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Socioeconomic status, self-efficacy, and mathematics achievement in Australia: a secondary analysis

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Abstract Previous studies have shown that both student and school socioeconomic status (SES) are strongly associated with student outcomes, but less is known about how these relationships may vary for different students, schools and nations. In this study we use a large international dataset to examine how student SES, school SES and self-efficacy are associated with mathematics performance among 15-year-old students in Australia. We found that increases in school SES are consistently associated with substantial increases in achievement in mathematics and this phenomenon holds for all groups, regardless of their individual SES. Furthermore, our findings show that the association of school SES with maths achievement persists even when subject-specific self-efficacy is taken into account. However, our findings also suggest modest differences among student groups disaggregated by these factors. In particular, the association between maths achievement and school SES appears moderately stronger for students with higher levels of self-efficacy compared with their peers with lower self-efficacy. Furthermore, among students with similar levels of self-efficacy, the association between maths achievement and school SES tends to be stronger for lower SES students than for their more privileged peers. From these findings, we highlight the importance of the Australian case for comparable systems of education, and provide a discussion of policy implications and strategies for mitigating the influence of school socioeconomic composition on academic achievement more generally.

Keywords Socioeconomic status · Mathematics achievement · Self-efficacy · School socioeconomic composition · Australia · PISA

1 Introduction

School socioeconomic composition is a strong predictor of student academic achievement in most countries (Coleman et al. 1966; OECD 2004a; Rumberger and Palardy 2005; Sirin

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2005; Sui-Chu and Willms 1996; Thrupp 1995, 1997; Willms 1986). However, although studies in numerous countries have shown that the socioeconomic profile of schools is strongly associated with students' academic achievement, our understanding of how the association may vary across groups of students, schools, or national contexts remains incomplete. For example, are all students equally influenced, or are some students more sensitive to the influence of their schools' socioeconomic composition? Are students with particular socioeconomic or ethnic backgrounds more sensitive? How does ability, motivation, self-efficacy, or other individual factors interact with the influence of individual and school socioeconomic status (SES) to pattern academic achievement? How do particular educational structures and policies mediate or exacerbate the influence of school socioeconomic composition?

Previous studies have examined variations in the association between school socioeconomic composition and achievement for students from different racial and socioeconomic backgrounds. For example, in the USA, the Coleman report (Coleman et al. 1966) found that lower SES African-American students benefited from attending a racially integrated school, whereas the achievement of their middle-class White peers did not change. More recent studies have implied that the association is strong for all students (Caldas and Bankston 1997; OECD 2004a; Tate 1997), but many of these studies have not disaggregated students by SES to show conclusively that the association is equally or similarly strong for all. To understand more clearly how the association may vary, Perry and McConney (2010) conducted a secondary analysis of Australian data from the 2003 Programme for International Student Assessment (PISA) and found the association between school SES and academic achievement to be substantial and highly consistent for all student groups, regardless of their individual SES. In addition, Perry and McConney (2010) found that student SES is associated with student achievement, in that students with higher SES backgrounds tend to outperform their peers with less privileged backgrounds.

This study builds on these findings by adding self-efficacy—an individual's belief that he/she can successfully complete a task or solve a problem (Bandura 1977). Self-efficacy influences motivation, effort, and persistence in solving problems, and this construct has been shown to be positively associated with achievement (Chiu and Xihua 2008; Lent et al. 1984; OECD 2004a; Siegel et al. 1985). Indeed, in some countries, including Australia, self-efficacy has been demonstrated to be a stronger predictor of academic achievement than either student or school SES (OECD 2004a). It is also a stronger predictor of academic achievement than other motivational constructs such as self-concept or instrumental motivation (OECD 2004a). Students with high levels of self-efficacy are more likely to exert effort to solve a problem than their peers with lower levels of self-efficacy (Bandura 1977), and this increased effort then leads to higher achievement.

Furthermore, self-efficacy has been shown to be positively correlated with student SES, with students from higher SES backgrounds reporting higher levels of self-efficacy than their less advantaged peers (Artelt et al. 2003). To our knowledge, however, no study has examined how the association between self-efficacy, student SES, and student achievement may vary in different school contexts. We do not know, for example, if the achievement of highly efficacious students is differently associated with school SES than that of their less efficacious peers. Anecdotally, it is not uncommon to encounter views that bright, advantaged, or motivated students will do well in most schools, regardless of the school's socioeconomic profile. However, previous research has shown that advantaged students are as sensitive to school composition as their less advantaged peers in Australia, weakening the claim that these students do well anywhere (within limits) (Perry and McConney 2010). However, it could also be the case that the association between school SES and student achievement is weaker for advantaged students who are also highly able, motivated, or self-efficacious.

