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SCIENCE, TECHNOLOGY AND MATHEMATICS TEACHING AND LEARNING IN RURAL SOUTH AUSTRALIA: PROBLEMS AND PROSPECTS

Julie Clark, Carol Aldous and Jim Davies
Flinders University

Alan Barnes and Bruce White
University of SA

Abstract

Metropolitan students achieve higher scores at year 12 in areas of mathematics, the sciences and technology than their rural counterparts. The exact nature of these relative deficits and their origins in rural schooling is less well understood, as is an understanding of the types of interventions that can redeem them. This paper examines the South Australian situation outlining the issues identified by staff, students and teachers in four rural schools. It identifies major priority areas for interventions and suggests some prospects for improving learning outcomes. The work is part of an ongoing initiative supported by the National Centre of Science, ICT and Mathematics Education for Rural and Regional Australia (SiMERR).

Introduction

This paper reports on the South Australian focus groups that were conducted as the second stage of a national research project which examined Science, ICT and Mathematics Education in Rural and Regional Australia. This part of the study collected the views of parents, teachers and primary and secondary students learning science, ICT, and mathematics in different regions of South Australia. It provides a series of snapshots of the educational issues in rural and regional areas across South Australia, including the disadvantages faced by country teachers in accessing professional development opportunities, adequate resources, and a range of learning experiences for their students.

Literature Review

According to Sidoti (2000) access to education in rural and remote areas is a human rights issue. Sidoti's inquiry into rural and remote education found that remote parents believe that access to education has actually decreased in recent years. Barriers described as both physical and economic may limit future employment and life opportunities.

Metropolitan students consistently achieve higher scores at Year 12 in areas of mathematics, the sciences and technology (Pegg, 2005). Findings of the Programme

for International Student Assessment (PISA) 2003 project which looked at mathematical and scientific literacy indicate that

Students in a metropolitan area performed at a significantly higher level than students in a provincial city, who in turn performed at a significantly higher level than students in rural areas (ACER, 2003)

While information technology can provide rural students with access to education, the links are often difficult to make and maintain in rural communities. "Internet access is especially difficult for students in remote areas. In some more isolated locations, students have no access at all" (Balsamo and Robinson, 2000, p. 103). Demands are often placed on teachers, who have no IT expertise, to select appropriate IT and to maintain systems.

The issues for rural education are exacerbated teacher retention problems. Some of the disadvantages of rural appointments (as perceived by teachers) include physical isolation, fewer educational opportunities for their children, limited social and leisure activities and less school facilities (Boylan and McSwan, 1998). Furthermore, high teacher turnover impacts the stability of the educational experience for rural students (Maxwell, Hansford and Bennett, 1997).

The most vulnerable rural group by far are indigenous youth (Alston & Kent, 2001). "According to the 1996 population census there were 957 young people between the ages of 12 and 18 residing in East Arnhem Land without access to secondary education" (Balsamo and Robinson, 2000, p. 57). A significantly lower number of indigenous youth complete high school and subsequently find work or continue study. In fact less than two thirds of Indigenous students progress from primary school to year 8 (Balsamo and Robinson). The 2000 OECD PISA found that Indigenous students in Australia performed at a lower level than their non-indigenous peers in reading literacy, mathematical literacy and scientific, literacy (Bortoli and Cresswell 2004).

Some inequities for indigenous students arise from fewer educational resources in the home environment (Bortoli and Cresswell 2004). Indigenous students reported a much lower homework time than non-Indigenous students. This is significant due to the positive correlation, found in the PISA study, between achievement and homework.

A second concern is described as educational aspirations. In general, Indigenous students plan to stay in education for a shorter time than their non-indigenous peers (Bortoli and Cresswell, 2004). This finding may be related in part to the lower average level of educational attainment reported by parents of indigenous students.

Methodology

Creswell (1998) recommends qualitative research for studies involving how or what questions. Ratcliff describes some of the strengths of qualitative research as follows: (a) provides depth and detail, (b) openness, (c) allows readers to "view" the experiences rather than have categories imposed on them, and (d) attempts to avoid

prejudgments (2003). The focus group interviews were designed as the second phase of a large national study. Four locations that were chosen to be somewhat representative of SA rural schools were selected for the study. Interviews allow information to be focused and insightful.

