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How do school resources and academic performance differ across Australia's rural, regional and metropolitan communities?

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Abstract This study uses data from the Programme for International Student Assessment (PISA) to gain a better understanding of how academic performance and resources vary across rural–urban school communities in Australia. While it is well known that schools in rural areas have difficulty recruiting and retaining teachers, the degree to which schools in larger sized communities across Australia also face this problem is less understood. Moreover, very little is known about the degree to which shortages of instructional materials and equipment are associated with rural–urban location. The analysis includes 353 schools across eight community types that range in size of <1,000 people in small country towns to more than a million people in large capital cities. School principals reported the degree to which instruction in their school is hindered by a shortage of resources, which include qualified teaching staff and instructional materials and equipment. The findings highlight the extent to which school resources vary across geographic location, as reported by school principals. Principals of schools in the centre of large cities were the least likely to report that shortages of teaching staff or instructional materials hinder learning, while principals in rural and remote communities were the most likely to report that such shortages hinder instruction. These differences closely mirror student PISA academic performance and school socioeconomic composition. PISA data indicates that schools located in small rural communities have the lowest

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socioeconomic profiles, the lowest academic performance and the largest shortages of teaching staff and instructional materials, while schools in central neighborhoods of large cities enjoy the highest socioeconomic profiles, the highest academic performance and the fewest shortages.

Keywords Geographic location · School resources · Rural education · Academic performance · PISA

Introduction

This study adds to our understanding about the shortage of school resources in rural communities by comparing rural, regional and urban school principals' responses on the *Programme for International Student Assessment* (PISA), an international assessment created by the Organization for Economic Cooperation and Development (OECD). PISA is an international assessment of reading, mathematics and science literacy designed for 15-year-old students. The performance of Australian students taking part in PISA 2009 has been characterized by the OECD as high performing and equitable compared to other countries (Thomson et al. 2010). However, a recent report for the Review of Funding for Schooling in Australia by the Nous Group (2011) suggests Australian students' performance in recent international tests:

> …masks a wide degree of variability within our education system. That variability relates to educational outcomes, and to equity—that is, the degree to which people from all backgrounds are able to realise their potential in school. (p. 5)

So whilst Australian students on average display positive educational outcomes, PISA data also indicate that three groups of students in Australia consistently have lower academic performance than their peers: students with lower socioeconomic status (SES), students in rural and remote communities, and Indigenous students (De Bortoli and Thomson 2010; Lokan et al. 2001; Thomson and De Bortoli 2008). Our focus in this paper is on analysing PISA questionnaire data concerning students and schools in rural and remote communities, including data provided by school principals.

According to an Australian government document (Baxter et al. 2011), Australia's population in 2009 was just <22 million people living in the following community types:

> Over two-thirds (69 %) of Australians live in major cities, one in five (20 %) live in inner regional areas, one in ten (9 %) in outer regional areas and around. one in forty (2.3 %) live in remote or very remote areas (1.5 % remote and 0.8 % very remote). (p. 1)

Educational opportunities and outcomes are limited in many rural and remote communities. In terms of educational opportunities, the Australian Human Rights and Equal Opportunity Commission (2000) states:

> State and Territory education departments provide primary schools in rural and remote locations once there is a critical mass of primary aged children. A remote community of fewer than 1,000 people is unlikely to be provided with a secondary school. Some 'primary' schools extend their provision beyond year 6 or 7 to year 8 or 9 and sometimes to year 10. Secondary provision to year 12 is almost non-existent in remote communities. (p. 11)

Australian students who attend schools in rural and remote communities experience lower educational outcomes than their peers in the cities (Human Rights and Equal Opportunity Commission 2000). They are less likely to attend university (James 2001), less likely to finish secondary school (Lamb et al. 2004), and have poorer performance on achievement tests (Williams 2005). In their analysis of PISA 2000 data, Cresswell and Underwood (2004) found that:

> …students in remote areas are not achieving at the same level as their city counterparts….It was found that 27 per cent of students from remote areas were achieving at the two lowest levels, compared to 12 per cent of students from major cities. At the other end of the scale, 18 per cent of remote students achieved at the two highest levels, compared to 46 per cent of the city students. (p. 33)

Cresswell and Underwood (2004) found similar patterns in their analysis of PISA 2003 data for Australia.

The reasons why students in rural and remote communities have lower educational outcomes than other students are complex and varied. Family background is a strong predictor of educational outcomes. Numerous studies have shown that students from lower socioeconomic backgrounds, which include many Indigenous and rural and remote students, typically achieve lower educational outcomes than their more privileged peers (Noel and de Broucker 2001; OECD 2010; Sirin 2005; Teese and Polesel 2003). Although international and Australian research has consistently shown that individual level factors such as socioeconomic status and home environment are the largest predictors of educational outcomes (Noel and de Broucker 2001), school resources are also important (Chiu and Khoo 2005; OECD 2005; Vignoles et al. 2000).

