among Year 7 and Year 9 students in government schools. Although there is considerable debate surrounding the development of the NAPLAN and the ways in which test results are used, NAPLAN data provide an opportunity to measure levels of academic achievement of Australian primary and secondary school students and to identify schools which might gain the most from an increase in resources.

The Australian Capital Territory (ACT) data offer the opportunity for an interesting case study of a relatively small and homogeneous jurisdiction. The ACT has the highest median income and educational attainment among Australian States and Territories. According to the 2011 Population Census conducted by the Australian Bureau of Statistics (ABS), almost three-quarters of the population aged 15 years and older had completed Year 12 or equivalent and over half of that population held a post school qualification (ABS, 2013). Almost 60 per cent of those with post school qualifications held a bachelor degree or higher. Given the strength of the positive association between parents' education and child's education (Chesters & Watson, 2013; Pfeffer, 2008; Redmond et al 2013; Stadelmann-Steffen, 2012), it is not surprising to find that ACT students perform well in the NAPLAN tests.

In this study, we utilise de-identified student-level data provided by the ACT Education Directorate and school-level data from the *MySchool* website to examine the impact of parental education and the level of educational advantage/ disadvantage of the school on academic achievement outcomes for secondary school students. The remainder of this paper is structured as follows: the second section presents a review of the literature on SES and educational achievement. In the third section we describe the data, variables and the analytical strategy. We then present the results before discussing our findings and their policy implications.

Literature review

There is considerable evidence that a student's socio-economic background and that of their peers has a significant influence on levels of academic achievement and educational attainment (see for example, Buckingham *et al.* 2013; Considine & Zappala 2002; Goss *et al.* 2016; Perry & McConney, 2010; McConney & Perry, 2010; Sirin, 2005; Rothman & McMillan, 2003). This literature examines the relationship between the SES of individual students, that of the student body in the schools they attend and academic achievement. For example, Considine and Zappala (2002) found that even amongst students attending disadvantaged schools, those with university-educated parents were 4.5 times more likely than their peers with low-educated parents to achieve outstanding academic results. Goss and others (2016) found that students attending disadvantaged schools made less progress than their peers attending the most advantaged schools. Gaps in progress between Years 3 and 9 ranged from one year and seven months for low achievers in Year 3 to two years and five

months for high achievers in Year 3 suggesting that students with the most academic potential were the most disadvantaged.

Researchers examining the effects of parental education and SES on child's educational achievement and attainment largely agree that high SES parents are able to facilitate the development of their children's cognitive abilities and provide them with the necessary cultural capital required for success at school (Ball 2010; Bourdieu 1984; Breen *et al.* 2009; Roska & Potter 2011; van de Werfhorst & Hofstede 2007). Furthermore, they are able to provide a home environment conducive to intellectual development and encourage their children's participation in appropriate extracurricular activities (Lareau 2011). In schools, teachers conflate familiarity with high status culture with academic aptitude, developing perceptions of higher levels of ability in children from higher SES families (Jaeger 2011). Sirin (2005:438) concluded that 'family SES at the student level is one of the strongest correlates of academic performance. At the school level, the correlates were even stronger.'

Expressing an alternative view, Marks (2014b) argues that once past performance in NAPLAN tests is taken into account, socio-economic status did not appear to have a significant effect on achievement among students in Victoria in Years 5 and 7. Test performance among Year 3 students is likely to be associated with individual SES, therefore, we argue that, SES is likely to have an indirect effect on outcomes in later years of schooling even if a direct effect is difficult to estimate (Chesters & Daly, 2015). Furthermore, Goss and others (2016) found that the achievement gap between students with university-educated parents and those with low-educated parents increased as students progressed through school. Comparing students with similar levels of achievement in Year 3, they found that high achieving students with university-educated parents were almost two years ahead of high achieving students with low-educated parents by Year 9. Their results suggest that despite demonstrating similar levels of academic potential in Year 3, students with low-educated parents were unable to keep pace with their peers who had university-educated parents.

There is also some debate in the literature regarding the size of school SES effects with some researchers arguing that school SES effects are either small or non-existent (Marks, 2015; Pokropek, 2015; Televantou *et al.*, 2015), whereas other researchers argue that the SES of the school population is associated with levels of academic achievement net of individual factors (Buckingham *et al.*, 2013; Chesters & Daly, 2015; Lim *et al.*, 2013;

McConney & Perry, 2010; OECD, 2010; Perry & McConney, 2010; Rothman & McMillan, 2003; Sirin, 2005).