We have therefore examined at a finer grain the association between school SES and mathematics achievement by asking two interrelated research questions:

1. How does the association between mathematics achievement and school SES vary for students with differing levels of self-efficacy?
2. How does the association between mathematics achievement and school SES vary when student groups are disaggregated by both individual SES and subject-specific self-efficacy (e.g., low SES/high self-efficacy students, high SES/low self-efficacy students, etc.)?

We chose mathematics as the focus because this subject area has historically been seen as less culturally dependent or influenced in comparison with other curriculum areas such as reading. From our perspective, therefore, our secondary analysis of maths achievement, and its association with varying levels of SES and self-efficacy, was viewed as potentially helpful in allowing comparison against future similar single-country case studies with a high degree of confidence that such analysis would be less confounded by national or state curricula than arguably might be the case with other subjects.

1.1 Rationale for examining Australia

It is plausible that the relationship between school socioeconomic composition and student achievement varies across countries. One reason for this may be the different characteristics of secondary schooling depending on national context. For example, in countries where high SES students tend to be concentrated in a relatively small number of schools, the association between school SES and student achievement may be stronger. Similarly, the association may be stronger in educational systems that have high levels of inequality in terms of resources and funding available to schools. Single-country case studies can extend our contextual understanding of the association and, as our understanding of the association in different national contexts grows, comparative analysis can serve to illuminate the educational, political, or sociocultural factors that mediate it.

Following this rationale, studies about the Australian case are relevant to an international audience for a number of reasons. First, most immigrants and ethnic minorities within Australia are relatively well integrated into society and do not suffer high levels of educational disadvantage (Lokan et al. 2001; OECD 2004a). This relative lack of racial or ethnic segregation associated with educational disadvantage means that the relationship between school SES and student achievement can be more "cleanly" examined without being confounded by race or ethnicity.[1]

Second, Australia enjoys a relatively equitable and high performing educational system compared with other OECD countries (Lokan et al. 2001; OECD 2004a). For example, in 2003, only a handful of countries performed statistically higher than Australia, and Canada was the only English-speaking country at a similar level. Further, like other high-performing countries in PISA, Australia enjoys more equitable outcomes than most other OECD members.

Finally, Australia provides an interesting case because of its high levels of privatization and school choice. School choice is widely available, and currently one-third of all students, and about 40% of all secondary students, attend private schools in Australia (Ryan and

[1] This is not to say that there is no group of educationally disadvantaged students in Australia. Indigenous Australians consistently have significantly lower educational outcomes compared with their nonindigenous peers. As they make up a relatively small percentage of the total population, roughly 1.5%, however, the scope of the challenge to the educational system more generally is much less than in many other countries.

Watson 2004). Since school SES can be both a driver and consequence of school choice, studies about systems with high levels of privatization and choice are especially relevant to improving our understanding of the association among school SES, student background, and academic achievement.

2 Method

This study is a secondary analysis of data derived from the 2003 Programme for International Student Assessment (PISA). In this secondary analysis, we used descriptive statistics and graphical representations to compare the mathematics achievement of secondary students across various student SES and self-efficacy backgrounds, and across a range of school SES profiles. While the 2006 dataset was available, we decided to use the 2003 dataset for this analysis so that we could directly compare and build upon the findings of Perry and McConney's (2010) secondary analysis of PISA 2003. That secondary analysis showed that the relationship between school SES and student achievement is similarly strong for all students, regardless of their individual SES. This study directly builds upon Perry and McConney's work by including another student variable, i.e., self-efficacy. By using the same dataset, we can examine the extent to which the relationship varies for students with different levels of self-efficacy. McConney and Perry (2010) have since conducted a similar study using PISA 2006 Australia, finding very similar results as in their earlier analysis of PISA 2003.

2.1 Data and variables

PISA is a major international assessment of 15-year-old students' academic performance in three subject areas: mathematics, reading, and science. This assessment program was developed and is managed by the Organisation for Economic Co-operation and Development (OECD), a nongovernmental research and policy organization headquartered in Paris, which is devoted to social, educational, economic, and environmental issues. Thirty OECD member countries participated in PISA 2003 as well as 11 partner countries (including, for example, Brazil, Indonesia, and Hong Kong-China), for a combined total of 41 participating countries. The 2003 PISA dataset for Australia comprised over 320 schools and more than 12,500 students representative of the population of 15-year-old students across the country, as well as identified subgroups within that population.

