RURAL HIGH SCHOOL STUDENTS' ATTITUDES TOWARDS SCHOOL SCIENCE

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ABSTRACT

This paper reports findings from an Australian survey of Year 10 students (N=3759) indicating that those in small rural and remote areas tend to enjoy school science significantly less than their peers in larger towns and cities (Lyons & Quinn, 2010). The study also found that rural and remote students were less inclined than those in other locations to enjoy science relative to other subjects. Such a result has not previously been recorded in the science education literature and raises a number of questions about the relevance and quality of the science education experienced by rural and remote students. It also raises timely questions about the applicability to rural and remote students of an Australian Science Curriculum. The paper explores these issues and their implications for policy and research.

INTRODUCTION

There is a great deal of evidence to suggest that students in rural and remote parts of Australia have a different experience of and response to high school science than their city cousins. It is well documented, for example, that those in rural and remote schools perform less well in tests of scientific literacy. According to the most recent Australian data from the Programme for International Student Assessment (PISA), the mean scientific literacy score of students attending remote area schools was 36 points lower than that of students attending schools in provincial areas, and 53 points lower than that of students in metropolitan areas (Thomson, De Bortoli, Nicholas, Hillman & Buckley, 2010). The mean score difference between students in metropolitan and remote schools equates to almost one-and-a-half years of schooling, and is consistent with patterns from earlier PISA studies.

It also appears that Australian students' attitudes to school science vary with location. For example, Waldrip and Fisher (1999) reported that rural students' attitudes towards school science were significantly lower than those of students in metropolitan and provincial schools. It is however reasonable to ask whether this is a reflection of science education or of education more generally. That is, do rural and remote students enjoy science less than their metropolitan peers relative to other subjects? To date there has been very little research to determine whether such differences in enjoyment and performance are limited to science education or

whether they are part and parcel of school education more generally. With regard to performance the PISA results would suggest the latter, since similar patterns are found in students' scores on reading and mathematical literacy tests, as shown in Figure 1.

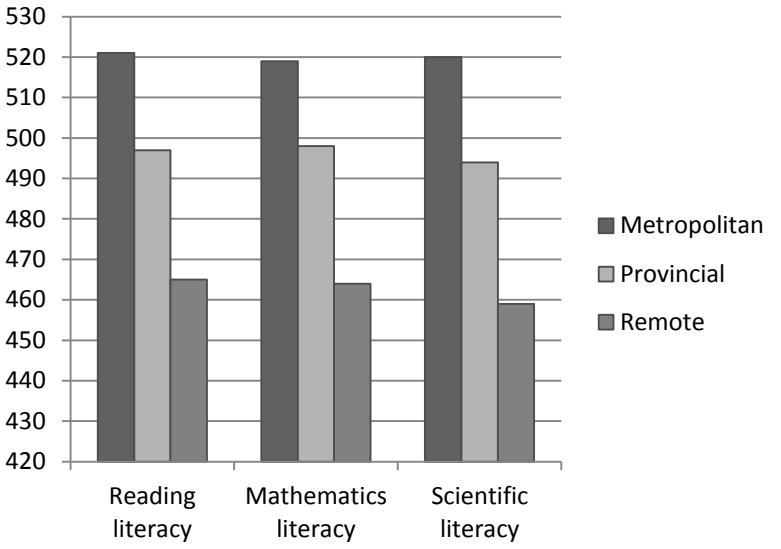

Figure 1. Mean scores of metropolitan, provincial and remote Australian students on the 2009 PISA domains of reading literacy, mathematics literacy and scientific literacy (Thomson et al., 2010).

This argument is supported by the findings of Young, Fraser and Woolnough (1997), who suggested that students in small rural and remote schools experience an inferior education in general. On the other hand, some studies point to the influence of broader contextual factors on rural students' attitudes to education. For example, Waldrip and Fisher (1999) and George (2000) argue that students' attitudes to science are related to family variables, including parental aspirations towards tertiary study. According to Alloway, Gilbert, Gilbert and Muspratt (2004), rural students in Australia often feel that their parents are not supportive of higher education and do not consider that there are advantages to be gained by their children going to university. Hence, students in rural areas may face intertwined challenges posed by their socioeconomic context, parental aspirations and inferior school education.

