Career Aspirations of Science Students in Rural and Urban Schools

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Paper presented to the Australian Association for Research in Education
Annual Conference
27 November - 1 December 1994
Newcastle, New South Wales

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Introduction

In 1990/91, a research study was undertaken in England of the Factors Affecting Schools Success in Producing Engineers and Scientists (FASSIPES). This study was conducted by Brian Woolnough at the Oxford University Department of Educational Studies, the Institute of Physics and the Institution of Electrical Engineers and National Power (Woolnough, 1991). Principally, Woolnough attempted to ascertain why young people chose to pursue a career in the physical sciences and engineering. In addition, characteristics of schools which appeared to influence students to pursue a study of science were investigated.

A number of countries have since replicated this study as an international research cooperative and the National Key Centre for School Science and Mathematics, Curtin University of Technology, Perth, Western Australia participated on behalf of Australia. Currently, the following nine countries have contributed to FASSIPES International in addition to the UK: Australia, Canada, China, Hungary, Italy, Japan and Portugal. In the Australian study, approximately 20 Western Australian high schools participated. Both science teachers and Year 12 students were surveyed and interviewed, with the results compiled by research staff at the National Key Centre for School Science and Mathematics. Science teachers were asked about the kind of science teaching they conducted and their perceptions about student career choices in science and engineering, while students were asked about their subject choices, grades and their reactions to the kind of science teaching they experience.

In our study, we compared the career aspirations of Year 12 Science and Physics students, from both rural and urban high schools in Western Australia. These students were in their last year of non-compulsory schooling before entering higher education. While we were particularly interested in students who chose science and engineering careers, we also found that career aspirations were different for rural and urban students. Summarily, our study found significant cultural differences between rural and urban students and these are discussed in this report, although in many ways these students had very similar reasons for choosing to become a scientist or engineer. This report will describe some of the similarities and differences found between rural and urban students.

The methodology and questionnaires were developed and trialled in England by Brian E Woolnough, Oxford University Department of Educational Studies, Oxford UK. Questionnaires were modified for the Australian setting and are available from the authors. The authors are grateful for the assistance provided by Woolnough. This paper forms the first of a series of research papers on the FASSIPES project.

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Fellow, Science and Mathematics Education Centre, Curtin University of Technology, GPO Box U1987, Perth, Western Australia, 6001, Australia. Brian E Woolnough can be contacted at: University of Oxford Department of Educational Studies, 15 Norham Gardens, Oxford, OX2 6PY, United Kingdom.

Two distinct types of schools were found to contribute to a school culture. These distinctions were geographic, that is, urban and rural. In this report, the term "urban" will refer to those schools located in the metropolitan urban and suburban areas of Perth, Western Australia. The term "rural" will refer to those schools located in what is generally referred to as rural and remote areas of Western Australia based on statistical local areas. This classification was first developed by Arundell using the 1986 census data (Department of Primary Industries and Energy, 1991) and is currently being updated by Shore using the 1991 census data (Australian Bureau of Statistics). People living in rural Western Australia have many different social, cultural, economic and eductional pursuits. This study was not meant to be all-inclusive, but rather to attempt to look into a few schools and their local communities in both rural and urban locations. These schools ranged markedly in demographic terms and we have only begun to understand how the community influences these schools. We hope that we will be able to continue to research and further understand rural education in Western Australia in the future.

Background to Australian Research in Rural Schools

In 1979, the National Conference on Rural Education was held in Perth under the auspices of the Centre for Educational Research and Innovation (CERI) of the Organisation for Economic Cooperation and Development (OECD). The most fundamental issue that was highlighted in this conference was the relationship between the rural school and its community (Education Department of Western Australia, 1980). That rural students participate in education to a lesser degree than students from metropolitan areas has long been the subject of concern to both policy makers and the government (Department of Primary Industries and Energy, 1988; Dawkins & Kerin, 1989).

While the education and training needs of rural Australians are similar to those of their metropolitan counterparts, the isolation of rural communities often makes it more difficult for Governments to effectively meet these needs. A low level of participation by young rural people in secondary education is one consequence of the disadvantages some rural Australians face in getting access to education and training.

(Dawkins & Kerin, 1989, p. 1)

Why this low level of participation of rural students in secondary and tertiary education exists is important for the future of young people in rural Australia. Major hurdles to participation in and completion of post-compulsory schooling and higher education were identified in rural and remote areas of Western Australia by McGregor and Latchem

(1991, p. 3):
- lack of a culture conducive to the pursuit of learning and higher study;
- lack of courses at the local level (many students cannot or do not wish to leave their home areas and, in any case, leaving is disadvantageous to regional development);
- lack of comprehensive Year 11 and 12 courses facilitating access to higher education;
- lack of information about courses and careers, entry requirements, entry procedures,
and detailed up-to-date information on units, personnel and practices;
- lack of tutorial and peer support in study through distance education;
- lack of local study centres; studying in isolation proves very daunting for remote/disadvantaged students.

A small study conducted by Stevens and Mason (1992) in one rural school in Western Australia found that the "main influence on the career choices have come from members of the students' nuclear families, particularly from mothers." These researchers found a lack of interpersonal support for young people in their study of a small Western Australian community. Most of the support provided appeared to come from within the students' nuclear families. Another important factor is the socioeconomic background of the local community and of the student's family. There is some indication that what is being measured in rural-urban difference studies is socioeconomic status and/or ethnicity. For example, Easton and Ellerbruch (1985) found that the poorer rural students scored considerably lower on citizenship and social studies tests than did students from upper socioeconomic urban communities in a US study. In another US study which held socioeconomic level and ethnicity constant, no urban-rural achievement gap was found (Edington & Martellaro, 1984).