Interviews were conducted with separate groups of parents teachers and students, who were chosen in conjunction with the school principal (see Appendix). Students were asked about each specific subject area and what they enjoyed and what they found difficult as well as questions about their futures and any relevance these subjects areas may have. Students were given the freedom to speak freely about matters as they saw them in the school and community. Teachers were asked about their backgrounds before being asked subject specific questions. Prompts were used like “what did you enjoy most teaching”, “what was most difficult” to elicit more open responses about issues. Teachers were asked to identify issues that related to rural or remote positioning of their school. Parents were asked about their background before asking about their aspirations for their children. They were asked about why they chose the school and what strengths and obstacles they saw in the school that could impact on their children learning mathematics, sciences and ICT. Parents were also asked to give an overview of what other aspects of their community and their school might affect their children’s’ progress. Both parents and teachers were asked for recommendations on actions and changes.

Location

Schooling in regional, rural and remote South Australia is predominantly a government enterprise, with a few substantial non-government primary¹ and secondary schools in some major centres, and small Catholic primary schools in a number of towns. Many of the schools in the country are Area Schools which cater for students from Reception (R – the year before Year 1) to senior secondary. Some of these are in towns; others are located between towns (‘in the middle of nowhere’) to minimise travel time. Only in the largest centres are there dedicated high schools.

Many towns have a primary school, with students being bussed to a secondary school. Travel to school by bus is a fact of life for many young people in country SA. Some have up to two hours’ travel a day. Schools can be quite small, and whilst there have been some closures of schools, this tends to be resisted by the communities. Another limit to school closures is access – within reasonable travel time – to an acceptable alternative.

Indigenous students are present in most areas and schools, but tend to be a significant part of the student population in the north and west of the state. In the very north-west corner of the state are the Anagpu-Pitjanjatjara (AP) Lands containing around ten schools with virtually 100% Indigenous student. These schools have special arrangements within the government sector in terms of staffing, resources and curriculum.

The schools involved in this study are described below.

Background to the schools

Table 1. Schools and focus group participants

School*	Sector	Type	MSGLC Category	Student population	No. Teachers	No. Parents	No. Students
The Bay Area School	Government	Area School (R-12)	3.2 (Very Remote)	450	6	2	7
Flower Valley Primary School	Catholic	Primary R-7	2.2.2 (Outer Provincial Area)	68	6	3	8
Greenview Area School	Government	Area School (R-12)	2.2.2 (Outer Provincial Area)	239 (139 primary, 100 secondary)	11	6	8
Sandy Grove Primary School	Government	Primary R-7	3.1 (Remote)	438	5	9	10

*** School names are pseudonyms**

Results

The Bay Area School

The school is located on the coast significantly more than two hours by road from Adelaide. The school caters for students from R-12, with a significant number of Indigenous students. The town has a population of around 4000 people supported by a number of local industries including wheat farming, gypsum mining, salt mining, and commercial fishing. The school offers vocational education subjects like Aquaculture, Retail, Hospitality, Conservation and Land Management and Doorways to Construction.

Mathematics

While all participants agreed in principle about the importance of mathematics, there was limited evidence in terms of time, place in the curriculum, student numbers at the senior years and professional development. The school has recently appointed a literacy/numeracy coordinator for R-9 and this has resulted in increased activity during numeracy week. Teachers were enthusiastic about the availability of National competitions for students. In addition, there have been efforts for specific focus on mathematics during selected weeks during the year.

Particular concern was expressed for mathematics in Years 10-12. Attracting and retaining qualified mathematics teachers is an ongoing problem for the school. The availability of rigorous mathematics topics that have pathways to university studies is dependent on student numbers and remains uncertain from year to year. Senior students electing to study mathematics in Year 11 and 12 often have to study mathematics through Open Access (a distance education provider). The students interviewed believed that they were disadvantaged with regards to their metropolitan

peers, as they only have 45 minutes a week of class time with their Open Access teacher.

Science

Both primary and secondary students described enjoyable practical science experiences. Students disliked 'boring note taking' and would like to do more hands-on science. Primary science was clearly advantaged at an area school.

I think having an area school where we actually have specialist teachers in the secondary part has been very good. The science teacher here; he's always really receptive if the primary people want to borrow things or want to ask advice he's very willing to share resources and things from the science lab (Primary Teacher).