PISA's raison d'être is to support member countries' educational systems for the development of the skills and knowledge necessary for personal and working life in developed countries. PISA therefore assesses literacy in three learning areas rather than achievement tied to a specific curriculum (OECD 2004a). In mathematics, PISA measures students' ability to activate their knowledge and skills to solve problems found in real-life situations. The mathematical content of PISA centers around four areas: space and shape, change and relationships, quantity, and uncertainty.

Test items are based on everyday scenarios and problems. For example, in question 15 of PISA 2003, students were shown a graph with the following text:

> A TV reporter showed this graph and said: 'The graph shows that there is a huge increase in the number of robberies from 1998 to 1999.' Do you consider the reporter's statement to be a reasonable interpretation of the graph? Give an explanation to support your answer. (OECD 2004b, p. 82)

The rationale for this test item is that statistics and graphs are often designed to misrepresent phenomena. In this particular test item, the *y*-axis of the graph starts at 500 incidents of robbery and ends at 525 incidents (as opposed to 0–525 incidents). The difference in robberies between the two years thus looks much larger on the graph than would be suggested by looking at numbers alone (508 incidents compared with 515 incidents a year later). Student responses were graded along six proficiency levels. At the lowest proficiency level for this test item, students were not able to see that the reporter's interpretation is unreasonable. At the highest proficiency level, students could explain in full detail why the interpretation is not reasonable.

The main variables from PISA that we used in this study are student socioeconomic status (SES), student self-efficacy in mathematics, and student achievement in maths. We also created a new variable—mean school SES—which we calculated by averaging the SES of all students at a particular school in the PISA sample. Student SES in PISA is termed "educational, social, and cultural status" (ESCS). This variable is a composite index of three separate measures: highest parental education, parental occupation, and cultural and economic resources. The last measure is based on a large number of questions about family resources and activities related to cultural and economic capital. For example, students are asked how many bedrooms, computers, books, and original artworks are in their home, and how often they visit museums, art galleries, and concert halls. ESCS is thus a comprehensive and detailed measure of individual student SES.

Self-efficacy in PISA is defined as a student's belief and confidence in his/her ability to successfully handle learning tasks and overcome learning challenges (e.g., Bandura 1977) within particular subject areas. Self-efficacy is therefore related to the student's motivation to work hard and persist with challenging tasks. While PISA includes a range of engagement constructs, we chose self-efficacy for our study because it is more strongly associated with student achievement than any of the other self-concept and motivational constructs. For example, variance in student achievement in Australia is explained 27% by self-efficacy, 17% by self-concept, 12% by maths anxiety, 4% by interest/enjoyment, and 3% by motivation (OECD 2004a, pp. 120, 122, 134, 137, 139).

The maths self-efficacy variable is an index constructed from eight questions about a student's self-confidence in solving work- and life-related mathematical problems. Sample self-efficacy questions from PISA 2003 include: "How confident do you feel about having to calculate the petrol consumption rate of a car? Calculating how much cheaper a television would be after a 30% discount? Understanding graphs presented in newspapers?" (OECD 2004b, p. 292). Students were given four categories to choose from: "very confident," "confident," "not very confident," and "not confident at all."

2.2 Procedures

The approach we used for this secondary analysis is similar to that recently used to compare the effectiveness of private and public schooling across student SES groups in the USA and Chile (Lubienski and Lubienski 2005; Matear 2006), and to examine the association between school SES and achievement in Australia (Perry and McConney 2010). Briefly, the procedures we used in computing maths performance means across student and school SES bands and across varying levels of maths self-efficacy were as follows:

1. The Australian subset (about 12,500 students) was extracted from the 2003 PISA data housed at the Australian Council for Educational Research (ACER);

2. We constructed average student achievement scores in maths using the sets of "plausible values" for each student provided in the dataset[2];
3. Using the individual student SES variable (labeled ESCS in the PISA dataset) we sorted the dataset according to SES and determined the quartile cut-scores to divide the dataset into four parts, based on student SES;
4. The overall Australian dataset was cut into quartiles of just over 3,000 students each, based on individual SES; that is, we computed the 25th, 50th, and 75th percentiles of the distribution of ESCS scores, and divided the dataset accordingly. (Quartiles were chosen to provide a range of data points while maintaining groups large enough to be further disaggregated according to student self-efficacy and school SES.) These quartiles are referred to as *low*, *mid-low*, *mid-high*, and *high* student SES groups;
5. Each of these student SES-based quartiles was further subdivided into four based on maths self-efficacy, quartile cut-scores having been determined on this variable using the overall Australian dataset;
6. Again using the individual SES variable, as well as the unique school identifier variable (321 schools in the Australian dataset), we computed a "mean school group SES" variable and added it to the dataset;
7. We determined the quartile cut-points on this mean school group SES variable;
8. Each student record therefore carried an average score in maths, maths self-efficacy, individual SES, unique school identifier, and mean SES of the school group to which he/she belonged;
9. Each of the 16 groups formed through disaggregation according to student SES and maths self-efficacy was then further disaggregated into 4 subgroups using the mean school group SES variable;
10. These procedures left us with 64 subgroups organized by individual student SES, maths self-efficacy, and mean school group SES; we then computed the mean maths achievement scores for each of these 64 subgroups.