In his report of young people's participation in Australian education, Finn (1991) found that young people from rural areas were less likely to participate in post compulsory schooling and higher education than those from urban locations. Finn attributed this directly to the fact that young people who live in rural areas were more likely to come from lower socioeconomic backgrounds. This has since been validated in Western Australia by my research using a limited dataset from the Monitoring Standards in Education (Young, 1994). While by no means conclusive in terms of possible variables, socioeconomic influences outweighed the rural effect in these analyses.

Drawing upon previous findings that young people were disadvantaged in the rural sector in terms of socioeconomic and participatory effects, we asked students about their career aspirations and those factors which influenced their choices and desires for their future. We found that socioeconomic background and community values impinged upon these choices and that this was where some of the urban/rural differences lay.

Sample Design

During 1993 and 1994, 729 Year 12 science and physics students were surveyed in 20 Western Australian high schools. Many students who indicated that they planned to continue their studies in the field of engineering were interviewed, along with their Principals and teachers. Further, this study encompassed many different communities and these are described as part of the overall context. To preserve anonymity, these students, teachers, schools and communities were given pseudonyms.

The Western Australian Context

In Western Australia, schools are scattered throughout metropolitan and rural locations with wide ranging community values and beliefs. The impact of these values on career aspirations was observed to a limited extent. While students in rural and remote locations participated in similar courses to those students residing in metropolitan Perth, they often reported that they had limited access to higher education course information. These students also tended to be motivated by different social factors, than students from suburban Perth. There were many significant differences noted between students from rural and suburban locations.

First Stage: 1993 Year 12 Science Students

In 1993, six schools from suburban Perth (3 schools including 267 students) and rural locations (3 schools including 165 students) participated in the initial stage of this study. We asked all of the Year 12 science students and teachers to participate, irrspective of their career aspirations. Of the 432 Year 12 science students who responded to the survey, 107 were studying Physics for the university entrance examination (Tertiary Entrance Examination, as it is called in Western Australia). The sample size for this stage was 432 students, 29 science teachers and 6 Principals from 6 schools (see Table 1).

Table 1. Sample size of 1993 study comprising Year 12 science students.

Schools
1993Yr 12
Science
StudentsYr 12
Science
TeachersRural/
UrbanPrivate/
Gov
School 1674RuralCatholic
School 4945UrbanCatholic
School 5472UrbanCatholic
School 612610UrbanGov
School 7495RuralCatholic
School 8493RuralCatholic
Total43229

Second Stage: 1994 Year 12 Physics Students

In 1994, 14 more high schools responded to our request to participate in this study. Of these schools, 7 were located in suburban and urban parts of Perth and 7 were located in rural parts of Western Australia.

In this stage of the study, only Year 12 physics students were asked to participate. There were two reasons for this. Firstly, these students were more likely to go on to study science and engineering courses. Secondly, it was much more manageable to approach a school in a personal way and survey students in a single morning or afternoon, when there was usually only one class and teacher involved. Of particular interest was the career aspirations of these students. It was decided to interview small groups of students about their career aspirations to augment the quantitative and open response data already collected. The sample size for this stage of the study was 297 Year 12 physics students, 20 Year 12 physics teachers and 14 schools (see Table 2).

Table 2. Sample size of 1994 study comprising Year 12 Physics students.

Schools
1994Yr 12
Physics
StudentsYr 12
Physics
TeachersRural/
UrbanPrivate/
Gov
School 1181RuralCatholic
School 1281RuralGov
School 13101RuralGov
School 14412RuralGov
School 15221RuralGov
School 16252UrbanGov
School 17161UrbanGov
School 19302UrbanGov
School 20282UrbanGov
School 2191RuralGov
School 23101UrbanGov
School 2491UrbanGov
School 26141RuralGov
School 27673UrbanGov
Total29720

Methodology

This research project consisted not only of two stages in terms of time line and sampling, but also involved the use of a large scale survey collection of data and an interview procedure. In 1993, 432 Year 12

science students were surveyed across schools from both urban and rural settings. While we obtained useful information, we decided to go out to the schools and become more involved in the data collection process in 1994. We also decided to collect data from Year 12 physics students only. We found that the both the quality and quantity of information was greatly improved by these two adjustments to our methodology. The quality of information was improved by focusing on those students more likely to pursue science and engineering careers, while the quantity of data collected improved as we increased personal contact with both the students and teachers involved. In 1994, a further 297 Year 12 physics students were surveyed, making a total of 729 students participating in this study.

There were three types of questionnaires used in this study: Principal, Teacher and Student. The questionnaires were derived from the Woolnough study and are replicated with permission from the authors (Woolnough, 1991). We used an interview schedule for student interviews.

The Principal filled in a questionnaire about school related information, the Year 12 science and physics teachers were asked open ended questions in a separate questionnaire and Year 12 science and physics students were asked about themselves and their home environment. They also filled in Likert response items about how they reacted to various activities in the school science lessons, what things influenced their career choice and further study, along with a personality profile.