According to the Organisation for Economic Co-operation and Development (OECD) (2010) the dispersion of reading results according to the socio-economic status of Australian students was less than the average for OECD countries, the socio-economic gradient was steeper than the OECD average, that is, there was a significant increase in scores as SES rose. In a more detailed examination of the 2012 Programme for International Student Assessment (PISA) results for mathematical literacy Thomson, De Bortoli and Buckley (2013) show that the socioeconomic gradient was steeper in the ACT than for Australia as a whole. Students from low socioeconomic backgrounds in the ACT performed less well than their counterparts in all states except Tasmania and the Northern Territory but those from more advantaged socioeconomic backgrounds performed better than the Australian average. This has implications for employability with the types of jobs available in the ACT typically requiring higher levels of education and skills. Of those employed in the ACT, 45 percent held a bachelor degree or higher qualification compared 29 percent nationally (Department of Education, 2015). The OECD report (2010) also found that students attending schools with socio-economically advantaged peers tend to perform better on PISA tests regardless of their own SES.

In two related studies Perry and McConney (2010) and McConney and Perry (2010) use data from PISA to examine the role of the school SES in the performance of Australian 15 year olds on the international tests. Perry and McConney (2010) concluded-

‘All students- regardless of their personal/family SES- benefit strongly and relatively equally from schooling contexts in which the SES of the school group is high. Conversely, all students, regardless of their individual SES, perform considerably less well on measures of academic achievement in school contexts characterized, in the aggregate, as low on the school SES continuum’. (p1149)

In their review of the literature regarding the impact of SES on literacy, Buckingham *et al.* (2013) found that both individual background and school background are important determinants of literacy skills. At the individual level, children from disadvantaged backgrounds are likely to spend less time reading, have less sleep, higher rates of absenteeism and mobility and less parental encouragement than those from more advantaged backgrounds. At the school-level, the practices and culture of the school were very important. Rothman and

McMillan's (2003) study of Year 9 students concluded that about a sixth of the variation in reading and mathematics scores was due to school-based factors such as the school's average socio-economic status and the school culture.

School quality, measured in different ways, has also been shown to have an important impact on the probability of completing Year 12 and the transition to university. Lim, Gemici and Karmel (2013), using data from the Longitudinal Survey of Australian Youth (LSAY), found that students from a low socio-economic background were more likely to complete Year 12, have a higher Tertiary Entrance Rank (TER) and enrol at university if they attended a school of academically higher quality. Their school quality measure was constructed using a range of variables including the predicted TER scores for the school, probability of university enrolment and characteristics of the student body apart from those of the individual student. Mahuteau and Mavromaras (2014) using PISA data linked to LSAY data for Australia, found that students with low PISA scores attending disadvantaged schools were at the greatest risk of dropping out before completing Year 12.

Apart from parental education, other family factors that may affect educational outcomes include migrant status and Indigenous status. Marks (2014b) found that students from language backgrounds other than English (LBOTE) achieved lower levels than their English-speaking peers on reading tests but at similar or higher levels on numeracy tests. For example, after controlling for region, SES and school attended, LBOTE students, on average, achieved at the same level as non-LBOTE students on Year 3 numeracy tests and 5 points lower on reading tests. On the Year 5 tests, LBOTE students scored six points higher on numeracy tests and four points lower on reading tests and on the Year 7 tests, LBOTE students scored 11 points higher on numeracy tests and five points lower on reading tests than their non-LBOTE peers. Considine and Zappala (2002) found that country of origin mediated the effect of LBOTE status. Their analysis shows that LBOTE students from regions other than the Middle East and Africa were three times more likely to achieve outstanding results than their English-speaking peers. Analysis of Queensland Year 9 NAPLAN data by Creagh (2014) showed that within the LBOTE cohort, visa category was an important variable with students on refugee visas being particularly disadvantaged in both reading and spelling tests.