Despite this senior school connection, the amount of science undertaken during the primary years was very limited. The science experiences were limited to a couple each year and appeared to be traditional and teacher centred. Primary teachers interviewed would welcome increased support through professional development in science.

Small student numbers in senior science classes were described as both positives and negatives. Clearly, small classes allow more attention for individual students. Unfortunately however, small numbers lead to uncertainty of subject availability.

The main problem is lack of access to many science and mathematics subjects in Year 11 and 12. Students are never certain what subjects will be available and may not plan on taking subjects such as physics. (Parent)

The school makes every possible effort to provide a range of science subject options for senior students, but were forced to allow numbers to dictate availability. In the past the school has combined with other schools to jointly offer specific science subjects, but this proved complicated for timetabling, travel and teacher assistance. Chemistry, for example, has not been offered at the school for the past 14 years.

As a result, students often study science via Open Access. Senior students complained about the inequity of this option, explaining that one phone call a week made this mode extremely challenging. The school attempts to provide teacher assistance for the practical work associated with distance-education science subjects but resources limited the time available. Students are commonly opting out of science subjects due to the perceived disadvantage they have in comparison to their metropolitan peers.

We constantly get feed-back that country students perform poorly in exams. Country students perhaps are picking wisely and try to avoid subjects with external exams. But those students also need to make sure that when they select, they select what fits the pattern and that most Uni courses they require for HESS general and one HESS restricted (Senior Teacher).

Isolation restricts student access to special science centres and support. While organisations such as the Investigator Science Centre and museum visit the region every few years, the event does not necessarily match the school curriculum needs. Teachers at the school believed that students at the school were quite disadvantaged by lack of access to special science facilities.

One response to isolation from science centres has been the development of connections with the local environment and industry and science at the school. A number of teachers are including coastal connections and aquaculture in science classes. One teacher mentioned an interdisciplinary focus, in year 10, that includes an examination of sustainability of the local area. Furthermore, the school offers classes in agriculture, horticulture and land management. The senior teachers interviewed were in favour of continuing to expand curriculum connections with the local area.

ICT

The school is well resourced in terms of computers, having 200 machines for the 450 students. All students are given opportunities to use computers in a variety of learning areas. Powerpoints, spread sheets, data bases and web quest were mentioned most frequently in the interviews. Film making was described as one specialised use of ICT across the learning areas.

Although the SACSA curriculum integrates ICT across learning areas for R-10, the school maintains specialised ICT classes for Year 6-9. This has led to a disconnection of ICT and other learning areas. Despite the large numbers of computers, integration of ICT within the primary curriculum remains minimal.

The unreliability of the network caused frustration among both students and teachers. Lack of local support and expertise in the IT area has forced teachers to learn how to fix and maintain the computers and network. A reliable network was seen as essential for the school, as it enabled students to have virtual connections thus helping to lessen the problems associated with the remote location. The need to be self-sufficient emerged frequently during the interviews and has limited the type of ICT used within the school.

Diversity

A significant percentage of the school population are from indigenous backgrounds. The richness of experiences and ideas that students from indigenous and non-indigenous backgrounds bring to the classroom is appreciated by the school community. There are however some concerns about providing indigenous students with an effective education in mathematics, science and ICT.

Many of the indigenous students attend school infrequently. One teacher described problems of curriculum continuity for indigenous students. He is interested in exploring an alternate curriculum that may be effective despite lengthy and unpredictable absences.

The indigenous students have a high mobility and transiency from different communities in the area. It's hard to get any consistency going with the students that randomly and

infrequently turn up. I mean you can't carry something on that the rest of the class is doing, so they end up doing a lot of one-offs. I don't think it benefits them a whole lot, but there's sort of no other strategy you can do, unless you set something up that they can sort of chip away at each time they do attend, which is what I'm trying to organise now (Teacher).

In addition to attendance, many indigenous students do not have access to educational resources within their communities. Unlike non-indigenous students, few indigenous students are able to use computers at home. This is a disadvantage for ongoing development of skills and knowledge and tends to widen the performance gap.

Including children with special needs into the classroom has proved to be a challenge for many of the teachers. While there is some SSO support, assistance from outside specialists is inadequate. The situation is exacerbated by the multi-year level classes that are often necessitated due to small numbers. For example, one teacher described the difficulty of teaching Year 8-9 mathematics that includes a number of students with special needs.