In particular, the Principal or Deputy Principal (DP) provided information regarding enrolment numbers in Years 11 and 12 and how many of their Year 12 students went onto higher education. Of course, some schools did not hold or collect the latter information. We also asked about the science laboratories, laboratory assistants, teaching staff, minutes per week science teaching and other information about the organisation of the school. Additionally, we interviewed some of the DP's about their school and communities.

Science teachers were asked about their teaching styles and methods in their science classes. We also asked some open-ended questions about what factors they thought would encourage or discourage students from taking up a career in, or going on to university or technical college to study, one of the sciences or engineering.

Year 12 science students in 1993 and Year 12 physics students in 1994 were surveyed with a questionnaire and many of these students were also interviewed. In the questionnaire, students were asked about the subjects they studied both in Years 11 and 12, the courses they hoped to study in higher education, the family and relative influences and what kind of career they hoped to achieve. A number of Likert type item responses regarding how they reacted to various types of activities in their science lessons, the factors which influenced their choice of a career in higher education in one of the physical sciences or engineering and a personality profile. These students were finally

asked to provide an open-ended response about how they came to decide to, or decide not to, pursue a career in science or engineering.
In addition to the questionnaires, some students were selected from both rural and urban schools for an interview. Due to time restrictions, we interviewed them in groups of three or four students at a time. While an interview schedule was used, we tried to remain flexible and respond to the student's description of family and other influences in their decisions.
In the following section some of the findings relating to rural and urban differences are discussed. Further results and discussion of findings about the career aspirations of Year 12 science students from this study may be found in Young et al. (1995).

Analysis of of the Survey Data

Higher Education and Careers

When student responses were compared by urban and rural schools, there were some differences in choices of higher education courses and careers. These differences were significant for career choices (see Tables 3 and 4). Because these students were studying science at the Year 12 level, it was expected that they would continue onto science, engineering and computing courses in higher education. We were surprised to find that 17 percent of urban and 19 percent of rural students indicated that they were going on to study non-science courses. This seemed to be a high number of students who had elected to study science for tertiary examination purposes. On the other hand, 74.5 percent of urban and 75.6 percent of rural students indicated that they were planning to study these scientific courses (note that some students idicated neither science nor non-science courses).
While the urban and rural schools studied in this project were similarly matched by socioeconomic measures of parental occupation, there were some profound differences in community values and beliefs. These will be discussed in a later section which will compare two rural communities and their schools.
In Table 4, we have presented a summary of career choices indicated by 439 of the 729 students (the other 290 students did not indicate a career choice). Many students were reluctant to specify a particular career path and often indicated two or three possible pathways for their futures. Others simply could not decide, often attributing their indecision to a lack of information and knowledge about the possibilities. These students wanted careers which were familiar to them. Of the students who did respond, 69 percent were planning a professional or managerial career. There were 71 percent of urban students and 66 percent of rural students who planned professional careers. In terms of scientific and engineering careers, there was a 3 percent difference between urban and rural students. There were 45.5 percent of urban students who chose these careers and 42.3 percent of rural students who selected scientific and engineering careers. The most popular career choice appeared to be a health or medical

professional (16 percent of urban students and 14 percent of rural students).

Activities in School Science Lessons

Students were asked about how they reacted to various types of activities in school science lessons. There were five significant differences noted for students from rural and urban schools as described in Table 5:

1.Students from rural schools appeared to enjoy planning their own experiments more than students from urban schools (item 1).

2.Students from rural schools preferred to be given clear instructions for practical experiments, however this was even more so for the urban students (item 2).

3.While both types of students liked extended practical projects, rural students indicated a preference for these (item 6).

4.Students liked structure and teacher directed learning, but urban students indicated a preference for this (item 9).

5.Whiles students tended to be uncertain about being involved in science and technology competitions, rural students liked them more (item 15).

Table 3. Higher Education Course Choice by Rurality of School.

Higher Education
Course ChoiceUrban
SchoolRural
School
Total
Physics347
Chemistry9413
Computer Science191736
Engineering572683
Other Science228129357
Other Non-science7445119
Unsure341346
Total424
(64.0)238
(36.0)662
(100.0)
Note:Number of Missing Observations: 67
t-test: t = 1.06, p = 0.289
Chi-Square: Pearson = 6.20, p = 0.516

Table 4. Career Choice by Rurality of School.

Career

ChoiceUrban
SchoolRural
School
Total
Labourer022
Machine Operator202
Sales181129
Clerk011
Trades person141226
Para-professional482674
Med/Sci Tech448
Build/Eng Tech9413
Air/Sea Transport15520
Nursing7613
Police6511
Miscell Para-prof729
Professional19194285
Natural Scientist211233
Building/Eng Prof421860
Health/Medical Prof462268
School Teacher291241
Social Prof718
Business Prof111021
Artists161430
Miscell Prof19524
Manager/Admin9918
Total283
(64.5)156
(35.5)439
(100.0)
Note:Number of Missing Observations: 290
t-test: t = 0.90, p = 0.367
Chi-Square: Pearson = 10.29, p = 0.173

Table 5. How students react to various types of activities in school science lessons
(Likert response set: strongly agree, agree, unsure, disagree, strongly disagree)