Rural and urban funding equity issues have come to the fore in Australia partly due to the Gonski Review (Gonski et al. 2011), a major education funding review commissioned recently by the federal government. The review proposes a more balanced and equitable funding formula to reduce large resource inequalities between schools and to ensure that all schools receive adequate funding to meet the needs of their students. The need for school funding reform in Australia is vital as explained by McMorrow (2011): "Constructing national recurrent target resource standards for schools….would be a major step towards the development of a funding model for schools that has integrity, rationality and sustainability" (p. 15).

It is indeed the case that rural schools often receive higher per-pupil funding than urban schools because they are more expensive to operate due to their small size, and because they often enrol a larger proportion of at-risk students who receive higher funding (e.g., Indigenous students). For example, the federal government's

My School website (Australian Curriculum Assessment and 2013) shows that Narrogin Primary School, located in a small rural community of ~4,200 people, has a net recurrent income of $14,139 per student, while Mandurah Primary School, located in a city of more than 83,000 people, receives $12,359 per student. The larger per-pupil funding in rural schools is not necessarily sufficient to provide an equitable distribution of school resources, however. It may be the case that rural schools need an even higher per-pupil funding in order to have a comparable level of teaching and learning resources.

In this study, we use questionnaire data from PISA 2009 to gain a better understanding of the extent to which school resources, vary according to where schools are geographically located. The school resource variables included in PISA 2009 relate to shortages of teaching staff, materials and equipment, as reported by school principals. Our primary aim is to examine differences in school resources across rural–urban locations as reported by school principals. Although it is well known that schools in rural and remote communities routinely experience high turnover of teachers and principals (Vinson et al. 2002), much less is known about how shortages of teaching staff, materials and equipment may vary across different types of communities in Australia.

Regardless of whether school resources are significantly related to students' educational outcomes or not, resources amongst Australian schools must be distributed across schools in a manner that ensures equality of access and opportunity for all students, in accordance with the National Declaration On Educational Goals For Young Australians (Ministerial Council on Education, Employment, Training and Youth Affairs 2008). All Australian students (Barr et al. 2008) have the right to:

> …equality of opportunity to access and participate in high-quality schooling that is free from discrimination based on gender, language, sexual orientation, pregnancy, culture, ethnicity, religion or disability, and differences arising from students' socioeconomic background or geographic location. (p. 6)

A secondary, related objective of this study is to examine how academic performance (as measured by PISA) varies across a wide range of rural–urban locations in Australia. Again, although it is well established that students in rural communities tend to perform less well than their urban peers, less is known about how the overall academic performance of schools varies by location. Is the relationship between school academic performance and community size, type or urbanicity consistently positive, or not? And, how do these relationships look when school and student socioeconomic composition are added to the mix?

Background

Educational outcomes are influenced and mediated by a complex web of factors derived from multiple sources, including the student, family, peers, community, school and the dominant culture within a society. A particular set of factors, namely those reflective of a school's resources, is the focus of this study. School resources

include instructional materials, infrastructure and teaching staff. Previous research has reported that school resources and learning environments are strongly associated with educational outcomes (Chiu and Khoo 2005). Of all school resources, most researchers agree that qualified teachers are the most important for student learning (Akiba et al. 2007; Darling-Hammond and Ball 1997; Darling-Hammond et al. 2005; Hanushek 2007; Hattie 2009).

Researchers for decades have noted that school resources are strongly correlated with both school and student SES, which leaves open the possibility that the importance of school resources is underestimated (Bowles and Levin 1968; Centra and Potter 1980). Chiu and Khoo (2005), among many others, have reported that higher SES schools are, on average, better resourced than lower SES schools in most countries, including Australia. Compared to schools that enroll students with mainly higher SES backgrounds, schools with large concentrations of students from low SES backgrounds have fewer teaching resources (Chiu and Khoo 2005; Tate 1997), have more difficulty recruiting and retaining teachers (Darling-Hammond 2009; Haberman 2006), and have fewer certified teachers (Clotfelter et al. 2007; Hanushek 2007; Ofsted 2000).

Within Australia and across the world the term 'rural' is defined in different ways. Black (2005, cited in Alston 2007), notes that "'Rural' is a highly contested term in Australia because of the diversity of population and geography" (p. 196). Many people question the rurality of Australia's lush coastal regions in comparison to the sparse Australian outback. PISA categorises school communities based on geographic location, taking account of the population size of the community and its distance from the nearest city. The context by which PISA classifies a school community's geographic location is not reflective of the community's proximity to the ocean, the quality of infrastructure or economic development.

In Australia, schools in rural and remote locations face many challenges, especially regarding teaching staff. Vinson et al. (2002) and Welch et al. (2007) have found that rural schools in New South Wales face teacher shortages. Analyses of PISA data indicate that rural schools in Australia have difficulties attracting and retaining experienced teachers (Cresswell and Underwood 2004; Thomson and De Bortoli 2008). None of these studies, however, has shown in detail how resources vary across schools in different locations. This study adds to our understanding about the shortage of school resources in rural communities by comparing principals' responses from rural, regional and urban communities.