Another diversity issue concerns the management of students with behavioural issues. Due to the remoteness of the school, there is no possibility of external support for these students. A lot of time and resources are often devoted to a few students with major behaviour issues.

I think one of the big obstacles we've got here is over management. Where we've got seven kids that are at a stage where in a city school they'd be sent to a behaviour school, whereas here we can't, we've just got to deal with them, and they can take a lot of time away from teachers, admin staff and SSO (Senior Teacher).

Other Comments: Plans and PD

The priority for mathematics and science at the senior years, in this area, was also influenced by long-term plans and local need. It was evident that many parents expect their children to remain in the local area following school completion. Some parents felt that because there was not a wide range of employment opportunities that require science and mathematics in the area, students 'probably do not see a need to study science or mathematics'.

All teachers interviewed expressed concern about professional development (PD) opportunities. Distance and finance precluded access to most metropolitan courses and remoteness even made rural opportunities difficult to organise. Many PD courses are offered once a week for 2-3 hours after school, making involvement impossible. Even if PD is a whole day in Adelaide, the cost of travel limits participation. In addition, as few TRT teachers are available in the area, teacher absence often puts burdens on other classes. For example, on the day of this interview, teacher absence had necessitated two classes to be placed together for the day.

Flower Valley Primary School

This is a small Catholic parish school, catering for boys and girls from Reception to Year 7. It is situated in a rural community a little more than two hours by road from

Adelaide. Horticulture, farming, tourism and winemaking are significant local industries.

Mathematics

All teachers perceived mathematics as an important learning area although there had been greater emphases on literacy in the last couple of years. The school had a designated literacy coordinator and a PE coordinator but no mathematics or science co-ordinator. Consequently some teachers felt that the teaching of mathematics had played second fiddle to the teaching of literacy and English. Students' perceptions of mathematics varied - with some students liking mathematics while others disliked it. In general, students enjoyed activities in mathematics that involved playing a game or participating in activities that they had not traditionally associated as being mathematics.

Science

The students readily recounted some fun activities they had done in science but admitted that science was not taught all the time. The teachers indicated that the teaching of science had not been their strong point and that while they endeavored to do their best, felt that some system based support in the form of consultants and resourcing would be useful.

“ I would say to employ a person that's focus ... is science so that they can come to you and make your life easier; not to necessarily teach everything but to sit down to make programs with you or to be able to supply you with those resources or say 'hey I can get this for you, we can do that' and have somebody working in that field. So you're still teaching it, you still have the onus on it, but you have the support ...somebody that's there, readily available, wanting to help you, willing to get resources, willing to help set up programs and just share the links between schools.” (Teacher)

It was suggested by both parents and teachers alike, that such support could take the form of an established science centre within the region that not only provided students with a place to visit but also supplied science resources to schools and teachers. Of the three subjects under consideration it was agreed that science came off as the 'poor cousin'.

ICT

The school was pleased with the suite of twelve computers it had acquired for the resource center. A specialist teacher for ICT undertook to give lessons in ICT to all students across the school using the resource centre facilities. Students shared one computer between two or worked individually at the computers in time blocks of twenty minutes swapping with another student as required. In addition at least one computer was present in each classroom. However the perception of usefulness varied among students, since not all classroom computers were in working order - a situation exacerbated by the low availability of technical support. Further, some teachers felt that more classroom computers (viz at least three to five per classroom) were needed in order to make meaningful links in classroom programs with ICT.

Diversity and Equity

Flower Valley Primary comprised students living locally to the surrounding environs with parents and guardians wanting their children to be educated within the spiritual tradition of Catholicism. The levels of resourcing were an issue of ongoing concern to the school community that manifest themselves in a number of ways. These included the limited range of programs the school could offer (viz: literacy and to a lesser extent numeracy and ICT), with no reservoir of funding available for implementing innovative programs in science. In addition access to community and other government agency resources was difficult since access to established communication networks within the government system was limited or non-existent. This meant that catholic students were often deprived of opportunities for learning experiences made readily available to those in the public sector.

Other Comments: A need to value the local environs and resources

A general observation was made that the teachers in this locality did not place value on contextualising the science, mathematics and ICTs to the local area. In their mind to do so was to teach an inferior mathematics or science compared with that offered in the city.