Researchers examining educational outcomes for Indigenous students invariably find that they are among the most disadvantaged students. Creagh (2014) found that, on average, the Year 9 reading and spelling scores of Indigenous students were far lower than those of non-

Indigenous students. Marks (2014b) found that the achievement gap between Indigenous and non-Indigenous students widened over time. After controlling for the effects of region, SES and school attended, Indigenous students scored, on average, 15.6 points lower in numeracy and 15 points lower on reading tests than non-Indigenous students in Year 3. By Year 7 the achievement gap in numeracy had increased to 22.3 points and the achievement gap in reading had increased to 22.4 points. Purdie and Buckley (2010) found that school attendance rates for Indigenous Australians are considerably lower than for the non-Indigenous population, concluding that a combination of home, school and individual factors accounted for the 10 percentage point gap in attendance rates. Using data from the Longitudinal Surveys of Australian Youth (LSAY), Biddle (2014) found that

‘ even after controlling for parental education, early childhood education, remoteness and language spoken at home, Indigenous students who miss a significant amount of school have substantially lower levels of maths, reading and science ability than those who do not.’ (p. 13)

Mahuteau and Mavrmaras (2014) concluded that once PISA scores at the age of 15 were controlled for, there was no independent effect of Indigenous status on the probability of dropping out of school.

In summary, the factors identified as being important determinants of academic achievement at the primary level have also been found to be significant at the secondary level although the strengths of these relationships vary over the course of schooling (Chesters & Daly, 2015). Socio-economic status of the individual, the socio-economic status of the student body, school quality, gender, LBOTE status and Indigeneity are all correlated with performance in academic tests.

Method

Data

We analyse data from two sources: the ACT ED (Australian Capital Territory, Education Directorate); and the *MySchool* website. The ACT ED provided de-identified individual level data on NAPLAN (National Assessment Program- Literacy and Numeracy) scores for reading and numeracy in Years 7 and 9. NAPLAN is a national testing of achievement across five educational domains: reading; writing; spelling; grammar; and numeracy at Year 3, 5, 7, and 9 levels. There is a common scale across all years ranging from 0 to 1000 in each domain so a score, for example, of 500 indicates the same level of achievement regardless of the year

of study for the student but the average national score and minimum standards increase at higher levels of schooling (ACARA 2011).

The ACT ED data also included measures of parents' education; Indigenous status; LBOTE (language background other than English) status; and sex all of which were collected at the time of enrolment. Data were available for students attending six combined schools and 11 secondary schools for four years: 2011, 2012, 2013 and 2014. We pool the data for the four years but examine the outcomes for Year 7 and Year 9 students separately (n=16160). We take the mean of the Year 7 (Year 9) reading and numeracy scores for each student to create the two outcome variables: Year 7 NAPLAN scores and Year 9 NAPLAN score.

In line with previous research (Lim & Gemici, 2011; Pfeffer, 2008), we use parents' education as an indicator of individual socio-economic status. Although socioeconomic status is multi-dimensional, Buckingham et al.'s (2013) review showed that parents' education is the strongest of the three commonly used indicators of individual SES (parents' education, occupation and income). The parents' education variable is derived from the highest level of education of either parent and has six categories: less than Year 12; Year 12; VET certificate; VET diploma; university; and missing. Sex is coded 1 for female and 0 for male. Indigenous status is coded 1 for either Aboriginal or Torres Strait Islander; and 0 for non-Indigenous. LBOTE status is coded 1 for language background other than English; and 0 for English speaking background.

The *MySchool* website data provide the school level variables, our measures of peer effects. We include one measure of the level of educational advantage/disadvantage based on the ICSEA (Index of Community Socio-Educational Advantage). ICSEA values are calculated using information on parents' occupation and parents' education for each student, level of remoteness of the school, the percentage of Indigenous students and the percentage of Language Background Other Than English (LBOTE) students with low-educated parents attending the school to provide an indication of levels of educational advantage/ disadvantage at the school level (ACARA 2011). The ICSEA ranges from 500 to 1300 with a mean of 1000 and a standard deviation of 100. The ICSEA means for the schools included in this study range from 970 and 1160. Due to the narrow range of ICSEA means, we use the percentage of students in the lowest ICSEA quartile as an indication of the level of educational disadvantage of the students' peers. We also include the percentage of Indigenous students and the percentage of LBOTE students attending the school as indicators of peer effects.