Mean
AllMean
UrbanMean
Ruralt-testp
1. I find the opportunity to plan my own experiments very satisfying
3.353.2633.514-3.420.001
2. I feel happiest when clear instructions are given to follow during practical experiments4.134.1983.9962.790.006
3. School science is about learning scientific facts and theories3.61
3.6073.629-0.310.760
4. School science is about learning to do science through scientific

investigations3.523.4833.600-1.590.112
5. Standard experiments, written up correctly, give confidence to continue with science3.523.5113.531-0.270.790
6. Extended practical projects show me what science is like and makes me interested in it3.533.4463.674-2.830.005
7. The best notes are short and concise4.104.0654.162-1.340.180
8. I find I need to write quite a lot in order to really express myself satisfactorily3.053.0153.101-0.960.335
9. I feel most confident when the science lessons are well structured

and teacher directed3.994.0523.8802.360.019
10. I value the opportunity when the teacher lets us plan our own activities3.423.3893.485-1.280.202
11. Student work is marked objectively by the teacher3.753.7683.7220.68 0.495
12. The most effective form of assessment is self assessment by the student (me)2.972.9483.023-0.870.383
13. Involvement in science clubs is an unhelpful distraction from the learning of real science2.772.7502.811-0.950.341
14. Parents are not involved in the work of the school science department3.663.6733.6500.310.759
15. Involvement in science and technology competitions is great fun3.09 3.0173.215-2.300.022
16. Local engineers can bring a stimulating dimension into science lessons.3.213.2043.224-0.260.792
17. Work experience in science based industry turns people off jobs in science or engineering2.492.5032.4750.370.712
Note: Statistically significant differences between rural and urban students are in bold.

Table 6.Significant factors in influencing choice of career and higher education courses.
(Likert response set: strongly agree, agree, unsure, disagree, strongly disagree)

Mean
AllMean
UrbanMean
Ruralt-testp
1. The teaching in the science department3.603.5773.640-0.810.417
2. The personal encouragement given by science teachers3.623.6123.641 -0.430.665
3. Supportive mathematics teaching in the school3.563.6363.4322.75 0.006
4. Supportive science teaching in the school3.703.7273.6421.290.197
5. Supportive technology teaching in the school3.323.3343.3010.55 0.581
6. Advice from the careers staff3.523.4913.568-1.090.274

7. The practical nature of the science lessons3.683.6533.721-1.04 0.298
8. The intellectual satisfaction in doing science3.643.6413.6410.00 1.00
9. The amount of involvement with human issues3.493.4883.4810.110.916
10. The amount of self-expression allowed in science lesson3.233.190 3.305-1.570.116
11. The tradition of good examination results in science3.713.7113.703 0.100.920
12. Outside speakers and visits to science firms and industrial sites 3.363.3143.442-1.800.072
13. Local scientists and engineers coming into the school3.143.0993.213 -1.790.074
14. Work experience in local companies3.543.4883.640-2.290.022
15. Involvement in science clubs (photographic, radio, etc...) 3.093.0663.137-1.330.186
16. Involvement in science competitions (e.g., Science Talent Search; Titration Stakes; Physics Quiz)3.283.2383.353-1.680.094
17. The level of difficulty of the sciences at school3.263.2493.283 -0.440.658
18. The amount of work required for school sciences3.093.1263.0351.16 0.246
19. The ease of entry to tertiary courses in science and engineering

2.962.9582.9530.060.954
20. The possibility of Austudy in higher education3.433.4533.3840.96 0.337
21. The status of jobs in science and engineering3.753.8033.6512.12 0.035
22. The likely salaries in science and engineering jobs3.883.9273.797 1.800.073
23. The likely job satisfaction in science and engineering jobs3.83 3.7933.894-1.420.156
24. The way in which sophisticated technology is used in military weapons2.812.8012.825-0.260.794
25. The job situation in local science based industry3.203.2113.1690.64 0.524
26. Experience of your family in science based industry3.143.1193.187 -1.040.298
27. Scientific hobbies and fiddling with gadgets at home3.523.4863.577 -1.270.205

Note: Statistically significant differences between rural and urban students are in bold.

Factors influencing Choice of Career and Higher Education in Physical Sciences or Engineering

Students were asked about significant factors which influenced their choice of career and higher education courses. There were three significant differences in responses for students from rural and urban

schools (see Table 6). Firstly, students from urban/suburban schools noted that the mathematics teaching in the school was more supportive when compared with students from rural schools (item 3). Secondly, students in rural schools reported a significantly greater amount of work experience in local companies influencing their decisions (item 14). Thirdly, while students in rural schools reported that jobs in science and engineering were significant status, they were not so enthusiastic about this as were students from urban schools (item 21).

Analysis of Interview and Open-ended Response Data: How did these students come to decide to pursue or not to pursue a career in science or engineering?

First Stage: Year 12 Science Students

The Year 12 science students responded to this open-ended question by referring to their community, their environment, their families and their work experiences. While male students tended to prefer geology, dentistry, mining and engineering, females students appeared more interested in biological and people related careers. This gender difference was a regular feature. There was mention made of interest as a key factor in selecting their career, but often familiarity played an even more important role in their choice. This occurred through family or other simple contacts such as work experience. The teacher and the school did not appear to play at critical role in career choices for these students.