This paper therefore has two related aims. First, it presents findings from a national study comparing self-reported enjoyment of school science by students in metropolitan, rural and remote high schools. Second, in view of the lack of distinction between rural students' attitudes to school science and their attitudes to school more generally, it also reports on students' enjoyment of school science relative to other school subjects and the extent to which this differs with location

THE CHOOSING SCIENCE STUDY

The Choosing Science study was designed to investigate a range of influences on Year 10 (15 - 16 year old) students' decisions about taking Year 11 science subjects. As part of that study, students were surveyed about their attitudes to school science and their enjoyment of science relative to other school subjects. Students' attitudes to school science were measured using the 'Enjoyment of Science Lessons' scale from Fraser's (1978) Test of Science Related Attitudes (TOSRA). The principal reason for using the TOSRA instrument was to enable comparisons between the attitudes of contemporary students and those of Fraser's 1977 cohort. Results of these comparisons are reported in Lyons and Quinn (2010). The 'Enjoyment of Science Lessons' scale comprised five positively and five negatively worded statements designed to measure students' enjoyment of school science. Students responded via a five point Likert-type format with the following options: Strongly disagree (1), Disagree (2), Unsure (3), Agree (4) and Strongly agree (5). The TOSRA scale has been validated many times and shown to be robust (Blalock et al., 2008). In our study the scale α reliability was 0.93.

With regard to the second aim of this paper, students' enjoyment of science relative to other subjects was elicited via a single item: "I like school science better than most other subjects". This item was taken from the Relevance of Science Education (ROSE) survey designed by Sjøberg and Schreiner (2007). Again, students responded via a five point Likert-type answer format.

SAMPLE CHARACTERISTICS

The Choosing Science sample consisted of Year 10 students intending to continue to senior secondary school and who had recently chosen their subjects for Year 11. The students were from 200 schools selected for state/territory, sector and geographical representation. Permission to participate was sought from education authorities, principals, parents and students. A total of 3801 students initially completed the online survey. Of these, 3759 responses were deemed fit for analysis. All states and territories were well represented, with the largest contingents being from NSW, Queensland, Victoria and South Australia. Geographical location was divided into four categories: Capital cities (state and territory); Large non-capital cities (pop.>25000), Rural cities/large towns (pop. 10000-25000) and Small rural and remote towns (pop. <10000). Close to half the students attended capital city schools, while about 12.5% were from small rural or remote areas. The breakdown of respondents in these categories is shown in Table 1. Further details of the sample composition can be found in the full Choosing Science report (Lyons & Quinn, 2010).

Table 1. Breakdown of Choosing Science respondents by sex and geographical location.

	Girls		Boys		Total	
Location Category	*count*	*%*	*count*	*%*	*count*	*%*
Capital city	863	*23*	878	*23.4*	1741	*46.3*
Large non-capital city	387	*10.3*	323	*8.6*	710	*18.9*
Rural city/large town	482	*12.8*	355	*9.4*	837	*22.3*
Small rural/remote town	262	*7*	209	*5.6*	471	*12.5*
Total	1994	*53*	1765	*47*	**3759**	***100***

ANALYSIS

Responses to the TOSRA 'Enjoyment of Science Lessons' scale were analysed by coding and reverse scoring the negatively worded items, calculating scale means and comparing these using MANOVAs across the sample variables, including sex, school type and geographical location. Given the large sample size a level of significance of $p<0.001$ and minimum reportable effect size of $\eta p2 = 0.01$ were adopted. Responses to the item "I like school science better than most other subjects" were crosstabulated with location. Patterns of difference were analysed using chi-square contingency table tests, with chi-square values of $p< 0.001$ taken as indicating significant differences between overall observed and expected values. Adjusted standardised residuals (ASRs) were used to evaluate the sources of the differences detected by significant chi-square relationships. ASRs greater than +3.30 or less than –3.30 indicate (at 99.9% probability level) that individual cell counts are significantly different to those expected if there was no association between the variables.

RESULTS

Enjoyment of school science

The mean enjoyment of science, as measured by the TOSRA scale, for the different location categories is shown in Figure 2. Mean responses above the scale mid-point (3.0) indicate a mean agreement, while mean responses below the mid-point indicate disagreement with particular items.