Unlike many prior studies, we have not used inferential statistics (e.g., analysis of variance, hierarchical linear modeling) to examine the association of varying levels of student SES, maths self-efficacy, and mean school group SES with student achievement in mathematics, as measured by PISA. In other words, we have not set out here to replicate the OECD's primary analyses of PISA, which employed multilevel modeling and which in our view clearly demonstrated substantial unique associations between individual and school-level SES and student achievement. Primarily, we chose our methodological approach because our purpose was, in the first instance, to unpack those previously demonstrated relationships to better describe and understand how each varied in the context of variations in the other. In other words, our research questions in this secondary analysis are clearly descriptive (e.g., what does the patterning of maths achievement look like across varying levels of SES and self-efficacy?) Therefore, our approach is also descriptive, by simply providing tabular and graphical descriptions of how student achievement varies for this PISA dataset, in the con-

[2] As explained by Wu (2005), in large-scale assessment programs such as the National Assessment of Educational Progress (NAEP), Trends in International Mathematics and Science Study (TIMSS), and PISA, achievement data sets provided for secondary analysts contain so-called "plausible values." Plausible values are multiple estimates of the unobservable latent achievement for each student. Wu has shown how plausible values can be used to: (1) address concerns with bias in the estimation of certain population parameters when point estimates of latent achievement are used to estimate those population parameters, (2) allow secondary data analysts to employ "standard" techniques and tools (e.g., SPSS, SAS procedures) to analyze achievement data that contain measurement error, and (3) facilitate the computation of standard errors of estimates when the sample design is complex.

text of differing levels of individual student SES, maths self-efficacy, and school SES. We believe that such descriptions are accessible and meaningful to a broad audience—including school administrators, policy-makers, and researchers—and hence add value to the primary multilevel analyses already done (OECD 2004a, 2007). Thus, in this case, we believe that our method represents a simple yet powerful and understandable approach to illuminating at a finer grain the interrelationships between individual and school-level SES, self-efficacy, and their association with students' performance in mathematics.

3 Findings

For this retrospective secondary analysis, we used disaggregated descriptive statistics to compare the mathematics achievement of high-SES students across four bands (quartiles) of maths self-efficacy, and across four bands of schools representing low through high SES schools. We then replicated these comparisons for students with mid-high, mid-low, and low SES backgrounds. In total, we calculated 64 means representing average achievement in maths for each of the subgroups disaggregated by student SES, student self-efficacy, and school SES.

In the first instance, consistent with what we already knew from previous studies (e.g., Chiu and Xihua 2008; Perry and McConney 2010), the individual SES of students matters greatly in terms of their academic achievement. For example, in mathematics, the typical student with a low SES background performs a full 100 points (just over 1 standard deviation) below the average high SES student. Second, and more pertinent to our current analysis, subject-specific student self-efficacy also matters greatly in the Australian context, as has been observed and reported more generally (e.g., Chiu and Xihua 2008). In maths, *within* the low student SES group, students with high self-efficacy performed on average more than 120 points (about 1.3 standard deviations) higher than students with low self-efficacy. Very similarly, *within* the high individual SES group, the typical student with low maths self-efficacy performed 115 points below the typical student with high maths self-efficacy.

Third, and most critical for the purposes of the current secondary analysis, the average socioeconomic composition of schools also plays a nontrivial, unique role in mathematics achievement for students disaggregated according to their individual SES backgrounds and their maths self-efficacy, as detailed in Table 1.

For example, for the typical low SES student, being part of a high SES school group (as compared with a low SES school group) is associated with improvements in maths achievement ranging from 37 points (0.4 standard deviation units) for students with low and high efficacy (first and fourth self-efficacy quartiles) to 71 points (0.8 standard deviations) for students with mid-high self-efficacy (third self-efficacy quartile). Table 1 also shows quite similar patterns for students with mid-low individual SES backgrounds. For these students, being part of a high SES school group was associated with improvements in maths achievement ranging from 0.5 standard deviations (44 points) for students with low maths self-efficacy to 0.6 standard deviations (52 points) for students with high self-efficacy.

