Raising Science Awareness by Engaging Schools and their Communities in Science-Related Projects

Gina Faye Pearse

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ABSTRACT

This case study documents the Mt Capital Native Grasses Project, a science-related project that involved a school-community partnership in investigating native grasses on a recreational reserve in Canberra. The project was part of a national trial in 2002 of a model developed as part of the Australian Science Teachers Association (ASTA) Science Awareness Raising Project. The Model endeavored to engage schools and their communities in science, with the aim of promoting scientific literacy in the community and the role of schools in its attainment. The Model was communicated through a written resource; the ASTA Science Awareness Raising Package. The purpose of this case study was to explore the success of the ASTA Science Awareness Raising Model by investigating how one individual community adapted the Model and carried out their project. Evidence was collected from a variety of sources including project documentation, direct observation of meetings, and interviews.

The Mt Capital Native Grasses Project involved Year 6 and Year 9 students from local schools in scientific studies of the vegetation of the hill. It culminated in a display of the students' work at the local shopping centre. The Project became "school-driven", with teachers assuming the sole responsibility for planning and executing the Project. As such, the Project was based around the educational outcomes for students rather than addressing the identified science-related community issue of native grasses. The educational value for students was recognised as the most positive outcome of the Project, as well as the development of "strong social links" between the two schools. There was limited involvement of the community outside of the school, which constrained the potential of the Project to raise science awareness amongst the "broader community", despite this being the main aim of the ASTA Science Awareness Project. These findings of the case study were supported by interviews with representative community members conducted by ASTA which reported very little change in people's ideas about science post-project. There was only limited use of the ASTA Science

Awareness Raising Package, although it was generally recognised as a "useful resource".

This case study suggests that the guiding principles embodied within the Model do provide a useful format to engage schools and their communities in a science-related project with the aim of increasing science awareness, but that some were not implemented in the Mt Capital Native Grasses Project. I propose that there are elements of project management in support of the Package that need to be considered to render the Model more effective. These include running a workshop on the Package and providing a National Coordinator to support the community's use of the Package. In addition, more realistic timelines and more effective written communication on behalf of ASTA may have allowed the community to implement the Model more fully. Encouraging the adoption of a community-based Local Leader/Coordinator may have also facilitated more community involvement.

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ASTA	Australian Science Teachers Association
CRC	Community Reference Committee
DEST	Department of Education, Science and Training
STA	Science Teacher Association
STA Coordinator	Science Teachers Association Coordinator

CHAPTER 1: INTRODUCTION

1.1 Introduction

This case study documents the Mt Capital* Native Grasses Project, a project that involved schools and their community in studying native grasses on a recreational reserve in Canberra. The project was part of a national trial in 2002 of a model developed by the Australian Science Teachers Association (ASTA). The Model endeavored to engage schools and their communities in science, with the aim of promoting scientific literacy in the community and the role of schools in its attainment. The Model was developed as part of the ASTA Science Awareness Raising Project, a project funded by the Department of Employment, Science and Training (DEST).

1.2 Background to the Study

The ASTA Science Awareness Raising Project

Since the term scientific literacy was introduced in the late 1950s to describe a desired familiarity with science on the part of the general public, it has become an internationally well-recognised educational slogan and contemporary educational goal (DeBoer, 2000; Laugksch, 2000). Over the last decades, however, science education at school has frequently drawn criticism for failing to achieve this goal (Rennie & Williams-Pearse, 2002). As Rennie and Williams-Pearse (2002) comment, "scientists, science educators and governments in Australia and other Western countries are bemoaning the presence of a citizenry that does not understand science" (p. 2). In this current climate, a Commonwealth Government report was prepared, entitled *The Status and Quality of Teaching and Learning of Science in Australian Schools* (Goodrum, Hackling and Rennie, 2001), which comprehensively looked at science school programmes, both primary and secondary, across Australia.

* Pseudonym used to protect anonymity

The report concluded that scientific literacy is a high priority for all citizens and suggested that more needs to be done to engage students in science education (Rennie & ASTA, 2003). Goodrum et al. (2001) set out a number of recommendations based on striving for an environment where:

> science and science education are valued by the community, have high priority in the school curriculum, and science teaching is perceived as exciting and valuable, contributing significantly to the development of persons and to the economic and social well-being of the nation (p. 150).