The descriptive statistics for the sample are presented in Table 1. Just six per cent of students had low-educated parents and 41 per cent had at least one parent who had completed a university degree. One-quarter of the students were from LBOTE families and three per cent of students were Indigenous. At the school level, the percentage of students located in the lowest ICSEA quartile ranged from 2 to 20 per cent. We grouped the schools into three categories according to the percentage of students located in the lowest ICSEA quartile: less than 5%; 5-7%; and more than 7%. Around one-third of students are allocated to each group. The percentage of Indigenous students ranged from 1 to 5 per cent. We grouped the schools into three categories according to the percentage of Indigenous students: less than 2%; 2-2.5%; and more than 2.5%. Around one-third of students are allocated to each group. The percentage of LBOTE students ranged from 12 to 55 per cent. We grouped the schools into three categories according to the percentage of LBOTE students: less than 20%; 20-27%; and more than 27%. Around one-third of students are allocated to each group.

[insert Table 1 about here]

Analytical strategy

In the first phase of our analyses, we examine the distribution of NAPLAN scores according to selected individual and school level (peer) characteristics to answer our first research question: Is parental education associated with educational achievement in Year 7 and Year 9? In the second phase of our analyses, we examine individual and peer effects on NAPLAN scores simultaneously by estimating fixed effects multi-level models for each of the two outcome variables: Year 7 NAPLAN scores and Year 9 NAPLAN scores to answer our second research question: Do peer effects mediate the association between parental education and educational achievement? The estimation of multi-level models is necessary because students are clustered within schools and therefore the observations are not entirely independent. Fixed effects models allows us to control for unobserved effects such as intelligence and motivation.

In the first model we include individual effects: parents' education, sex, Indigenous status and LBOTE status. In the second model, we add in the peer effects variables: percentage of students in ICSEA quartile 1; percentage of Indigenous students; and percentage of LBOTE students at the school. Our analyses are performed on data pertaining to four cohorts of ACT government school students rather than samples taken from the

cohorts, therefore, levels of statistical significance are not reported in this paper. Levels of statistical significance provide an indication of whether the results obtained from the analysis of data from a sample of the population reflect the results that would be obtained if data from the whole population were analysed. Using population data negates any concerns regarding sampling error. For example, some researchers have argued that school compositional effects are phantom effects related to sampling error (Pokropek 2015; Televantou et al. 2015).

Results

In the first phase of the analyses, we examine the distribution of Year 7 and Year 9 NAPLAN scores. The school mean NAPLAN scores range from 503 to 589 in Year 7 and from 548 to 623 in Year 9. As shown in Table 2, across all schools, the mean scores were 549 in Year 7 and 587 in Year 9 and the median scores were 546 in Year 7 and 584 in Year 9 indicating that the distribution was not skewed towards either the upper or lower bound.

[insert Table 2 about here]

Next we examine the distribution of scores according to selected individual characteristics- see Table 3. There is a clear pattern of association between parents' education and NAPLAN scores in both Years 7 and 9. As the level of parents' education increases, the mean score increases as does the score at the 25th percentile, the median and the 75th percentile. For example, for Year 7 students with low-educated parents the 25th percentile score is 456 whereas for Year 7 students with at least one university-educated parent, the 25th percentile score is 532. This indicates that there is a wide variation in the scores of the lowest achieving students according to parents' education. At the other end of the distribution, for students with low-educated parents, the 75th percentile score was 530 and for the students with at least one university-educated parent, the 75th percentile score was 624. In other words, the lowest performing students with at least one university-educated parent were almost on par with the highest performing students with low-educated parents. Differences in the distribution according to gender were minimal with both male and female students having similar scores at the 25th percentile, median and the 75th percentile. Differences according to Indigenous status were substantial with Indigenous students' scores at the upper bound of each quartile being around 50 points lower than those of non-Indigenous students. There were only small differences in the distribution according to LBOTE status with similar scores being recorded for LBOTE and non-LBOTE students at the 25th percentile, median and the 75th percentile.

[insert Table 3 about here]

We also examined the distribution in NAPLAN scores according to school level characteristics- see Table 4. In both Year 7 and Year 9 as the percentage of students located in the lowest ICSEA quartile increased, the scores at the 25th percentile, median and 75th percentile decreased. There is no clear pattern according to the percentage of Indigenous students. Students attending schools where between 2 and 2.5 per cent of students were Indigenous achieved higher scores than students attending schools where less than 2 per cent of students were Indigenous. On the other hand, students attending schools where more than 2.5 per cent of students were Indigenous achieved lower scores than students attending schools where less than 2 per cent of students were Indigenous. The effect for percentage of LBOTE students follows a similar pattern.