Table 2 presents a consistent story for students with mid-high and high SES backgrounds. For the typical student with a mid-high SES background, being part of a high SES school group (as compared with a low SES school group) is associated with improvements in maths achievement ranging from 39 points (0.4 standard deviations) for students with mid-low maths self-efficacy to 66 points (0.7 standard deviations) for students with high self-efficacy.

Similar patterns of maths achievement were also evident for students with high individual SES backgrounds. For these students, being part of a high SES school group was associated with improvements in maths achievement ranging from 0.3 standard deviations (31 points)

Table 1 Mean maths achievement for students with low and mid-low SES backgrounds varied by levels of maths self-efficacy and school group SES

Maths self-efficacy	School group SES			
	First quartile	Second quartile	Third quartile	Fourth quartile
Students with *low* SES backgrounds				
First quartile	$n = 586$	$n = 440$	$n = 209$	$n = 53$
	427.2	438.6	442.4	464.6
Second quartile	$n = 426$	$n = 255$	$n = 151$	$n = 47$
	467.7	474.7	489.3	521.7
Third quartile	$n = 220$	$n = 178$	$n = 118$	$n = 48$
	507.0	510.8	520.1	577.7
Fourth quartile	$n = 130$	$n = 102$	$n = 65$	$n = 33$
	544.9	558.4	571.5	581.8
Students with *mid-low* SES backgrounds				
First quartile	$n = 259$	$n = 314$	$n = 265$	$n = 87$
	447.9	457.8	463.6	499.0
Second quartile	$n = 265$	$n = 304$	$n = 269$	$n = 121$
	486.2	494.0	512.7	530.3
Third quartile	$n = 181$	$n = 204$	$n = 214$	$n = 116$
	515.4	535.6	547.1	565.8
Fourth quartile	$n = 117$	$n = 140$	$n = 131$	$n = 94$
	563.2	569.6	590.1	615.0

for students with low maths self-efficacy to 0.6 standard deviations (54 points) for students with mid-low and high self-efficacy.

In summary, the findings depicted in Tables 1 and 2 strongly suggest that, for the Australian case, PISA data indicate that both student self-efficacy and school-level SES consistently and substantially matter for students' mathematics achievement; this relationship holds across the four levels of individual student SES. Put another way, our systematic disaggregation of the PISA 2003 data for Australia clearly shows that increases in both self-efficacy and school SES are consistently associated with improvements in maths achievement across a range of student SES levels.

While it is clear that average student mathematics achievement is greater in higher SES schools compared with lower SES schools, we nevertheless also found modest achievement differences among student groups disaggregated by self-efficacy and individual SES. First, as shown in Table 3, the general tendency was for groups with higher self-efficacy to exhibit slightly larger achievement differences between low and high SES schools. For example, the average difference in maths achievement between students in low and high SES schools for students having low self-efficacy (comprising students with low, mid-low, mid-high, and high SES) is 0.425 standard deviation units; the average achievement difference for the mid-low and mid-high self-efficacy groups is 0.525, and the average achievement difference for the high self-efficacy group is 0.575. Students with lower levels of maths self-efficacy tend to show somewhat more modest differences in maths achievement between low and high SES schools as compared with their peers with high levels of self-efficacy.

Second, it seems that student-level SES mediates the relationship between school SES and maths achievement. Among the student groups, students with low SES and mid-high

Table 2 Mean maths achievement for students with mid-high and high SES backgrounds varied by levels of maths self-efficacy and school group SES

Maths self-efficacy	School group SES			
	First quartile	Second quartile	Third quartile	Fourth quartile
Students with *mid-high* SES backgrounds				
First quartile	$n = 137$	$n = 185$	$n = 250$	$n = 164$
	456.0	465.5	478.4	503.0
Second quartile	$n = 118$	$n = 225$	$n = 247$	$n = 255$
	500.7	500.8	527.0	540.2
Third quartile	$n = 107$	$n = 194$	$n = 243$	$n = 247$
	538.3	534.5	556.5	578.5
Fourth quartile	$n = 98$	$n = 161$	$n = 210$	$n = 246$
	563.9	578.9	592.5	629.8
Students with *high* SES backgrounds				
First quartile	$n = 32$	$n = 91$	$n = 146$	$n = 185$
	489.7	492.9	497.2	520.3
Second quartile	$n = 37$	$n = 97$	$n = 207$	$n = 344$
	507.7	521.5	536.0	562.1
Third quartile	$n = 59$	$n = 124$	$n = 239$	$n = 489$
	554.6	550.2	563.3	594.6
Fourth quartile	$n = 59$	$n = 118$	$n = 245$	$n = 619$
	583.3	581.7	608.4	635.4

self-efficacy show the largest achievement differences between low and high SES schools—0.8 standard deviation units. In contrast, students in the high SES and low self-efficacy group show the most modest achievement difference—0.3 standard deviation units. In general, students from mid-high and high SES backgrounds with low self-efficacy tended to show modest achievement differences between low and high SES schools, whereas the association between school SES and maths achievement seemed more robust for high self-efficacy/low SES students.