While student factors are probably more important than school-level factors in predicting academic performance, the latter are nonetheless important. For example, Rothman and McMillan (2003) report, "Approximately less than one-sixth of the variation in scores on tests of reading comprehension and mathematics [tertiary entrance scores] could be attributed to differences between schools…" (p. 30). Student background characteristics do not explain all of the differences in educational outcomes between students in different geographic locations, however. Young (1998) found that students who attend rural and remote schools in Western Australia, a sparsely populated state, have lower academic performance than their peers in the cities even after controlling for student socioeconomic status (SES). Similarly, Welch et al. (2007) found in New South Wales that students in rural and

remote communities were less likely to complete year 12 than their peers in larger cities, even after controlling for student SES. Welch et al. (2007) also found that school completion rates varied after controlling for concentrations of Indigenous students and school size. These studies suggest that school characteristics (other than school size) may vary by rural–urban location, and that these differences may help explain performance gaps between rural and urban students. This conclusion is also strongly supported by analyses of PISA data that demonstrate that school resources mediate the relationship between school and student socioeconomic status and academic performance (Chiu and Khoo 2005).

Method

This study examines data from PISA 2009. PISA is a large international student performance assessment of 15-year-olds. Since 2000 PISA has conducted assessments every 3 years. Each participating country's sample is drawn to be statistically representative of the total number of students enrolled in different types of schools (e.g., private or public), communities and geographical locations. The latest publicly available PISA assessment was conducted during 2009, with over 65 countries and nearly 470,000 students taking part (data from the last round of PISA, conducted in 2012, has yet to be released). The Australian PISA 2009 sample includes 353 schools and 14,251 students (Thomson et al. 2010). The PISA 2009 dataset includes responses to two main questionnaires: one completed by students and the other by school principals.

PISA is not a perfect tool for evaluating educational systems and student outcomes (Hopmann et al. 2008). Like all cross-sectional datasets, PISA does not allow researchers to show causal relationships among student or school characteristics and student performance. However, its advantage is that the number of participating countries and students is very large, and that it includes an extensive range of student and school variables. Another potential limitation of PISA data is many of the variables relating to school resources and learning environments are reported by the questionnaire respondents (i.e., either students or principals).

The Australian PISA 2009 dataset sourced from the Australian Council for Educational Research (ACER) groups participating schools into eight geographic categories based on the population size of the community; this variable is called 'School Community'. The eight categories range from communities with less than 1,000 inhabitants (the most 'rural' of the eight categories) to communities with more than 1,000,000 inhabitants (the most 'urban' category). ACER has redefined the five categories utilised within the original PISA data into eight geographic categories to better characterise the broad geographic variation of Australian communities. For Australia, the distribution of students and schools in these eight geographic categories is shown in Table 1.

In this investigation we calculated two additional contextual variables for each school community: (1) the average school SES; and (2) the ratio of Indigenous to non Indigenous students. We calculated these variables because, in the Australian case, they tend to be strongly associated with rurality and in Australian school

communities the Indigenous to non Indigenous ratio is a strong indicator of cultural dynamics. Each variable was calculated from individual student records in the PISA 2009 sample. Table 2 provides the ratios of Indigenous to non Indigenous students by community type and school SES. It should also be noted that Australia over-samples Indigenous students in PISA to gain a better understanding of the complexity of issues that affect this group of students.

Table 2 shows that the density of Indigenous students in rural school communities in Australia is greater than in school communities close to the centre of very large cities. There is the option for rural Australian students to transfer to city school communities or attend boarding school. However, as is highlighted by the mean SES variable and explained by the Human Rights and Equal Opportunity Commission (2000) "…for many Indigenous students each of these options violates cultural expectations and needs and is therefore unrealistic" (p. 14).

Table 1 Distribution of students and schools by school community

School community	Population	Number of students	Number of schools
Small rural community	<1,000	182 (1 %)	6
A small country town	1,000 to about 3,000	467 (3 %)	15
A medium-sized country town	3,000 to about 15,000	1,811 (13 %)	45
A larger town	15,000 to about 50,000	1,571 (11 %)	39
A very large town	50,000 to about 100,000	1,236 (9 %)	29
A city	100,000 to about 1 million	4,538 (32 %)	108
Elsewhere in a very large city	>1 million	2,297 (16 %)	59
Close to the centre of a very large city	>1 million	2,148 (15 %)	52
Total		14,250 (100 %)	353

Table 2 Indigeneity of school communities

School community	Population	Ratio of indigenous to non indigenous students	Mean school SES
Small rural community	<1,000	1:10.4	−0.02
A small country town	1,000 to about 3,000	1:7.6	−0.01
A medium-sized country town	3,000 to about 15,000	1:7.1	0.11
A larger town	15,000 to about 50,000	1:6.6	0.15
A very large town	50,000 to about 100,000	1:6.1	0.22
A city	100,000 to about 1 million	1:12.6	0.47
Elsewhere in a very large city	>1 million	1:25.7	0.35
Close to the centre of a very large city	>1 million	1:31.5	0.52
Average		1:11.5	0.34

Our study utilises PISA questionnaire data provided by school principals about students, teachers and resources within individual schools. PISA collects such information because previous studies have reported that school resources are associated with student educational outcomes (Diseth 2007; Hoy et al. 2006; Schleicher 2009; Stewart 2008).