The first recommendation suggested "that the Commonwealth and educational jurisdictions promote the importance of science education in schools, particularly its fundamental role in developing scientific literacy" (Goodrum et al., p. 170). In response to this first recommendation, DEST decided to fund the development of a model to raise science awareness in the community (Rennie & Williams-Pearse, 2002). DEST stated that the purpose of the model was to engage schools and their communities in science with the aim of increasing "the Australian community's awareness of why science is important, why time is spent on it at school, and why scientific literacy is a desirable outcome of schooling for all students" (Rennie & Williams-Pearse, 2002, p. 3). The Commonwealth Government entered into a project contract with ASTA which involved two steps: firstly to develop a science-awareness raising model that could be used by a diverse range of schools and their communities; and secondly, to then field-test the model across Australian states and territories. The trial of the Model also included an assessment of the impact of the localised models on raising science awareness within the school(s) and their communities (Rennie & Williams-Pearse, 2002). The trial was to end with refinement of the ASTA Science Awareness Raising Model, with the aim of it becoming a resource to be disseminated to schools and communities in the future. Consequently, ASTA engaged an educational researcher at Curtin University of Technology to be involved in the

developmental phase of what later became known as the ASTA Science Awareness Raising Project.

The ASTA Science Awareness Raising Model

Development of the ASTA Science Awareness Raising Model

The development of the ASTA Science Awareness Raising Model occurred late in 2001. At the commencement of the ASTA Science Awareness Raising Project, the initial concept of the model was vague. The Model was to centre on the definition of scientific literacy that was set out in the Goodrum et al. (2001) report:

> Scientific literacy is a high priority for all citizens, helping them to be interested in, and understand the world around them, to be sceptical and questioning of claims made by others about scientific matters, to be able to identify questions, investigate and draw evidence-based conclusions, and to make informed decisions about the environment and their own health and well-being (p. 455).

To assist in developing the ASTA Science Awareness Raising Model, a comprehensive review of the literature and of science-awareness-raising activities was carried out, especially community-based science related projects conducted in Australia (Rennie & ASTA, 2003). The way that people evaluated their science-related activities, if any, was also examined. It was soon recognised that the activities considered to be most successful in changing people's knowledge and ideas about science were those which engaged people in a two way dialogue between scientists/specialists and lay people (Rennie & ASTA, 2003). This interaction, with the interplay between science and local knowledge, became a central notion to the ASTA Science Awareness Raising Model. Another issue that became evident was the concept of choice. When it comes to science-related community activities, individual members will choose whether or not to engage, and they will make

this decision based on whether the issues involved are important and interesting to them (Rennie & ASTA, 2003).

In summary, the ASTA Science Awareness Raising Model was to be interactive, include an issue which is important to the community and use both science and local knowledge. The Model was to be used by communities throughout Australia so it had to be adaptable. As it was an ASTA project, it also had to link into science at schools at least contributing to the "working scientifically" strand of the curriculum. To ensure that participants were learning something about science from utilising the ASTA Science Awareness Raising Model, it had to include an educative element: to focus on science as a way of knowing, thinking and acting; and to model science process. As it was based on the definition of scientific literacy that was set out in the Goodrum et al. (2001) report, it had to involve the community in negotiation and decision-making based on different perspectives and the information collected (both local and science-related) (Rennie & ASTA, 2003). Each community that implemented the Model was required to have a "tangible outcome", to show that they had achieved something worthwhile. In addition, it was considered that "a model with any chance of success would also need to deal with some general organisational principles involved with working with the community" (Rennie & ASTA, 2003, p. 3/22). For example, as the ASTA Science Awareness Raising Project was about increasing the community's awareness of science, the Model needed to provide guidance and information on how to communicate with the broader community.

The Model that arose was effectively the theoretical framework that included all the elements that were identified as essential. These elements were termed the guiding principles of the ASTA Science Awareness Raising Model. The Model was communicated through the ASTA Science Awareness Raising Package; a written resource sent out to communities so they could adapt the Model to suit their local circumstances. (Further detail of the development of

ASTA Science Awareness Raising Model can be found in Rennie & ASTA, 2003.)