“ I don’t know that what I teach would be any different from what I would teach if I was in a metropolitan school to be honest”

“In maths you don’t do area and start looking at areas of farms or anything like that, there’s no specific even there, or in science you don’t do experiments based on what pigs do on blocks or fruit blocks or those sorts of things ... I don’t think there’s a real difference”

Greenview Area School

This school is located in a small rural hamlet within a relatively prosperous farming and tourism region some 3 hours from Adelaide. The school itself has classes from reception to year 12 and offers the SACE Accredited Certificate in Agriculture and IT Certificate II. The school has its own farm, vineyard and fish ponds.

Mathematics

There was a strong recognition among teachers of the need for mathematics as an enabling discipline in the schools. Parents were less specific but recognised the value of mathematics when questioned specifically about the extent of the need for mathematics in everyday life and in a variety of trades and university courses. Generally however the younger children interviewed were unclear about the critical underpinning role of mathematics in their future career options. However there were exceptions with one student only recently realising that the mathematics that he did not like doing was necessary for electrical trades and another student now committed to getting through his year 11 mathematics course because it was the only way to get into the apprenticeship that he wanted. The more senior students were generally aware of the importance of mathematics and bemoaned that fact that they had not realised this importance earlier in high school and had paid more attention to it.

Science

Generally attitudes to science were positive but attitudes to the learning of science varied. Middle school students felt that were bored by the textbook and wanted more hands on experience in the local fish ponds, farm or in the lab. In fact it became apparent that one teacher used access to these facilities as a inducement to read and understand materials in the set text.

The role of Agricultural subjects was critical in the school. The school is unusual in that numbers actually increase from year 10 as students come to board and take on various agricultural studies and make use of the various agricultural facilities at the school. It is clear that the need for servicing of this program has results in retaining some senior science subjects in the school. However some students still had to take Open Access college distance courses for senior science and mathematics subjects. Mentoring however was generally possible for these student as staff had sufficient expertise.

ICT

The school had a substantial, if aging, resource of ICT equipment. There seemed to be wide spread use of computing for assessment preparation and specific allocated learning tasks. Some options for focussed ICT studies exist in year 10 but generally ICT was not specifically taught in middle school as in these years supposedly ICT was being integrated into the curriculum. Some teachers actually considered that ICT was being “integrated out of the curriculum” with no subject taking responsibility for core ICT skills and understanding. These deficits then showed up as students tried to take senior ICT subjects. Students however felt they were well exposed to ICT at school and at home. One student who vocally expressed a dislike of computers admitted, with some pride, that he was the only one of his farming family who could find the accounts on the family computer. Significant problems with ICT in this school was access to expertise(especially in networking) and the lengthy turn around time for repairs.

Diversity

Generally the school seemed well balanced in relation to gender, however some parents noted difficulties for girls in certain senior subjects. While the number of Indigenous students(some 2%) is small some of these had been quite successful academically. One particular indigenous student took extensive advantage of Open Access courses. School card holders are around 10% and the school provides some extra support to some of these students with computer access and priority for obsolescent computers. There is no significant NESB population in the school.

Summary

The Greenview school community seems positive about its future. The school is in a rural growth region with employment prospects in industries including general farming, viticulture, aquaculture, fishing, forestry, tourism and construction. However parents are particularly aware that their children are likely to go the “big city” to complete secondary studies, for tertiary studies or for work. The school feels the impact of this in its senior years where as one teacher put it:

‘the loss of kids to private city schools, not so much the numbers as leaders (lynchpins of the courses) who would encourage and support others’

As with many schools Greenview faces the prospect of many of its long term teachers retiring in coming years, most of the senior teachers have been in place for many years. The school will face particular problems in renewing its senior science, mathematics and ICT teachers.

Teachers in all areas bemoaned the loss of fundamental skills blaming a “fuzzy SACSA with nothing rigorous or difficult”. They felt that this was jeopardising retention to year 11 and 12. They felt that science had been particularly “dumbed down”. Moreover younger students were not aware of how critical science and mathematics were to their future career options. The lack of access to professional development and training was keenly felt, with distance from the city seen as a major inhibitor. One teacher commented “they (professional developers) wont come further than Bridgewater (an Adelaide Hills town)”. Other practical problems were the cost, accommodation and replacement in class.