[insert Table 4 about here]

In the second phase of our analyses, we seek to disentangle these effects by constructing a series of hierarchical linear models to examine the effects of both individual level and school level characteristics on students' NAPLAN scores. In the first set of models, presented in Table 5, the outcome variable is the students' Year 7 scores. Preliminary analysis showed that the proportion of total variance due to within-school variation was 0.88, therefore within-school variation, that is, differences between students within schools were a far more important factor in overall variance than differences between students attending different schools. In Model 1, when only individual factors, parents' education, sex, Indigenous status and LBOTE status, are included, between-school variance accounts for seven per cent of the variation. The coefficients, for Model 1, reported in the first column indicate that even after controlling for the effects of sex, Indigenous status and LBOTE status, parents' education has a positive effect on the student's Year 7 score. Compared to students with low-educated parents, those with parents who had completed Year 12 or who had completed a VET certificate scored, on average, 19 points higher; those parents with VET diplomas scored, on average, 29 points higher; and those with university-educated parents scored, on average, 64 points higher. Indigenous students' scores were, on average, 37 points lower and LBOTE students' scores were, on average, 13 points lower, net of other factors.

When we include the school level variables in Model 2, between-school variance accounts for just three per cent of unexplained variation. The percentage of students in the lowest ICSEA quartile has a negative association with Year 7 score, net of the effects of the other factors. Students attending schools with a higher percentage of students in the lowest ICSEA quartile scored, on average, 30 points lower than those attending schools with a low percentage of students in the lowest ICSEA quartile. Students attending schools where at least 20 per cent of the students were LBOTE students scored, on average, 6 points higher, net of the effects of the other factors.

[insert Table 5 about here]

The second set of models presented in Table 5 examines the associations between individual level factors and school level factors and NAPLAN scores in Year 9. Preliminary analysis showed that the proportion of total variance due to within-school variation was 0.90. In Model 1, when only individual factors: parents' education, sex, Indigenous status and LBOTE status; are included, between-school variance accounts for six per cent of the unexplained variation. The coefficients reported in the first model indicate that even after controlling for the effects of sex, Indigenous status and LBOTE status, parents' education has a positive effect on the student's Year 9 NAPLAN score. Having at least one parent who completed Year 12 is associated with an increase of 28 points; having at least one parent with a VET certificate is associated with an increase of 18 points; having at least one parent with a VET diploma is associated with an increase of 32 points; and having at least one university-educated parent is associated with an increase of 68 points. Indigenous students' scores were, on average, 35 points lower than those of non-Indigenous students and LBOTE students' scores were, on average, 9 points lower than those of non-LBOTE students, net of other factors.

When school characteristics are included in Model 2, we find that between-school variance accounts for just one per cent of the unexplained variation. Sex, parents' education, Indigenous status and LBOTE status have similar effects as those reported for Model 1. Of the school level characteristics, the percentage of students located in ICSEA quartile 1 has a negative association with Year 9 NAPLAN score, net of the effects of the other factors. Students attending schools where at least seven per cent of the students were located in the lowest ICSEA quartile scored, on average, 30 points lower than students attending schools where less than five per cent of students were located in the lowest ICSEA quartile. Percentage of LBOTE students has a positive effect on NAPLAN scores. Students attending

schools where LBOTE students account for at least 28 per cent of all students score, on average, 11.5 points higher than students attending schools where LBOTE students made up less than 20 per cent of the student population.

Discussion

The analyses presented in this paper show that both individual socio-economic status and average level of educational advantage/disadvantage of the school population are associated with child's academic achievement, as measured by NAPLAN literacy and numeracy tests, thus confirming the findings of the majority of previous research. Research examining the links between socio-economic status and academic achievement, as measured by the PISA tests, conducted by Perry and McConney (2010) also found that academic achievement was positively correlated with socio-economic status at both an individual and school level. Their measure of socio-economic status was based on the economic, social and cultural status (ESCS) measure calculated by the PISA project team. After conducting a comprehensive meta-analysis of existing research, Buckingham *et al.* (2013) also concluded that individual and school socioeconomic status were positively correlated with academic achievement. Sirin's (2005) review of research conducted in the US also showed that socio-economic status of both the family and the school were key predictors of student's academic performance. Previous researchers (Buckingham *et al.* 2013; Lim & Gemici 2011; Pfeffer 2008) provide evidence that parents' education is a key indicator of child's socio-economic status, therefore, in this paper parents' education is used as a proxy for socio-economic status.