Principal responses to questions of teaching personnel shortages stem from the following questionnaire questions: Question 10, "The goal of the following set of three questions is to gather information about the student-computer ratio in your school" and Question 11, "Is your school's capacity to provide instruction hindered by any of the following issues?" Question 11 contains 13 'issues' that relate to the question stem: six issues concerning shortages of qualified teaching staff and seven issues about shortages of teaching materials and equipment. The response categories to the 13 issues comprise the following: 'not at all' (coded 1), 'very little' (coded 2), 'to some extent' (coded 3), and 'a lot' (coded 4). In keeping with the questionnaire format, we have kept principals' responses about shortages of teaching materials and personnel together in our analysis. We acknowledge, however, that these two domains are likely to have different impacts on student experiences and outcomes.

We calculated descriptive statistics (means, standard deviations, and frequencies) for principal responses to each item, across all eight school communities. Our purpose was to gather information from school principals about the degree to which shortages of teaching staff, materials and equipment vary across the eight rural–urban locations.

Findings

As reported in Table 2, the proportion of Indigenous to non Indigenous students is highest in school communities with 100,000 residents or less. Mean school SES is lowest in small rural communities and highest in school communities close to the centre of a very large city. Patterns in Table 2 indicate that school SES increases with the size of the community, with one exception. The average school SES is reported higher in smaller cities (<1,000,000 residents) than in the 'fringe suburbs' elsewhere in a very large city (more than 1,000,000 residents).

As noted above, we also calculated students' average literacy performance for the three subjects (mathematics, reading and science) assessed in PISA, for each of the eight school communities. These results are presented in Table 3.

Australia's PISA 2009 literacy performance outlined in Table 3 shows that students who attend school in a city centre achieve, on average, considerably higher mean scores than their peers in rural communities. This pattern supports research by Cresswell and Underwood (2004) who reported that Australian students who attended schools in close proximity to major cities and inner regional locations had stronger performance in the PISA 2000 Reading Assessment than students in regional and remote geographic locations. Indeed, student academic performance scores in PISA 2009 mathematics, reading and science appear positively related to community size, wherein increases in the size of the community are generally associated with higher literacy performance average scores. The apparent

Table 3 Mean mathematics, reading and science literacy performance scores by geographic location

School community	Population	Mathematics M (SD)	Reading M (SD)	Science M (SD)
Small rural community	<1,000	469.2 (80.3)	472.0 (91.4)	483.6 (84.8)
A small country town	1,000 to about 3,000	480.6 (87.8)	475.8 (97.0)	501.1 (97.3)
A medium-sized country town	3,000 to about 15,000	491.4 (82.2)	489.8 (93.1)	506.5 (93.2)
A larger town	15,000 to about 50,000	486.3 (84.9)	485.4 (93.8)	501.2 (95.3)
A very large town	50,000 to about 100,000	502.9 (87.7)	503.0 (94.6)	517.0 (96.6)
A city	100,000 to about 1 million	525.8 (88.8)	528.0 (93.6)	540.5 (96.8)
Elsewhere in a very large city	>1 million	514.8 (86.8)	516.2 (92.8)	524.6 (95.0)
Closer to the centre of a very large city	>1 million	541.3 (89.9)	541.7 (94.9)	550.8 (97.8)
Average		514.3 (89.4)	514.9 (96.0)	527.3 (97.6)

relationship between literacy performance and school community size is not completely linear, however. Average scores in all subjects were higher in medium-sized country towns than in larger towns. Another exception is that average scores are higher in smaller cities than "elsewhere in a very large city"; in other words, student literacy performance is higher in large regional cities than in the outer suburbs of the large capital cities. This pattern closely mirrors the pattern between mean school SES and community type reported in Table 2.

Figure 1 highlights the relationships among school community, school SES, indigeneity and student literacy performance in reading, mathematics and science, as assessed in PISA 2009.

Figure 1 illustrates that schools in small rural communities and small country towns enroll students with lower SES backgrounds, whereas schools close to the centre of very large cities tend to enroll students with higher SES backgrounds. Figure 1 reflects the strong association that exists between mean school SES and mathematics, reading and science literacy performance. There are a few exceptions to this pattern and for this reason the performance of students from larger towns (15,000–50,000 residents) is of interest. Likewise, the Indigenous to non Indigenous student ratio represented in Fig. 1 suggests that higher ratios are linked to weaker academic performance in mathematics, reading and science.