The role of subjects taken at a distance through Open Access college is significant in the school. Such distance subjects can fill missing gaps in the senior years where low student numbers do not make a class viable or where teachers are unable to take the subject. But they also broaden the opportunities that are perceived by students (eg. music). A strength of the school is that it can generally offer expert mentoring to Open Access students. However despite the school policy to encourage independent learning skills from year 7, not all students find distance learning to their liking. One suggestion was that more actual Open Access subjects should be available in Middle School so students can experience this mode under less pressure than that in senior years.

Sandy Grove Primary School

The school is situated several hours’ drive from Adelaide in a relatively large centre. Local industry is dominated by fishing and farming. The school community is characterised by cultural diversity, with a significant Indigenous population (12% of enrolments). The region offers a wealth of recreational activities including fishing, surfing, swimming and boating in local national parks and beaches. Approximately 60% of the students are School Card holders.

Mathematics

The students that were interviewed were very positive about the Mathematics that they did at school, and indicated that they liked Mathematics and did it everyday for between an hour and one and a half hours. The students interviewed also indicated that they thought that they were good at mathematics and that they could see it was useful (spending money, measuring, mapping) and that they did a variety of activities most of which they enjoyed. Two of the year seven students indicated that they enjoyed the challenge of new work while the younger students said that they expected that mathematics would get hard in year 8, when they do algebra.

The teachers were quite confident in their ability to teach mathematics although they did not consider it to be a strength in the school, as there is more of a literacy, Health and PE focus currently. The teachers had done very little professional development in mathematics teaching recently, one teacher had been to a numeracy expo. There was

one teacher in particular on staff who was able to be a resource person for mathematics. The school is a “Learning to Learn” school which means that there has been a significant level of PD in the school and they indicated that some of the ideas had been applied in the teaching across the board.

The principal and parents were very happy with the mathematics being taught in the school. The principal indicated that she would like to have a specialist mathematics teacher but the funding does not allow this as they are currently focussing on other areas.

Science

The students were quite positive about the science that they did, although a number did not think that they did much science and it seemed to be based around projects in particular in the earlier years. The younger students tended to do science as an integrated subject and so were not always able to identify that it was science that they were doing. All of the students enjoyed when that did “experiments” and other science type activities.

The teachers were less confident in teaching science than the other areas and two of the teachers were not at all confident in teaching science. The facilities for science are quite limited and there was no indication that there were any teachers who could be considered as a resource person. The parents were less interested in science than mathematics, although they thought that it was probably well done. The principal was happy with the way it was taught but was keen to make more connections with local industries and a local marine research centre, in order to further develop science. She was also keen to have some of the travelling shows from Adelaide eg Museum, Science Investigator Centre stay longer and visit more frequently as there is a perception that the students are missing out by not being in Adelaide. There was also a suggestion of a Mathematician or Scientist in residence, like the artist in residence scheme.

ICT

The level of ICT equipment in the school was very good, there was a “Computer Room” and each classroom had at least 3 computers. All of the computers were on the network and the teachers indicated that it was quite reliable. The students all indicated that they enjoyed using computers and were able to use one when they wanted to or needed to. The majority indicated that one thing that frustrated them was that a lot of websites were blocked and so they could not access them at school, this was frustrating for them when they were doing research and they would find a site through a search and then not be able to access it. All of the students interviewed had access to a computer at home and all except one had internet access at home. The teachers were confident in their ability to teaching using the technology and their students’ access to computers. There were two staff members they said were good with using ICT and that were willing to help anyone and so acted as resource people. The type of usage described by the teachers and students were word-processing PowerPoint presentations using the internet for research.

Diversity

The school has a high percentage of school card holders and also a significant number of indigenous backgrounds. The school is part of the SNAP staffing process (Schools

with Significant Number of Aboriginal People), which has helped with some staffing issues. The school runs programs for the indigenous students and has a Pitjantjatjara language program. There are general concerns with Literacy and Numeracy in the school these are being addressed in a number of ways eg PD for teachers, special programs for low achieving students.

Other comments: Tyranny of Distance

Overall there was a 'very positive feel in the school' and the staff, students and parents are happy to be there. (this has not always been the case) The teachers would like more accessible PD within the school. The teachers commented that Adelaide based PD is very expensive to get to and in addition it is not always able to be TRT's for classroom release. Classes often need to be split due to lack of TRT availability.

The teachers would like more travelling shows and more funding to set up links with local industry and resources, funding for time release. They would also like specialist teachers in the science area and funded positions for mathematics and ICT specialists.