Some of the reasons these students gave for choosing a career in science or engineering were:

- I would like to rectify the mistakes of the past by a career in the environment
- Geology provides the type of lifestyle I wish to have
- I found dentistry an interesting career
- Science would keep me interested, challenged and satisfied
- Teaching staff in science do encourage the students to pursue a career in science
- Mining industry because I grew up in the goldfields
- Engineering/geophysics based on my interest and where I am likely to get employed
- Engineering for the high salary

- Marine biology due to my work experience
- I chose a chemistry career as it was a challenge
- Both of my brothers are studying engineering
- I am interested with human benefits: human biology (female)
- Nursing, because I always enjoyed science and got top marks
- My teacher “fired” my interest
- The extremely competitive nature of tertiary entrance was discouraging
- I spent a lot of time in the bush and am interested in horticulture
- I’ve been to the UWA Dentistry Open Day and found the course very interesting
- I find physics fundamental in nature and one of the pure sciences that

can explain why things happen or predict events
- I am interested in sound technology
- Science appeals to me and suits my personality
- I enjoy helping people: physiotherapy

Some of these students wanted to serve and care for other people, while others were interested in science as a challenging career. There were some students who combined their love of people and science to pursue a career in nursing or medicine. In addition, numerous rural students referred to their desire to remain employed in the country, with the lifestyle it provided.

The Year 12 science students who chose not to pursue a career in science or engineering reported some interesting attitudes. One point immediately apparent for a student from a rural school, and reiterated by interviews in other rural schools, was "the lack of counselling in choosing subjects for a future career". The students who chose not to pursue a career in science or engineering referred to lack of interest and boredom. Many of these students felt that they were more creative and perceived the sciences not to be a creative field. Some were discouraged by the high level of competitiveness which was required to get into engineering courses. One student who intended to become a primary school teacher said:

I enjoy biology, but not physics or chemistry, just because it is not interesting. I prefer the humanities subjects, because I like to express myself and communicate with others.

Another fine arts student said:

Science does not interest me, because it is impersonal and non-creative and very destructive. There are many problems created and people think that science is beneficial. But the world is continuing to be polluted and people are hungry for money.

The word "boring" was used repeatedly in these student responses. These students expressed strong, negative feelings towards science.

Second Stage: Year 12 Physics Students

We were more successful in this stage of the study in obtaining open-ended responses from students and teachers. This appeared to be directly related to our active involvement in distribution of the questionnaires and interviewing students in the schools. We found that this technique was useful and effective.

We expected these students would choose a career in science, engineering or computing, due to their enrolment in physics for tertiary entrance examination. However, there were some students who had no intention of continuing their career in the sciences.

Year 12 physics students provided an interesting array of information regarding their career aspirations and views about science and engineering careers.

Engineering. Rural students described engineering summer camps at the University of Western Australia as very influential in their choice. In addition, the Australian Defence Force Academy actively recruited these students, both rural and urban. The importance of influential family members who worked in the field of engineering and work experience in the field of engineering was also highlighted. One rural

student was involved in the CSIRO's 2040 program and this led him to

try for engineering. For urban students, there appeared to be different kinds of reasons for choosing engineering, although the National Science Summer School was an important influencing factor for at least two urban students. Some urban students appeared to have an interest in science, while others were influenced by family members. Again, work experience confirmed many students' choice of engineering. Finally, there was an awareness of the prestige and financial security provided by a career in engineering. There were 27 male students who planned to study engineering and 2 female students. Many students expressed a frustration at the lack of career guidance information available to them.

Physics. There were very few students who indicated that they would pursue a career in physics. Most students had selected careers in more practical science and engineering fields of study. Those students who chose physics careers had a obvious love of physics and the theories attached to this field of science.

Computing. Most students perceived computer science courses to be a scientific career. They were influenced to aspire to computer science by their fathers, work experience and a love of computers and computer programming.

Science. It was interesting to note that many students did not perceive nursing or medicine to be a scientific career and listed these careers under non-science courses. These students appeared to categorise nursing and medicine as human service type of careers. Female students who wanted to study nursing were often motivated by a desire to care for people. Further, female students described their choice of a biological science career as caring for animals and the environment.

Non-science Courses. Of the students who did not wish to study science in the future, many female students perceived science negatively. They felt that they would be unable to express themselves creatively if they chose a scientific career. Examples of female quotations from urban schools are:

I decided not to pursue a career in science or engineering, because I have more interest in children and helping them learn for their future.

I would not like a career in science or engineering, because the way that they have been taught in this high school is dull and boring. The majority of chemistry and physics teachers need to teach these course in a more interesting way to stimulate the students' minds.

In the following two sections, we present a picture of a small mining community and a large country city. The relationship between the school and their communities is described based upon interviews with teachers and deputy prinicpals. We observed that this relationship was fundamental to the ambiance of the school and predict that this relationship must be incorporated in futher educational research.

Mintown: A Small Mining Community

Mintown is a small mining town in Western Australia. People in Mintown

were distinctly more relaxed than the city. Teachers considered the relaxed pace of life in this town to be a disadvantage for student performance. They were continually frustrated by the lack of competitive drive amongst their students. We noted that these same teachers enjoyed the lifestyle themselves and seemed to have become a part of the community. While most teachers at Mintown Senior High School tended to be young and enthusiastic, due to the Education Department policy of sending inexperienced teachers out to the country to teach, there was now a growing tendency for older, family oriented teachers to apply to come to Mintown to teach. These older teachers saw Mintown as an ideal location to raise their children and get away from the city pressures. Teachers in this school reported a sense that the stress of the city was beneficial for academic achievement, but detrimental to the family and health.