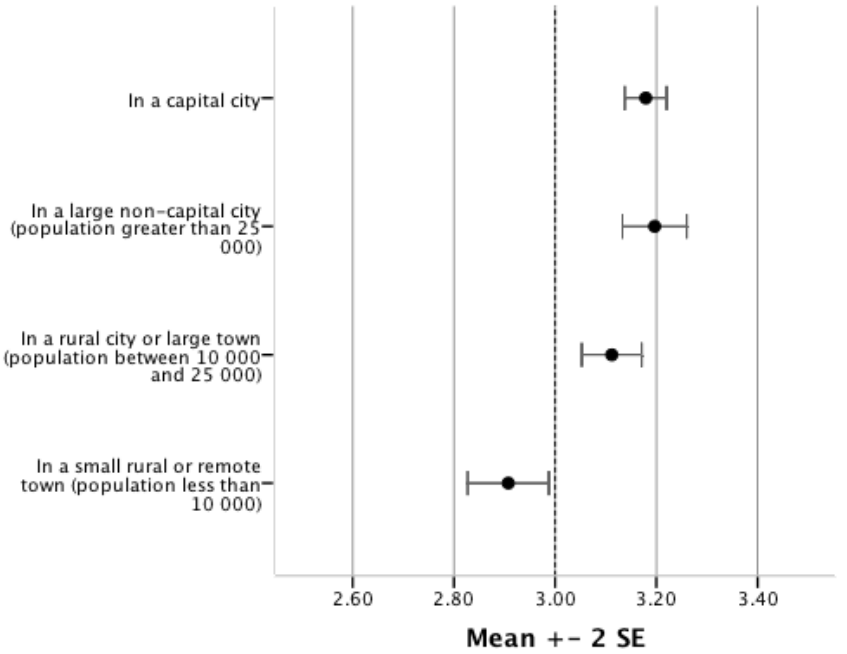

Figure 2: Means of responses to the TOSRA enjoyment scale across different locations. [Response scale = 1 (Strongly disagree); 2 (Disagree); 3 (Unsure); 4 (Agree) and 5 (Strongly agree)].

Post hoc comparisons of means within the different locations showed that mean enjoyment of science among students in the small rural/remote group was significantly less than for students in the other three location categories [$F(3,3755) = 13.91$, $p. < 0.001$, $\eta p2 = 0.01$]. Whereas students in more highly populated areas tended to enjoy science, students in small rural /remote schools tended to disagree that school science was enjoyable.

Comparison with other subjects

Figure 3 shows the frequencies of student responses to the proposition "I like school science better than most other subjects" across the four different location categories.

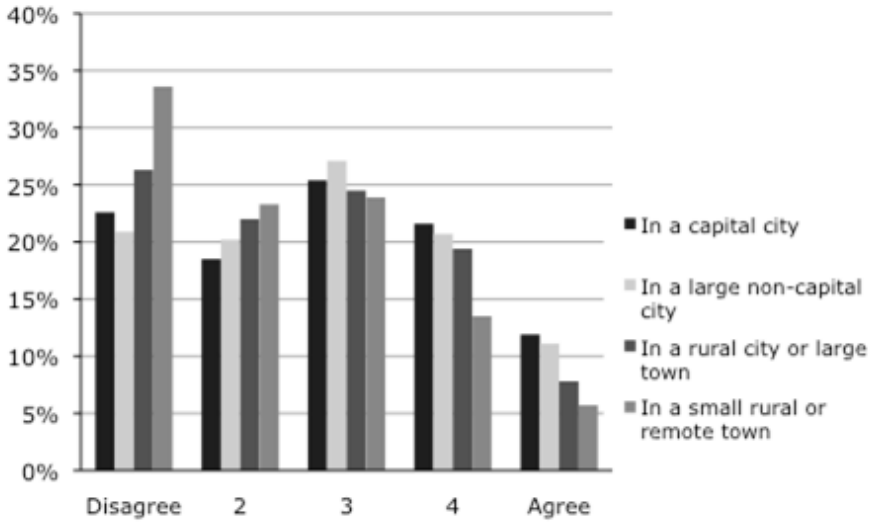

Figure 3: Frequencies of student responses to the question "I like school science better than most other subjects" broken down by location. [Response scale = 1 (disagree) through to 5 (agree)].

As shown by Figure 3, students in rural and remote schools were less inclined than others to agree that they liked school science more than most subjects, and significantly more inclined to disagree [$\chi 2(12) = 46.33$; $p<0.001$; Cramer's V=0.07, ASR = 4.2].

DISCUSSION

The Choosing Science study found that Year 10 students in small rural and remote schools reported enjoying science less than did their peers in larger centres. This finding is in line with previous attitudinal studies (e.g. Waldrip & Fisher, 1999) and parallels the differences in science literacy evident from PISA results (Thomson et al., 2010). However, adding to the picture of socio-geographical differences in enjoyment of school science was the further finding that the 'enjoyment gap' between science and most other school subjects was greater in small rural and remote schools. That is, students in these schools were even less likely than their peers in more populous areas to enjoy science relative to other school subjects.