BRINGING TOGETHER THE EMERGING ISSUES

Mathematics

Mathematics is an enabling subject for many university degrees. Students generally seemed to appreciate that this was true of science, applied science and engineering degrees but not so much of degrees in health sciences, business and accounting. Students and in some cases teachers and schools did not seem to realise that mathematics is also important in many trades areas such as electrician and carpentry. This lack of understanding of the importance of mathematics in for personal futures is consistent with widespread negative attitudes to mathematics as a subject. Both need addressing with practical and innovative action plans at school and system levels.

The issue of skilled mathematics teachers is problematic for rural schools. Many teachers who have responsibility for mathematics teaching have no background in it and there is inadequate professional development for them. The looming retirement of the skilled mathematics teachers will compound the staffing problems and will be further exacerbated by the difficulties of rural recruitment.

Science

Of the three learning areas under consideration the difficulties of delivering effective science education under isolated conditions appear to be the most profound. This is partly because science is a resource rich learning area requiring specialist knowledge, equipment and physical space, particularly in the senior years of schooling. When faced with the pressure of limited staffing along with the material expenses required of a resource rich learning area, the option to deliver curriculum by other means such as that available through open access, is all too often chosen as the best available option for students. Unfortunately the perception of many students in remote locations, whether rightly or wrongly, that the quality of science teaching and learning available by distance mode places them at a disadvantage when compared to their metropolitan counterparts, means that the incentive to pursue the sciences into the senior years, (particularly physics and chemistry) is not particularly strong. This in turn leads to a self defeating cycle in which low numbers of science students in the

senior years predicated a low level staffing need for science teachers to be appointed in isolated schools. One solution to this problem might be for systems and government to introduce revised formulae for staffing science teachers within remote locations.

As with many metropolitan schools the level and amount of primary science taught in rural and regional schools was not high. However, geographical isolation placed an added burden on the accessibility of resources available to assist with the teaching of science (viz museums, science centers, nature education centre etc) adding further impediment to its delivery. Although students in the primary years of schooling reported being involved in 'hands on' science activities, such activities were not in the main programmed in a regular way as for other learning areas such as mathematics and any science concepts presented were not sequentially developed.

Primary teachers themselves identified science as one area about which they were least confident. In consideration of these concerns the suggestion was made, by more than one individual that science co-ordinators be appointed in primary schools together with some level of resourcing commensurate with equipment and space needs for the subject. The benefits to be gained by a person working alongside others within the school community to plan and maintain a comprehensive primary science program across all year levels were large.

The need to establish links with local industry was identified as being both important and beneficial to the learning and teaching of science. However without additional resourcing, the constraints of time meant that in many instances this situation was unlikely to change within the near future. (Perhaps the appointment of a co-ordinator in science could manage this for the mutual benefit of all).

ICT

There was a generally positive response to the use of ICT in the schools involved. Hardware levels were quite reasonable and access was not identified as a major issue. There was still a sense of more would be better, but it was not signalled as a desperate need. Technical support was highlighted as an issue, particularly in relation to networking issues and this was exacerbated by the distance from Adelaide or a large regional centre. Internet access, in particular WWW access was seen as a valued resource and a way of negating distance in terms of information access. This was at times frustrated by the filtering mechanisms within the school to the point where some students would do their research at home.

The schools all had at least one teacher who was identified with at least an interest and some expertise in the use of ICT in teaching and learning and supported other staff. The teachers were quite positive about their ability to incorporate ICT into their students learning although the level of the integration varied. There were few examples of innovative classroom use of ICT and reluctance on behalf of some of the teachers to use it as part of their own professional development.

The students seemed very comfortable with their use of ICT at school and at home and there was a high level of home ownership and use in general, although Indigenous student access at home may be an issue. The issues that seemed to emerge were the access to technical support and ongoing professional development (PD). There was a

sense that having an identifiable person in the school that was able to support them and do some PD was a working model, but the question then becomes how these people access PD. While the use of ICT has developed in the schools there is still a lot of further development possible. A focus on the “expert” or “key” teachers may be a way forward.

Diversity

The diversity and equity issues appear to be somewhat unique for each of the four focus group schools. This is not surprising, as each school was chosen to represent a particular category of rural school. The diversity concerns raised were directly related to the specific locality of each school.