Our contribution to the field is that we analysed both individual level and school level data for secondary school students to examine whether peer effects mediate the association between parental education and educational achievement. Our results show that parents' education had a strong positive effect on academic achievement in both Year 7 and Year 9 NAPLAN tests. At the school level, we used the percentage of students located in the lowest ICSEA quartile as our measure of socio-economic status. Our results show that attending a school with a lower proportion of students in the lowest ICSEA quartile was positively associated with academic achievement as measured by NAPLAN tests in Year 7 and Year 9, even after controlling for the effects of parents' education, sex, Indigenous status and LBOTE status. Therefore, we find that peer effects mediate the association between parental education and educational achievement. Although students with low-educated parents scored, on average, 64 points lower than their peers with university-educated parents, attending a secondary school with a small proportion of students located in the lowest ICSEA quartile

was associated with an, on average, increase of 30 points, net of the effects of the other factors.

Differences in levels of academic achievement according to socio-economic status have been a persistent feature of Australian education systems. As the results presented here show, these differences are due to two distinct, though related, factors: disadvantage at the student level and disadvantage at the school level. Given the difficulties inherent in implementing policies aimed at improving levels of parental education, policies aimed at overcoming disadvantage related to parental education implemented at the school level may provide a more immediate return on investment. As Chui and Khoo (2005) argue, equalizing the distribution of resources will allow for a more efficient use of finite resources and an improvement in overall achievement scores. Providing extra resources to already well-resourced schools has a much smaller effect on overall levels of achievement than providing extra resources to schools with low levels of resources due to diminishing marginal returns. Students with highly-educated parents tend to concentrate in well-resourced schools whereas students with lower-educated parents tend to concentrate in poorly-resourced schools.

Redman and others (2013) found that the relationship between parents' education and child's education has not changed over time bringing into question the ability of education policies implemented during the past three decades to alleviate inequality related to family background and facilitate social mobility via education (see also Chesters & Watson, 2013). As Marks and others (2006) point out wealthy families are able to locate in areas with well-resourced schools and pay for extra tutoring for their children whereas poorer families are typically located in areas with poorly-resourced schools. They concluded that direct government intervention was required to level the playing field and ensure that all schools are well-resourced schools. McConney and Perry (2010: 448) also concluded that where one goes to school has a strong influence over educational outcomes and go so far as to say that this association is becoming stronger over time thus 'reducing the effectiveness of the educational system'.

Conclusion

The enduring association between family socio-economic status and, in particular, parental education and educational achievement and attainment is an important social issue in Australia. As an increasing proportion of jobs require tertiary level qualifications, individuals with lower levels of education will find it increasingly difficult to find well-paid, secure employment. The association between levels of academic achievement in secondary school

and levels of academic attainment are well-established, therefore, in this paper we examined the associations between levels of family and peer group educational advantage in secondary schools and educational achievement as measured by NAPLAN tests. Our analysis of NAPLAN test scores for four cohorts of secondary school students attending government schools in the ACT show that secondary students with university-educated parents achieve at much higher levels than their peers with low-educated parents and that attending a school with a higher proportion of students from educationally disadvantaged families has a negative impact on educational achievement. In other words, students attending schools with a higher proportion of educationally disadvantaged students, regardless of their parents' levels of education, achieve at lower levels than their peers attending schools with a low proportion of educationally disadvantaged students. Given that education is a State and Territory responsibility in Australia and that each jurisdiction has its own particular characteristics, further research in this field is necessary to determine whether these findings are representative of Australia more generally. However, the results presented here provide evidence that government policies designed to facilitate social mobility via education may need to factor in levels of inequality at the school level as well as levels of inequality at the family level.