Table 4 summarizes principals' responses to questions about student-computer ratios across the eight school communities. Principals were asked to report on the number of computers that are available to 15 year-olds in their school and to identify the number of computers that have Internet access.

Table 4 suggests that, according to school principals, the mean number of computers available to 15-year-old students within year 10, across school communities, closely matches the mean number of students within this range. Similarly these data indicate that almost all school computers have Internet access.

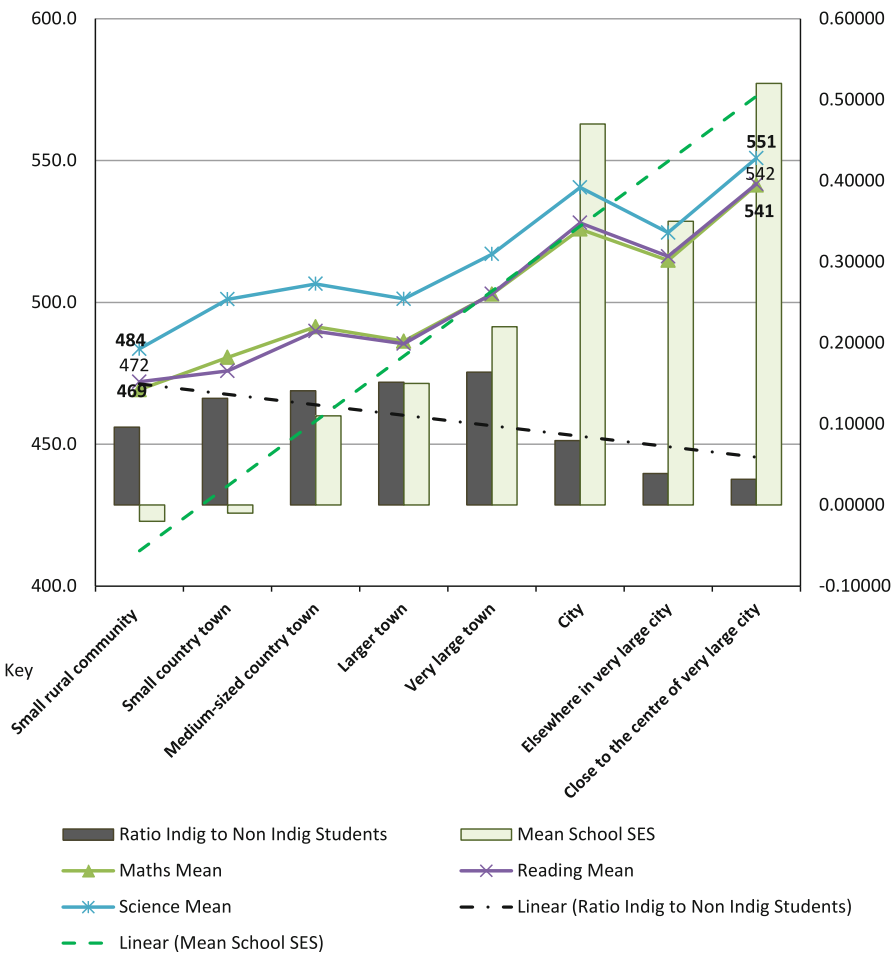

Fig. 1 Mathematics, reading and science academic performance in PISA 2009 by mean school SES and geographic location

Thus, the data show that the student to computer ratio is very similar across the eight school communities, ranging from 0.9 to 1.1. The data provided by principals reports the ratio of computers to students, is largest in both the smallest rural communities and the most urban school communities. This is perhaps the result of the Labour government's education revolution, which included a policy of providing computers to every school (Buchanan 2011; Rudd et al. 2007).

A school's capacity to provide instruction can be hindered in many ways. Tables 5 and 6 report principals' responses to questions about their school's resources, which includes teaching staff, materials and equipment. Principals were asked about the degree to which their school's capacity to provide instruction is hindered by a lack of teaching personnel (Table 5) and teaching resources (Table 6).