This town was rated highly by the socioeconomic measures used by the Australian Bureau of Statistics. Salaries were high and there was a high retention rate from year 10 to year 11. While private rental properties were expensive (approximately $250 per week), the government employees housing was reasonable (approximately $140-180 per week). Teachers were among the lowest paid people in Mintown. Parents who worked for the various mining companies were usually well paid, although not necessarily well educated. This was perceived to be a problem for teachers, who found it difficult to inspire their students to continue their education. This perception was repeated in other towns which we visited. Teachers reported that there were many parents who did not value secondary and tertiary education for their children. These parents seemed to feel that they had a good life without getting an education. In their eyes, their success both financially and in employment was not related to their education.

There were two towns nearby, Blacktown and Rome, whose children could attend school up to year 10 at Blacktown District High School. In earlier years, Blacktown was a significant mining town contributing to the local community both economically and socially. This town was wealthy and had the only hospital and shopping centre in the 1970's. Blacktown no longer holds the status it used to, while Mintown has increased in status markedly. This is probably due to the reduction in mining at Blacktown. Historically, Rome is a much older town serving the agricultural properties and aboriginal communities. Rome has had fewer resources and less socioeconomic benefits. Children from Blacktown District High School rarely went onto year 11 at Mintown Senior High School. When they did, they tended to be ill prepared for year 11 subjects and their career aspirations were minimal in comparison to those students from Mintown. Students in Mintown almost always went onto year 11 from year 10. Students at Blacktown District High School were distinctly disadvantaged. Students from Blacktown DHS came from Blacktown and Rome. While students from Rome were 90 percent Aboriginal and tended not to go onto year 11 at Mintown, students from Blacktown were mostly non-Aboriginal and these students did go onto

year 11. On the whole, Aboriginal students tended not to complete their high school education.

Most students do not go onto university at Mintown. The more able students tend to mix with lower ability students in large classes here, this is mostly due to the higher retention rate. Teachers feel that this mixing has a negative influence on those students who have the potential and ability to achieve at the tertiary level. Although able students could move to the city and attend university, they are more comfortable in the town, living with their families and earning good salaries in the mining companies. Additionally, the more able students have little incentive to study hard at home. With their peers influencing them to spend time socialising, their attitude to study is poor:

Three Year 12 Physics students from Mintown Senior High School who planned to go onto study engineering were interviewed. Two were from Mintown and one was from Blacktown. When asked about the problems of choosing a career in the country, these students felt that the access to career information was poor and that they had no idea of their competitiveness by academic standards in the city. The lack of competitiveness was clear to them.

Darrell was planning to do chemical or aeronautical engineering at the Australian Defence Force Academy (ADFA), Bruce was planning to do electronic engineering at UWA and Marcus was planning to do electrical engineering at a TAFE college in the city. They were all concerned about being able to get into the course of their choice. These three students did not seem concerned about leaving home, but more about being accepted and the cost of the courses.

Darrell was keen to get into ADFA, because the course would be paid for. Darrell's mother was a laboratory assistant and his father supervises in the salt mines. Darrell's father is pleased that his son has chosen to go to university, because he always wanted to do this himself. When Darrell was provided with information by ADFA at a recruiting seminar, he was keen to continue his studies this way. He felt that ADFA would provide an easier route financially for his family.

Marcus was Macedonian and came from Blacktown. Marcus found that the mathematics he had learned previously in Blacktown was negligible. It is a small town and students doing the hard subjects are few. These classes are small or else offered through distance education. Marcus felt ill-equiped for tertiary studies. Marcus said that his natural ability to do physics was prime factor in his choice of engineering, but he felt that he was not so able to study at the university level. Marcus wanted to study at TAFE because he felt more comfortable with the difficulty level of this course.

Two Year 12 physics students from a private high school in Mintown were also interviewed. These students appeared to be greatly influenced by family members to study science in high school. They felt that their teacher was not typically boring, but was enthusiastic and a good story

teller. These students associate with other students who plan to go to university and appear to be encouraged to aspire to higher education courses. These students were also keen to get away from the town and live and study in the city. Overall, these students appeared to have more good influences to go on to study higher education. The influences here appeared to be family, peer and school support providing an expectation that these students can aspire to tertiary studies.

Bordon: A Large Country City

Bordon is a community of 29,000 people and has two government, Bordon Senior High School and Lane Senior High School, and one Catholic high school, St. Ruth's College. It is a regional centre serving a large area of farming and mining communities. People come to this town for exports, shopping, business, education, parts and it is a major port for most of the surrounding districts. It is also a major port, government centre and wholesaling centre.

Many itinerant people come here on a seasonal basis, for fishing and packing. The more traditional people have been here a long time and many are very wealthy; they send their children to school in the city, although some come to school in Bordon. Of lower socioeconomic status are those who are skilled, while others are government employees. Many country people, middle-class government and business people and people living in caravan parks send their children to Bordon Senior High School.

The two government high schools in Bordon were classified at a lower socioeconomic level based upon the ABS 1991 census. Both of these high schools were rated as priority schools by the social justice unit (Department of Education, Western Australia, Federal Funding Program), that is, it is classified a being relatively disadvantaged.

The fishing industry has created many wealthy people in this town. These people have spectacular assets because of the way the lobster industry has valued pots. They speak roughly, dress casually and have no great ambitions for their children, except to become wealthy like they are in the same sort of industry. For example, at the yacht club, there are cray fishermen who have retired early. They are multimillionaires. Some run hobby businesses to keep themselves busy, while others do nothing.