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Table 1. Individual and school level characteristics of the sample

Individual Characteristics	n= 16160	Per cent
Parental education		
<Year 12	914	6
Year 12	1202	7
VET certificate	3104	19
VET diploma	2096	13
University	6717	41
Missing	2127	13
Sex		
Male	8137	50
Female	8023	50
Indigenous status		
Non-Indigenous	15715	97
Indigenous	445	3
LBOTE status		
Non-LBOTE	11927	74
LBOTE	4233	26
Peer group characteristics measured at the school level		
	n=	Per cent
Percent in ICSEA Quartile 1		
<5%	5200	32
5-7%	5695	35
>7%	5265	33
Percent Indigenous		
<2%	6352	39
2- 2.5%	4786	30
>2.5%	5022	31
Percent LBOTE		
<20%	5095	32
20-27%	4981	31
>27%	6084	37

Table 2 Overall distribution of NAPLAN scores for Years 7 and 9

NAPLAN scores	Year 7	Year 9
25 th percentile	498	537
Median	546	584
75 th percentile	595	635
Mean	549	587
Range	213-866	170-866

Table 3 Distribution of NAPLAN scores according to selected individual level characteristics

	Year 7				Year 9			
	25th percentile	median	75th percentile	mean	25th percentile	median	75th percentile	mean
Parents' education								
<Year 12	456	489	530	497	494	532	575	536
Year 12	478	513	560	521	526	565	608	567
VET cert.	480	516	560	521	517	555	594	557
VET dip.	492	534	574	535	533	576	616	576

University	532	578	624	578	573	618	666	619
Male	496	547	600	550	535	583	637	586
Female	500	545	591	548	540	585	633	588
Indigenous	452	489	542	497	493	535	576	537
Non-Indigenous	500	547	597	550	539	585	636	588
LBOTE	497	549	600	552	539	589	645	591
Non-LBOTE	498	545	593	547	537	583	633	585

Table 4 Distribution of NAPLAN scores according to selected school level characteristics

	Year 7				Year 9			
	25 th percentile	median	75 th percentile	mean	25 th percentile	median	75 th percentile	mean
% ICSEA								
Quartile 1								
<5%	525	574	622	575	567	616	665	616
5-7%	503	548	593	549	540	583	630	586
>7%	475	514	560	520	516	559	605	562

%Indigenous								
<2%	503	547	591	548	544	587	633	589
2- 2.5%	502	553	605	556	541	587	646	593
>2.5%	487	536	590	541	527	577	630	579
%LBOTE								
<20%	483	526	574	531	521	565	612	567
20-27%	498	543	589	544	538	583	629	584
>27%	515	564	615	566	556	605	658	607

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Table 5. Effect of parents' education on NAPLAN score in Year 7 and Year 9

	Year7 Model 1		Year7 Model 2		Year9 Model 1		Year9 Model 2	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Individual characteristics								
Parents' education								
<Year 12 (ref.)								
Year 12	19.29	3.78	19.15	3.78	27.78	4.05	27.64	4.05
VET cert	18.94	3.28	18.84	3.28	18.15	3.44	18.07	3.44
VET diploma	29.08	3.46	28.90	3.46	32.33	3.65	32.00	3.64
University	63.84	3.15	63.57	3.15	68.33	3.31	68.20	3.31
Missing	34.06	3.56	33.92	3.56	34.72	3.63	34.48	3.62
Female =1	-1.34	1.37	-1.34	1.37	1.11	1.43	1.15	1.43
Indigenous =1	-36.85	4.13	-36.74	4.13	-35.33	4.49	-35.31	4.49
LBOTE =1	-12.64	1.63	-12.68	1.63	-9.21	1.69	-9.29	1.69
School characteristics								
Combined school =1			-6.24	5.62			-7.11	3.05
% lowest ICSEA quartile								
<5% (ref.)								
5-7%			-10.81	7.85			-13.45	4.12
>7%			-29.88	9.05			-29.62	4.74
% LBOTE								

<20%								
20-27%			6.30	6.62			9.60	3.55
>27%			6.40	8.92			11.49	4.66
constant	506.58	5.22	522.68	9.58	541.74	4.97	522.68	5.72
Random effects								
Between school	0.07		0.03		0.06		0.01	
variance								
proportion								
Within school	0.93		0.97		0.94		0.99	
variance								
proportion								

Year 7: level 1 n= 8122 students; level 2 n= 17 schools; Year 9 level 1 n= 8038 students; level 2 n= 17 schools