Table 4 Ratio of student numbers to computers by school community

School community	Total number of students in modal grade for 15-year-olds (Mean)	Computers for education in modal grade (Mean)	Ratio of computers to students	Computers in modal grade with internet access (Mean)
Small rural community	34.7	38.7	1.1	38.7
A small country town	54.7	57.8	1.1	57.8
A medium-sized country town	119.3	108.4	0.9	107.9
A larger town	160.8	140.7	0.9	140.7
A very large town	196.9	172.5	0.9	171.9
A city	173.4	171.9	1.0	171.3
Elsewhere in a very large city	165.0	180.7	1.1	179.8
Close to the centre of a very large city	188.3	202.4	1.1	201.6
Average	160.4	159.3	1.0	158.3

According to the responses provided by school principals, shortages in teaching personnel vary moderately across the school communities, with principals in the smallest, most rural communities more likely to report that shortages hinder instruction in their schools compared to principals in more urban areas. The general trend shown in Table 5 is that shortages of teaching personnel become less pronounced, as the size of the school community increases, although there are a few exceptions as is evident in a larger town and a very large town data. The largest differences, according to location, in the degree to which teacher shortages were perceived by principals as hindering instruction were seen in mathematics. On average, school principals in small rural communities reported this a problem to some extent (mean = 2.7), whereas principals in urban schools reported maths teacher shortages a hindrance only to a very little extent (mean = 1.7). Somewhat surprisingly, we found that principals' reported that teaching personnel shortages were also a hindrance in towns ranging in size from 15,000 to 50,000 residents (a larger town). This suggests that shortages of teaching personnel are not limited to the most rural or remote communities. The number of principals who responded that their school is 'to some extent' affected by teacher shortages varies substantially across the school communities. For example, 83 % of principals in small rural communities report that a lack of mathematics teachers hinders instruction to some extent or a lot, compared to only 17 % of principals in communities close to the centre of a very large city. Further, one-half of principals in small rural communities report that a shortage of qualified teachers hinders instruction in their school to some

Table 5 Lack of teaching personnel by school community as reported by principals

My school's capacity to provide instruction is hindered by a lack of						
School community	Science teachers	Mathematics teachers	English teachers	Qualified teachers	Library staff	Other personnel
Small rural community						
M	2.3	2.7	2.5	2.5	1.5	2.5
% 'to some extent'	50	83.3	33.3	50	16.7	33.3
% 'a lot'	0	0	16.7	16.7	0	16.7
A small country town						
M	2.1	2.5	1.9	2.1	2.2	2.3
% 'to some extent'	20	46.7	20	46.7	26.7	33.3
% 'a lot'	13.3	13.3	6.7	0	20	6.7
A medium-sized country town						
M	1.8	1.9	1.6	2.2	1.4	1.9
% 'to some extent'	28.9	22.2	15.6	40	4.4	24.4
% 'a lot	0	8.9	0	2.2	2.2	2.2
A larger town						
M	2.2	2.3	1.9	2.2	1.2	1.9
% 'to some extent'	43.6	56.4	30.8	30.8	2.6	20.5
% 'a lot'	2.6	2.6	0	0	0	7.7
A very large town						
M	2.1	2.1	1.7	2.0	1.5	1.8
% 'to some extent'	34.5	34.5	24.1	27.6	13.8	20.7
% 'a lot'	6.9	6.9	0	3.4	3.4	6.9
A city						
M	1.8	1.9	1.6	1.9	1.4	1.8
% 'to some extent'	19.4	22.2	18.5	32.4	7.4	21.3
% 'a lot'	2.8	6.5	0	0	0	2.8
Elsewhere in a very large city						
M	1.7	1.9	1.5	1.8	1.3	1.5
% 'to some extent'	27.1	27.1	5.1	20.3	5.1	8.5
% 'a lot	1.7	5.1	1.7	5.1	0	3.4
Close to the centre of a very large city						
M	1.5	1.7	1.5	1.7	1.3	1.8
% 'to some extent'	11.5	15.4	17.3	19.2	9.6	21.2
% 'a lot'	1.9	1.9	0	1.9	0	7.7
Mean	1.9	2.1	1.8	2.0	1.5	1.9

Principal questionnaire response categories for question 11 coded as: 1: not at all, 2: very little, 3: to some extent and 4: a lot

Table 6 Shortages of teaching resources

My school's capacity to provide instruction is hindered by a lack or shortage of:							
School community	Science laboratory equipment	Instructional material	Computers	Internet	Computer software	Library materials	Audio–visual materials
Small rural community							
M	1.8	2.2	2.3	1.7	1.7	1.7	2.3
% 'to some extent'	33.3	50	16.7	16.7	0	16.7	50
% 'a lot'	0	0	16.7	0	0	0	0
A small country town							
M	2.1	2.1	2.0	1.7	2.3	2.3	2.4
% 'to some extent'	33.3	40	20	6.7	40	33.3	40
% 'a lot'	6.7	0	6.7	0	6.7	6.7	6.7
A medium-sized country town							
M	2.0	1.7	2.2	2.0	2.0	1.9	2.0
% 'to some extent'	35.6	17.8	37.8	22.2	28.9	17.8	24.4
% 'a lot'	2.2	0	6.7	4.4	4.4	4.4	2.2
A larger town							
M	1.7	1.7	2.1	2.0	1.9	1.7	2.0
% 'to some extent'	10.3	15.4	25.6	10.3	15.4	12.8	25.6
% 'a lot'	2.6	2.6	5.1	12.8	2.6	0	0
A very large town							
M	1.9	1.5	2.1	2.0	2.0	1.8	1.8
% 'to some extent'	31	17.2	34.5	37.9	24.1	24.1	24.1
% 'a lot'	3.4	0	3.4	0	3.4	0	0
A city							
M	1.9	1.6	1.9	1.7	1.9	1.7	1.8
% 'to some extent'	20.4	14.8	20.4	14.8	17.6	7.4	13
% 'a lot'	4.6	0.9	3.7	3.7	3.7	2.8	2.8
Elsewhere in a very large city							
M	1.8	1.6	1.9	1.7	1.7	1.6	1.8
% 'to some extent'	15.3	10.2	18.6	13.6	15.3	5.1	18.6
% 'a lot'	6.8	5.1	8.5	5.1	3.4	5.1	3.4
Close to the centre of a very large city							
M	1.61	1.4	1.7	1.6	1.5	1.3	1.4
% 'to some extent'	13.5	7.7	17.3	11.5	9.6	3.8	3.8
% 'a lot'	3.8	0	3.8	3.8	0	0	1.9
Mean	1.8	1.6	2.0	1.8	1.8	1.7	1.8