There is another class of people living in Bordon. Doctors, Dentists and Lawyers also have expensive homes. These people tend to value education more and desire that their children be well educated. This professional class send their children to the city, Perth, to be educated.

Student Aspirations

Throughout Western Australia, approximately 12% of students don't do any Tertiary Entrance Examination (TEE) subjects in Year 12. In Bordon, this figure is 30%. That is, three times the number of students don't want to do the TEE and go to university - they do want to gain their high school graduation. The state average for students

who apply to get into university is 30%, while at Bordon SHS this figure is 20%.

According to the school staff in Bordon, there appeared to be a lower proportion of students getting into university in rural schools, of those who apply, when compared to the metropolitan settings (staff referred to statistics from the Secondary Education Authority). As the application rate was also lower, it appeared that rural students are disadvantaged in terms of their aspirations and their chances. Further research is certainly warranted here in order to ascertain whether this was true and how change could be implemented.

There were some reasons given for the lower aspirations of students in Bordon by the Deputy Principal at Bordon SHS. The benigness of people in Bordon makes it difficult for the children to leave. It is more comfortable for them to stay. There are not motivated to seek a university education. The family is important to them and to the overall culture of the town. The children appear to hold old-fashioned, country West Australian values and dress accordingly. There is no agenda for change. They are very happy with the pedestrian, quiet, secure, family values, sporting club, local entertainment and local opportunities.

There is not a lot of motivation and not a lot of hard study here. However, this Deputy Principal felt that the school should match the community and not dance to some other tune. He said:

“The school should be a reflection of the community.”

Bordon Senior High School has a large upper school, due to the two boarding hostels which serves the surrounding agricultural and mining areas. In Year 12, there are 100 students of whom half expect to go on to higher education. Although 50 students hope to get into university, only 25 are likely to achieve this aspiration. This was true for Lane Senior High School as well, where only half of those students who hope to go to university will get in.

Teachers at both of these high schools reported that homesickness was a distinct problem for students who chose to attend higher educational institutions in Perth. The different culture which confronts them in the city and the lack of family support sends many students back home to Bordon.

Bordon SHS Students

In Bordon, aspirations to study engineering appear to be related to friends and family influences as in the cases of John and Robert, two Year 12 Physics students from Lane SHS. For example, John became interested in mining engineering because his sister extolled this type of career. She had won a scholarship from the mining industry and he saw this as an opportunity to gain financial assistance. He had also been down to Kalgoorlie recently to see how she worked and studied at the mining school. John was impressed with the community of students and the accommodation provided for them. The country life is a big factor in John’s career choice. He hates the city and prefers to remain in a small, rural community. John’s father was reasonably well to do with assets in local fishing areas. John’s father was a taxi driver and very proud of his children’s aspirations.

Robert does not like the cities either. He does not like being cooped up and prefers a career which would allow him to work outside. Robert has his heart set on being a geophysicist. He has a friend of the family who has written to them about being a geophysicist. Robert also has good memories of growing copper sulphate crystals at school. Born and raised on a farm, Robert's brother has a Bachelor of Agriculture

from Muresk and a sister who is studying dentistry. Both his brother and father are supportive of his aspirations. All of the male members of the family run the farm. The two brothers organise soil and plant tissue analysis. Additionally, there are sheep and cattle on this farm. Robert wants to try a different life for awhile and perhaps return to the farm later on.

Kaitlin and Brendan were two Year 12 Physics students attending Bordon SHS. They were influenced greatly by the Science Talent Search. Kaitlin studies aeronautics at school, her father is an aeronautical mechanic and her two brothers aeronautical engineers. Brendan discusses physics theories with his father, although his father is a delivery driver. Brendan felt that recruiting drives by the defence forces treated him like a target or number, and not like a human being. These students were influenced to study Physics by the enthusiasm of the science teachers. They had poor memories of primary school science and only began to enjoy science when they got into Year 8 science classes. Family support was important for these students, but not in their decisions and choices. Kaitlin was not sure what kind of science course she wanted to study, although she does want to include physics. Brendan wants to do mechanical engineering and design better systems. He hopes to be a flight technician. Brendan felt that Year 8 science should be more interesting, with courses designed for them to work at their own pace. Kaitlin and Brendan attended extension science classes, with more advanced units in Years 8 to 10. They felt that these classes were important for making science more interesting. Kaitlin also felt that career information was limited. Brendan felt that career advice did not inform the students about what the jobs entail.

Michael was always interested in magnetism and electricity. When Michael was given a computer and provided with a build your own radio, he wanted to know how they work. James like to pull things apart and fix them. Michael did not like the new Physics syllabus. He preferred to avoid English and arts type subjects. Michael liked logic and mathematical equations. He liked the order of physics.

Like Michael, Sandra was also interested in magnetism and electricity. Sandra's brother had an electrical kit and her father was an electrician. She felt that, to be a scientist, she needed to go overseas to be successful. Sandra did not believe that Australia was a place for scientists or astronomers. Her perception of Australia was sad to hear, especially from girls in the country. These women appeared ready to leave their hometown and their country in order to

pursue their careers in science. Additionally, Sandra was keen to study medicine and serve overseas in war-torn countries.

St Ruth's College Students

St Ruth's College is a Catholic girls' high school located in Bordon. We asked some of the Year 12 science students, who intended to pursue a career in science, about the reasons for this decision. These girls indicated that they were concerned about the environment. These students described their work experiences and how influential they were:

Clare: Well, when I went for my work experience, I met a marine biologist and she was having a really great time in her job and she really enjoyed it and she got to go diving and everything, and I thought well it would be really good so I decided to do that.