This new finding raises questions about the relevance and appropriateness of school science experiences for students in these schools. Further research is required to explore this finding in greater detail and tease out how the differences relate to pedagogy, the curriculum and other factors. Nevertheless, a number of hypotheses can be proposed. For example, science teaching is a specialized area in terms of teacher expertise and equipment, and Australia has an acknowledged problem in attracting and retaining qualified science teachers in small rural and remote schools (Lyons, Cooksey, Panizzon, Parnell & Pegg, 2006). It may well be that the uneven quality and short stays of science teachers in these schools impact on students' engagement with the subject.

On the other hand, the problem may also relate to perceived relevance. Science syllabuses at the Year 10 level tend to be more academic than those in earlier years and orientated more towards students intending to take science at the senior secondary and university levels. Many students in small rural and remote schools are less inclined than their city-based peers towards academic pathways (Alloway et al., 2004) and may not regard the Year 10 curriculum as especially relevant to their aspirations.

Other areas for exploration include the quality of science facilities and equipment in small rural and remote schools, the relevance of curriculum topics and program examples and textbooks, the lack of access to science-related sites such as museums and institutes, and the lack of professional development opportunities for teachers.

In the context of the impending implementation of the Australian Science Curriculum and a national system of accreditation for teachers, it is important that the differential experience of rural students and teachers is taken into account. In this respect it is encouraging that The Shape of the Australian Curriculum – Science, which has guided development of the Australian Science Curriculum, explicitly highlights issues of equity and opportunity and the need to consider how 'particular groups may have previously been excluded' (National Curriculum Board, 2009, p. 10). This study highlights some persistent issues about enjoyment of school science by rural students, suggesting that this particular group is facing issues of inequitable opportunity and potential exclusion. This is of concern as many of the future custodians of Australia's rural ecosystems and agricultural enterprises will be drawn from current rural high school classes, and their engagement with relevant scientific concepts is important for the sustainability of both of these fields. On these grounds, and in the interests of equitable educational opportunity, the challenges and problems faced by students and science teachers in small rural and remote areas need to be acknowledged and addressed.

REFERENCES

Alloway, N., Gilbert, P., Gilbert, R., & Muspratt, S. (2004). Factors impacting on student aspirations and expectations in regional Australia. Canberra: Department of Education, Science and Training.

Blalock, C. L., Lichtenstein, M. J., Owen, S., Pruski, L., Marshall, C. & Topperwein, M. (2008). In pursuit of validity: A comprehensive review of science attitude instruments 1935-2005. *International Journal of Science Education, 30*(7), 961-977.

Fraser, B. (1978). Development of a test of science-related attitudes. *Science Education, 62*(4), 509-515.

George, R. (2000). Measuring change in students' attitudes toward science over time: An application of latent variable growth modeling. *Journal of Science Education and Technology, 9*(3), 213-225.

Lyons, T., Cooksey, R., Panizzon, D., Parnell, A. & Pegg, J. (2006). *Science, ICT and Mathematics Education in Rural and Regional Australia: The SiMERR National Survey*. DEST: Canberra.

Lyons, T. & Quinn, F. (2010). *Choosing Science: Understanding the declines in senior high school science enrolments*. Research report to the Australian Science Teachers Association (ASTA). Retrieved from http://www.une.edu.au/simerr

National Curriculum Board (2009). Shape of the Australian Curriculum: Science, Commonwealth of Australia, Canberra. Retrieved 28 September 2011 from www.acara.edu.au/publications.html

Sjøberg, S. & Schreiner, C. (2007). Perceptions and images of science and science education. In M. Claessens (Ed.) *Communicating European Research 2005*. Dordrecht: Springer.

Thomson, S., De Bortoli, L., Nicholas, M., Hillman, K. & Buckley, S. (2010). *Challenges for Australian Education: Results from PISA 2009*. Melbourne: ACER.

Waldrip, B. & Fisher, D. (1999). Differences in country and metropolitan students' perceptions of teacher-student interactions and classroom learning environments. Paper presented at the annual meeting of the Australasian Association for Research in Education, Melbourne, 29 November – 2 December.

Young, D.J., Fraser, B.J., & Woolnough, B.E. (1997). Factors affecting student career choice in science: An Australian study of rural and urban schools. *Research in Science Education, 27*(2), 195-214.