Principal questionnaire response categories for question 11 coded as: 1: not at all, 2: very little, 3: to some extent and 4: a lot

363 extent and another 17 % reported a lot. By comparison, 19 % of principals close the
364 centre of a very large city report that a shortage of qualified teachers hinders
365 instruction to some extent and 2 % reported a lot. Across all school communities,

principals reported a greater lack of mathematics, science and qualified teachers than shortages of English teachers or library staff.

When we placed school principals' responses into two categories, favourable (not at all and very little) and unfavourable (to some extent and a lot), the distribution of responses is noticeable. Sixty-six percent of principals of schools in small rural communities responded unfavourably regarding a shortage of qualified teachers as opposed to only 21 % of school principals close to the centre of a very large city.

Table 6 reports principals' responses about shortages of seven types of teaching resources. As portrayed in Table 6, on average, across all geographic regions of Australia school principals report that teaching resource shortages have very little negative effect on their schools' capacity to provide instruction. However, a more detailed examination of the frequencies of responses for each variable identifies that a small percentage of principals indicate that their school's capacity to provide instruction is indeed hindered, and that these trends are patterned by school location. For example, Table 6 reports considerable difference in the distribution of principals' response to, "My school's capacity to provide instruction is hindered by a lack or shortage of: computers". The largest proportion of principals who reported that a shortage of computers affects instruction to some extent or a lot, is found in small country towns (45 % of principals), while the smallest proportion is found in schools near a very large city centre (21 %). This may suggest that computers are especially useful for supporting learning in rural communities, where access to other materials such as instructional and audio-visual materials may be limited. Understanding the value each resource provides individual school communities has the potential to make a difference to how schools are resourced. Teese (2006) argues that "They [disadvantaged students] should be funded as vehicles of system renovation, aimed at delivering benefits to the school system as a whole" (p. 9).

Additionally, the range in principals' responses to shortages of instructional materials and audio–visual materials across school communities is substantial. Overall, school principals in the two smallest community groups report much higher shortages than their peers in larger communities. One-half of principals in small rural communities and 40 % of principals in small country towns report that a shortage of instructional materials hinders instruction in their school to some extent. This number drops substantially in larger communities, from 18 % in schools located in medium size country towns to <8 % in schools close to the centre of very large cities.

A comparison of Tables 5 and 6 indicates that school principals in small rural communities are more likely to respond that their school's capacity to provide instruction is hindered more by shortages of teaching personnel than by shortages of teaching resources, as shown by the higher mean values in Table 5. The findings presented in Tables 5 and 6 indicate that principal questionnaire responses to questions about teaching resources do vary by school community. For instance, school principals located in very large cities tend to suggest that their schools have sufficient resources, on average, in comparison to schools in small rural communities, for which principals on average tend to report resource shortages. The pattern is not completely linear, however, with principals of schools in very

large towns reporting larger shortages of teaching resources than principals of schools in larger towns, for example. Nevertheless, there is a very strong pattern in the data that shows that instruction is perceived, by school principals to be hindered substantially more in smaller communities than in the larger, most urban communities. While this finding is not surprising, our analysis is able to show in detail the extent to which the availability of resources is patterned according to school community.

Discussion

Our analysis of PISA 2009 data for Australia details principals' views and responses about their school's resources, according to eight types of geographic community. Our analysis found the following:

i. Principals' responses indicate that shortages of resources are associated with school community; overall, principals of schools in small towns report that their schools have fewer resources compared to principals of schools in very large cities.
ii. Many principals, especially those in less populated school communities, report that within their school instruction is hindered to some extent by a lack of resources, in particular shortages of teaching personnel.
iii. Principals' responses suggest that the relationship between school resources and school community size is generally strong. However, some principals of schools in large towns report fewer resources than the principals of schools in smaller communities, and some principals of schools in non-central communities of very large cities (more than 1 million residents) report similar levels of resources as compared to schools in smaller communities.
iv. The differences in principals' responses to shortages of teaching personnel are more pronounced across the school communities than are principals' responses to differences in shortages of teaching materials. This is particularly noticeable in the areas of mathematics, science and qualified teachers.
v. Trends in the availability of resources across school communities are associated with trends in both school SES and average school literacy performance on PISA.