Our intent in systematically disaggregating these data additionally included providing a finer-grained depiction of the profiles of the relationships between SES and maths performance, including such issues as whether there are evident "school SES thresholds" that must first be reached before the positive relationship between school SES and academic performance is seen, and whether observed relationships continue to be positive across the entire range of self-efficacy and school SES. Figures 1, 2, 3, and 4 start to offer answers to these questions.

First, from these figures the strength and consistency of the association between school SES and mathematics performance across the cohorts representing different levels of student SES, as well as across the four levels of maths self-efficacy, are noteworthy. In no case is there crossover among the lines representing maths achievement for different levels of student self-efficacy across the four student SES cohorts.

Second, consistently across the student SES quartiles, but perhaps most notably for students with low and mid-low maths self-efficacy, there does appear to be something like a school SES threshold—located between the second and third school SES quartiles—below

Table 3 Mean mathematics achievement differences between students in low and high SES schools, disaggregated by mathematics self-efficacy and student-level SES

Level of self-efficacy	Achievement difference between high and low SES schools	Standard deviation (SD) units
Low SES students		
Q1 (low)	37	0.4
Q2 (mid-low)	54	0.6
Q3 (mid-high)	71	0.8
Q4 (high)	37	0.4
Mid-low SES students		
Q1 (low)	51	0.5
Q2 (mid-low)	44	0.5
Q3 (mid-high)	50	0.5
Q4 (high)	52	0.6
Mid-high SES students		
Q1 (low)	47	0.5
Q2 (mid-low)	39	0.4
Q3 (mid-high)	40	0.4
Q4 (high)	66	0.7
High SES students		
Q1 (low)	31	0.3
Q2 (mid-low)	54	0.6
Q3 (mid-high)	40	0.4
Q4 (high)	52	0.6

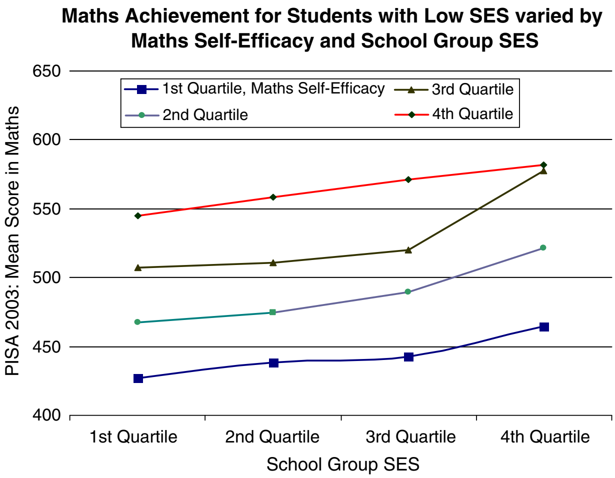

Fig. 1 Maths achievement for low SES students across self-efficacy and school SES quartiles

which the relationship between school SES and maths achievement is positive but modest, and beyond which the relationship becomes more strongly positive. For the Australian sample, this may reflect the transition from lower and middle SES public schools, to private and/or more affluent public schools.

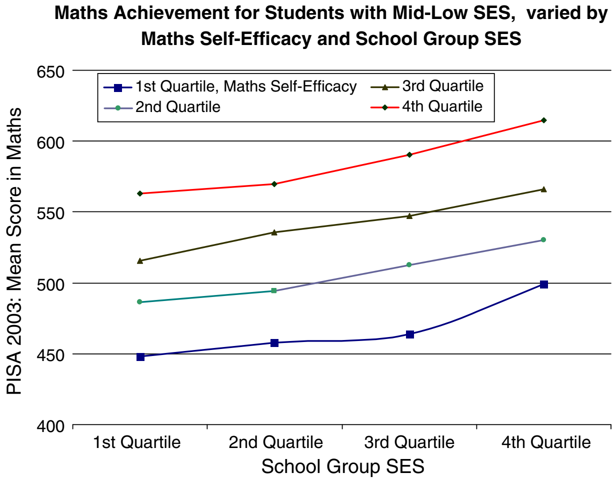

Fig. 2 Maths achievement for mid-low SES students across self-efficacy and school SES quartiles