Sandy Grove receives additional funding and staffing, due to its classification as a SNAP school. This funding has allowed special Indigenous programs, including one in the Pitjantjatjara language, to be run in the school. Teachers at Bay Area school however, believed that current special programs for Indigenous students did not solve problems caused by erratic school attendance. The current curriculum does not match the needs of students who attend infrequently. Too often, Indigenous students have no continuity in learning experiences. In addition, concerns were raised about the lack of educational resources available to Indigenous students in their homes. This finding supports the research of Bortoli and Cresswell (2004).

While concerns for special needs support were only discussed at Bay Area School, it is likely to be an issue in many rural schools. Special needs were not directly addressed in this project and therefore not mentioned at three of the focus group schools. Isolation from specialists has forced schools to handle extraordinary situations on an almost daily basis.

A number of participants across the schools discussed issues of equitable access to resources. Flower Valley Primary Catholic School teachers believed that the resource problem was exacerbated through poor communication with government schools in the area. Bay Area school and Sandy Grove indicated that access to science resources such as the museum and the Investigator Science Centre remain ongoing problems. All schools advocated for increased funding for science coordinators and for projects with local industry.

Finally, access to PD is a universal problem for teachers in rural schools. Economics and distance preclude teachers from participating in most PD. As a result, teachers feel even more isolated from their metropolitan peers and current educational practice.

Conclusion

Inequities of access appear to be the major concern of rural and remote schools. As a result, students in the senior years are given fewer subject options in the areas of mathematics, science and IT. Ultimately, restricted choice limits entry into tertiary study and technical trades.

The distance education option for taking subjects was viewed differently by the schools. Greenview Area School’s more positive attitude to distance education may be related to the additional support offered by teachers to students using this mode. In

contrast Bay Area School's more negative perception may result from the very limited support that teachers are able to offer students taking subjects via distance education.

Rural schools are generally not able to use resources such as museums, science centres and nature centres. This problem is further exacerbated by unreliable internet connections that make virtual tours difficult also. This problem can be addressed in part by making more links between rural schools and local industry and the environment. Rural schools need to be given funding and time to form valuable links with the science that already exists in the surrounding area.

Science remains the left behind subject area. This is particularly the case in primary schools and it is important that support be given to teachers in the form of science coordinators at all rural schools. In addition, teachers need PD delivered in a viable format for rural schools.

Lack of accessibility to PD was a concern voiced by teachers at all four of the schools. Distance and TRT availability prevented teachers from participating in most PD. PD is particularly important for rural teachers, as they are often forced to teach science and mathematics subjects that are outside of their knowledge base.

Equity issues are a major concern for rural schools. Mathematics, science and ICT are crucial subject areas that are significantly impacted by geographic isolation. Clearly additional funding and resources are needed to give rural students access to the same educational opportunities as their metropolitan peers.

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Appendix

Questions for Teachers

- a) What are your reasons for teaching in a rural/regional school?
- b) What do you see as the strengths of your school in helping students achieve their potential in science, ICT and mathematics?
- c) What do you see as obstacles to students achieving their potential in science, ICT and mathematics?
- d) Do you have any examples of successful initiatives or programmes?
- e) What are your views on attracting and retaining qualified science, ICT and mathematics teachers for rural schools?
- f) What recommendations would you make to education authorities to improve student outcomes in these subject areas in rural schools?

Questions for Parents/caregivers

- a) What are your reasons for living in a rural and regional area, and for your choice of school?
- b) What are your educational aspirations for your children?
- c) What are the strengths of your children's school in helping them achieve their potential in science, ICT and mathematics?
- d) What do you see as obstacles to students achieving their potential in science, ICT and mathematics in rural/regional schools?
- e) Do you know of any successful initiatives or programmes?
- f) What local community factors affect student outcomes in science, mathematics, and ICT education?
- g) What recommendations would you make to education authorities to improve student outcomes in these subject areas in rural schools?

Questions for students

- a) What are the advantages of living and schooling in this area?
- b) What are the disadvantages of living and schooling in this area?
- c) What would you like to do when you leave school? Do you intend to stay here or move?
- d) What do you think of mathematics (positive and negative)? What are you doing in mathematics?
- e) What do you think of science (positive and negative)? What are you doing in science?
- f) What do you think of ICT classes (positive and negative)? What are you doing in ICT? (only where appropriate)
- g) Tell me about your experiences of using computers in this school (positive and negative).