The trends displayed in Fig. 1 highlight that school SES has a strong positive association with students' academic performance in mathematics, reading and science. Our analysis also reports that principals of schools in rural communities believe their school experiences substantial shortages of resources. While this is perhaps not surprising, it should not be taken for granted as normal or natural. We argue that policymakers should expend more effort on understanding the values and needs of school communities and reduce the resource gap between rural and urban schools. We base this argument on the responses of school principals themselves, as reported in this study, as well as by research by Chiu and Khoo (2005), that suggests inequality in the distribution of resources lowers the performance of disadvantaged

students. Policy makers can certainly address some of the resource inequalities found in our analysis, especially those related to instructional materials.

Student access to computers and the Internet, as alluded to previously, has emerged as a significant issue in recent times. In Australia the issue of high speed broadband being rolled out to rural communities became one important focus of the 2007 and 2010 federal election campaigns. As noted by Fehring (2010), Labor "…policy initiatives were designed to achieve equity of access to information and communication technologies for all students, regardless of socioeconomic status or geographic location" (p. 181). Ilomäki and Kankaanranta (2009) have noted, "The same trend regarding heavy ICT investment in education has become evident in many developing countries…" (p. 101).

As reported in Table 6, principals' responses about the distribution of computer and information communication technology varies, whereas, there is very little difference between principals' responses to questions on school community resources. Reassuringly, principals of regional school communities reflect the most appealing ratio of student numbers to computers. This suggests that recent government education policy has made a difference to digital technology resources in Australia's rural school community sector. However, PISA does not collect information about many other important aspects, such as the speed of Internet access, availability of technical support, the impact of such resources on learning or the quality of resources used within each school community. The extent to which computers are used and valued as an instructional teaching tool is also unclear. Minguez and Ballesteros (2008) state, "According to the PISA Report 2005 report …[it is unknown if] school-based access [to computers] has an effect strong enough to compensate for the effect of lacking a computer at home" (p. 433).

One limitation of this study is the small number of participating principals of schools in some school communities. Caution should therefore be exercised when generalizing; at the same time, however, the strength of using the PISA dataset is that it is a nationally representative sample. Our analysis is also limited by the unavailability of a variable about teacher experience. It is well known that rural schools often have large numbers of recent teacher graduates and less experienced school principals. Further, although these data reflect the views of school principals rather than an objective measure of these aspects of school resourcing, asking principals about the degree to which instruction in their school is hindered by a shortage of experienced teachers would be highly relevant for the Australian context.

Conclusion

Our analysis of PISA 2009 examines in fine-grained detail principals' responses to questions concerning school resources. The findings of our analysis suggest an unequal distribution of resources (teaching materials and personnel) between rural and urban schools. The analysis provided in this paper is unable to explain why student performance is higher in larger communities, nor does it establish how school resources could mediate the relationship between geographic status and

education outcomes. However, this study has unearthed patterns as reported by school principals about the distribution of school resources across Australia's eight school communities. Whilst the trends examined in this paper cannot be used to assess the degree to which school resources relate to learning outcomes, previous studies from a range of international contexts support the claim that they are important for learning outcomes. Moreover, shortages of teaching materials and personnel also affect the learning experiences of students. We agree with Gordon and Monastiriotis (2006)that more research should be centred on, socioeconomic status and school constructs such as school resources and learning environments on educational opportunities, experiences and outcomes.

The findings of this study can be useful for a wide audience, including education researchers, practitioners and policymakers. One policy recommendation that could stem from the feedback of principals would be to increase the availability of instructional materials for schools in rural and remote communities. Addressing teaching shortages in rural communities is difficult, but providing sufficient instructional materials should be a routine matter for a wealthy country such as Australia. The findings of our study could also be useful for graduate teachers from capital cities who are preparing for work in rural communities as it will heighten their awareness of the contrasts that exist between school communities across Australia. Finally, it may also help researchers and policy makers understand how schools in particular settings can be better supported.

Our findings show that the distribution of resources across school communities as reported by principals closely mirrors school academic performance and school socioeconomic status. Our findings suggest that rural schools are more affected by shortages of teaching materials and personnel than are schools in larger towns and cities. Rural schools have lower performance scores and higher levels of social disadvantage. To reduce the performance gap between rural and urban schools, we would argue that schools in rural communities should have the opportunity to have resources distributed according to community needs. This could equate to the same or even more resources than their urban counterparts, not less.

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