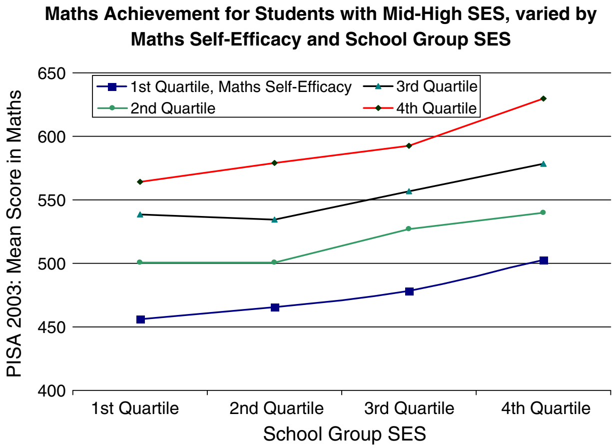

Fig. 3 Maths achievement for mid-high SES students across self-efficacy and school SES quartiles

Thus, the findings from this secondary analysis of the Australian PISA 2003 data appear clear and consistent. Despite some modest differences among the groups as described above, in general these analyses show that all students—regardless of their personal/family SES or their pre-existing maths self-efficacy—benefit to a nontrivial extent from schooling contexts in which the SES of the school group is high.

Conversely, all students, regardless of their individual SES or maths self-efficacy, perform less well in school contexts characterized as low on the school SES continuum.

These findings are consistent with other studies that have found that all students are sensitive to the influence of the aggregated socioeconomic composition of their schools. Furthermore, our findings add to the research literature by showing more detailed differences between students with different levels of self-efficacy and socioeconomic status. Previously, using this same dataset, Perry and McConney (2010) showed that the association between school SES and maths achievement is very similar for all students, regardless of their individual SES. This study shows that, when self-efficacy is added, the association between

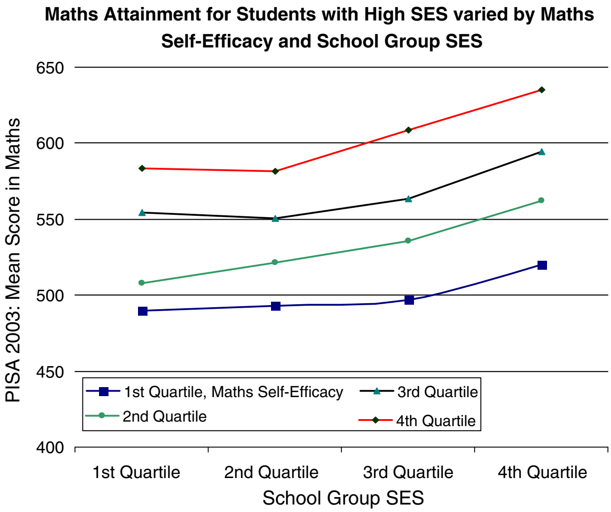

Fig. 4 Maths achievement for high SES students across self-efficacy and school SES quartiles

school SES and maths achievement remains consistent, and at the same time slightly more pronounced for students with high maths self-efficacy.

4 Discussion

The research literature has shown that the socioeconomic composition of a school is strongly associated with student academic achievement. However, our understanding about how this relationship may vary for different students and in different countries continues to evolve. This study develops our understanding about the relationship between school SES and student achievement by examining the association in the context of two additional student characteristics: subject-specific self-efficacy and socioeconomic status.

The study examines data from Australia, whose educational system can be characterized as relatively equitable and effective, with high levels of school choice and privatization. As many of the studies about school socioeconomic composition and student achievement have been conducted in the USA, studies of other national contexts can illuminate the ways in which educational policies and structures influence the relationship. From an educational policy point of view, understanding who is most affected by school composition can help shape policy options. For example, if high SES students are relatively immune to the influence of school composition, then there is no policy disincentive to fostering the integration of schools by SES. If, on the other hand, low SES students are strongly influenced by school composition, then policies need to take that into account. Our current study is therefore an early step in developing a larger comparative understanding of the relationship between school socioeconomic composition and student achievement.

4.1 Australian educational context

Australia has a comprehensive system of secondary education wherein most schools belong to the same type of institution (e.g., “high school”) and provide a general academic education. This type of secondary school system is common in other Anglo-Saxon countries, Asia, and Northern Europe. Vocational education programs at the secondary school level are typically integrated into these comprehensive schools rather than placed in separate vocational institutions.