Susan: I've sort of been interested in agriculture and just how like it impacts on the environment and how you can sort of improve it and get more out of the land and stuff. So hopefully I can do Agricultural Science or Environmental Management. Just because there is a wide variety of opportunities in that end. I did work experience at the Agricultural Department and I have also just decided that when I finish school I am going to do Marine Biology or Environmental Management.

These students appeared to have had few positive primary school science experiences. Their experiences with learning science seemed to be more prominent in lower school (Years 8 to 10; this is generally students aged 13 to 15 years old in Western Australia).

Clare: I didn't even really know what science was until I got to high school.

I mean I heard it, guys in white coats and everything.

Interv: So in primary school what did you do in science, or don't you remember doing science?

Clare: All I used to think about was health and that.

Susan: I remember having to put plastic bags over this tree once, over the flowers.

Clare: I remember having to learn plant cells in primary school.

Susan: Did you? Gosh! We didn't do anything at all to do with science.

When the students were asked about influential people in their decision to pursue a particular career, few mentioned their parents and most were disappointed with their teachers. These students also appeared to choose a range of higher education courses in order to ensure that they got into a course of their choice:

Kerry: But none of the science teachers here have really pushed us to do something.

Jan:I have put Landscape Architecture at University of Western Australia (UWA), only because I saw it about a couple of days before we had to put in our applications and it sounded good, and then I put Environmental Management second at Edith Cowan University.

Mandy:I applied for the University at Townsville as well and that was for Marine Biology, and then at the end I didn't know what else to put so I put a bit of Hotel Management in there just for something different.

Jan: Psychology and all the rest of it!

Mandy:I also applied to UWA for Marine Biology down there and Environmental Management at Curtin is my second choice.
These girls also indicated a dislike for engineering because they associated it with a harsh, unfeeling type of life. They much preferred to choose a biological sciences career.

Jan: My brother did it (engineering) and didn't really find it interesting at all, and now he is even changing and doing uni again because he doesn't want to do it anymore.

Interv: What did he do?

Jan: Mechanical engineering. Four years of it, and now he is going back because he doesn't want to do it anymore. I reckon there is a big difference between something like mechanical engineering which is all machines and stuff and marine biology. I feel much more attracted to something like outdoors and the environment. The beauty of it, otherwise you are just working with machines that go round and round. It sounds like a really monotonous job whereas you are always seeing different things out in the great outdoors.
These comments from the girls were similar to those discussed by students who wanted to study engineering. Many students perceived engineering to be boring and an indoors type of job, while other students perceived engineering to be an exciting outdoors career. When they were asked what the main factors that influenced them to choose their career pathway:

Mandy:Just a love of the outdoors and not wanting to have a career where I sit in an office all day and that sort of thing. I want to be able to enjoy my work as well as earn a living by it.

Jan:Just because I like agriculture, and like it is good to see something that you can do like if you improve the production of some animal or other breed or something and you can see it, it gives yourself a good feeling and they can say "Oh, I did that". You can actually see your work.

Mandy:I don't know - I just did well at it so I thought well yes, it would be good to do something I could be proud of and something I wasn't ashamed of doing. I could be proud if I kind of got involved with the environment and everything.

Interv: And you think that work experience was particularly important for you?

Mandy:Yes, because you know they change everything and they do whale counting and everything and they were doing research on a disease carried by snails and they weren't sure if it was like caused by humans or if it was just natural. It turned out to be just natural, but they were all involved with it and everything. That was really good and they had turtles that they were tagging.

Discussion

This study found that students chose their future careers on the basis of their experiences, their family support and advice, their gender, the information presented either directly or indirectly to them at school and their own beliefs and value systems. Because most of these factors varied with the type of community in which the student lived and went to school, there were distinct differences between the rural and urban students. For example, many students chose careers which were attainable to them in the country and would provide employment for them in the country. Rural students appeared to have a wider access to alternative work experiences which were "outdoors" in nature, such as marine biology and mining engineering. Additionally, while some rural students were reportedly reluctant to leave their communities, most of the Year 12 science students which we interviewed were optimistic about studying higher educational courses in other states or cities. This contrasted with teachers who often told of school leavers who went to Perth to attend university and returned six months later, unhappy with the city life and homesick. When students were interviewed they did not seem at all concerned about leaving their homes and families. These students appeared anxious to become independent and start new ventures in higher education.

We found that there were a number of students who chose careers along sex-stereotyped lines, in terms of females wanting to do human and biologically related courses and males wanting to do computing and engineering type of courses. There were exceptions to this trend and we observed some females electing to do non-traditional scientific courses.

Implications for Further Research

While this study was limited to assessing career and higher education course choices of a selected sample of Western Australian rural and urban Year 12 science students, we were aware that the low level of participation of rural students in secondary and tertiary education would form the basis of a more substantial research study. Our study involved a small number of schools and students, but the findings are pertinent to an overall understanding of why students choose science and engineering careers.

The importance of the home, family support, peer expectations and school support in helping a student to choose his or her career was highlighted by this research.

Finally, this study suggests that further research be conducted in rural communities to identify factors associated with student career aspirations and higher education course choices. Secondly, students and schools in rural communities should be provided with better access to a wider selection of career information and work experiences.

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