Curriculum is created at the state level, and all schools within the state must adhere to the given curriculum standards or framework. Recently, the Commonwealth (federal) government has appointed a commission to design and implement a national curriculum that will be valid for all states. It is currently expected that Australia's first national curriculum in English, mathematics, the sciences, and history will be implemented beginning in 2011.

Schools in Australia are managed and funded differently according to the sector to which they belong. Public schools are overseen and primarily funded by state government education departments. Public schools within a state are funded relatively equally, with schools in underserved areas or with large numbers of underserved students receiving additional funding. Private schools are managed by their respective nongovernment organizations (e.g., the Catholic or Anglican Church, etc.). Private schools charge fees but also receive substantial public funding, primarily from the the Commonwealth government. Some private schools, for example, receive approximately 40% of their funding from government sources (Independent Schools Council of Australia 2008). High status private schools typically charge up to $15,000 Australian dollars per year, approximately 25% of the average annual wage in Australia. While expensive, these fees are significantly less than comparable American or British schools, which do not receive government funding.

The private school sector is large in Australia, enrolling almost 40% of all secondary students. Australia has a long history of private schooling, and enrolments have been steadily increasing over the past few decades. While many private schools have long attracted students from high SES backgrounds, new enrolments are coming primarily from the middle classes (Ryan and Watson 2004). The result is that average student SES is lowest in public schools and highest in non-Catholic private schools (Ryan and Watson 2004). Overall, school segregation by student SES has increased in Australia over the past three decades, with high SES students more likely to be concentrated in a smaller number of schools than in the past (Rothman 2003).

While all schools are held to the same curriculum standards, Australian secondary schools differ in the quality and range of academic subjects offered. The majority of secondary schools with the highest examination results are high-status private schools, although some public schools have excellent results as well. A common public perception is that private secondary schools are the best providers of high-quality academic preparation for university. While this is certainly an overly simplistic belief (e.g., many private schools have mediocre examination results), research has shown that opportunities for studying a rigorous academic curriculum are decreasing in the public school sector (Edwards 2006). This phenomenon is significant because curriculum is the main mediator of educational advantage (Marks et al. 2006).

Within the public school sector, students are guaranteed a place at their local school but may apply for admission to any "out of area" public school in their state. Most families can find a place at their preferred out-of-area primary school, but the situation for secondary schools is less assured. Finding a place at a public secondary school with a strong academic reputation is particularly difficult, and therefore is often limited to students within the catchment zone. Moreover, renting or purchasing a home within the catchment zone of a school with a strong academic reputation is often expensive in Australia, similar to in the USA and many other countries. Thus, school choice at the secondary level is theoretically possible but often highly constrained, especially for families with limited financial resources.

5 Conclusions

Our analyses of the PISA data suggest that the relationship between mathematics achievement and school SES is slightly stronger for students with higher levels of self-efficacy than for their peers with lower levels of self-efficacy. Presumably this is because high SES schools in Australia are associated with access to more academically challenging curriculum and supportive learning environments than lower SES schools, and students with higher levels of self-efficacy have the cognitive and affective tools to maximize their learning in this enriched environment. Our second finding is that student SES further interacts with self-efficacy, school SES, and student achievement. The association between maths achievement and school SES is strongest for low SES students with high levels of self-efficacy, and weakest for high SES students with low levels of self-efficacy.

In Australia, the students who are most likely to benefit from attending a high SES school are low SES, high self-efficacy students, and yet this is the very group of students who tend to have the least access to rigorous academic curriculum. Partly because of their limited financial resources, lower SES students in Australia tend to attend public schools in working-class neighborhoods, many of which are increasingly focusing on vocational education. As schooling becomes more segregated in Australia, research shows that students in working-class communities have fewer opportunities to study an enriched academic curriculum (Edwards 2006).

Our findings suggest that all students should have equal access to a rigorous academic curriculum, regardless of their financial resources. This is currently not the case in Australia. We argue that Australian policy-makers should look to countries that have more equitable and efficient student outcomes, such as Canada and Finland, for guidance. These countries are better able to help students from less privileged backgrounds reach their full potential and to minimize the importance of family financial resources for obtaining a rigorous academic experience. One of the main ways in which they do this is by minimizing differences (resources, curriculum, etc.) between schools, thus minimizing incentives for social segregation among schools. From both social justice and economic productivity perspectives, we therefore argue that policies that potentially increase segregation and resource differences among schools should be avoided.

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