The ASTA Science Awareness Raising Package

The ASTA Science Awareness Raising Package was a support package for a community to work on a science-related issue relevant to their local area. Essentially, it provided a framework and the resources and tools for schools, teachers and the community to plan and execute their project. The ASTA Science Awareness Raising Package, in its initial draft form that was used during the trial, consisted of four main sections. It opened with an introductory section describing the aims and background of the ASTA Science Awareness Raising Project. The next section was a process guide, which consisted of a short series of steps to develop and implement the school-community project. The process guide delineated the four phases that were envisaged for a project, the kind of activities undertaken for each phase and identified who would most likely be responsible for them (Rennie & Williams-Pearse, 2002). The process guide was accompanied by resources that provided additional information, and proformas for keeping records and writing reports. The third section of the ASTA Science Awareness Raising Package provided two examples/case studies of science-related projects that had been carried out in Australia. The final section was a short annotated bibliography. (See Appendix A for an extract of the Package including the Table of Contents and Process Guide.).

The People

The ASTA Science Awareness Raising Model suggested the people who could be involved in a school-community project and outlined an organisational structure, which ASTA considered essential for all communities participating in the trial. The "community" was predicted to include students, teachers and parents from local schools, local business and industry, and representatives of

local science and interest groups. Each trial community was required to have a Community Reference Committee (CRC), a strategically chosen group to represent all the stakeholders with an interest in the school-community project. The CRC was to meet on a regular basis and it was their responsibility to drive and co-ordinate the local activities. A "Local Leader" was to act as chair of the CRC. During the trial, it was their responsibility to liaise and report back to ASTA. The CRC also included a Science Teachers Association Coordinator (STA Coordinator), a member of ASTA that resided in the state or territory of the project. These were people who had been identified by ASTA at the beginning of the Project, and put in contact with Local Leaders during the trial. As the STA Coordinators had been involved in the early development stage of the Project, they acted as advisors "on the ground". They also shared the responsibility to report back to ASTA. This organisational structure was considered essential as it assisted in their communication with the community, as well as providing accountability for how funds were spent during the trial.

With regards to the aim of the ASTA Science Awareness Project of promoting scientific literacy in the community, in terms of the Mt Capital Native Grasses Project, the "broader community" could be defined as those people that were not involved directly in the processes of Project.

Trial of the ASTA Science Awareness Raising Model

In July 2001, ASTA announced a call for expressions of interest in participating in the trial of the ASTA Science Awareness Raising Model. This was made through ASTA's two journals (*Australian Science Teachers Journal* and *Investigating: Australian Primary and Junior Science Journal*) and their website (www.asta.edu.au) (see Figure 1). It was thought that these avenues would increase the likelihood of involving teachers as Local Leaders, a group with which ASTA already had a working relationship. Those who had shown

an interest in participating in the trial were asked to complete a more detailed nomination form outlining:

> the nature of the community represented in the nomination, the kind of project being proposed and the links that this project has with science, the relationships and partnerships that already existed or were possible to build within the community, and the type of outcome that was being proposed through each project (Rennie & Williams-Pearse, 2002, p. 5).

Science awareness raising project

get involved...

The Commonwealth Government has commissioned ASTA to undertake a science awareness raising project in eight communities across Australia. The project is funded under the Commonwealth Quality Outcomes Programme.

The *Status and Quality of Teaching and Learning of Science in Australian Schools* report written by Associate Professors Denis Goodrum and Mark Hackling and Professor Leonie Rennie was released in March this year. In response to the recommendations of this report, the Commonwealth Government is providing $2.5 million over three years towards a National School Science Project (NSSP). The NSSP will:

- **promote awareness of science education;**
- **develop and trial curriculum resources and professional development models; and**
- **develop a resource bank of assessment tools for teachers.**

This science awareness raising project is part of the National School Science Project.

The focus of the ASTA *Development of a Science Awareness Raising Model* project is to develop and trial a science awareness raising model that can be used by schools and their communities to identify, document and promote scientific literacy in ways that are appropriate for each community.

This project will seek ways of building effective partnerships between schools, their communities and local industries to promote understanding in the educational and broader community about why science is important, why time is spent on it at school and why scientific literacy is a desirable outcome of schooling.

We are looking for communities and their schools to be involved in the project....

FOR FURTHER INFORMATION ABOUT THE PROJECT VISIT THE ASTA WEBSITE www.asta.edu.au or...

PO Box 334, Deakin West ACT 2600 • Phone: (02) 6282 9377 • Fax: (02) 6282 9477 • email: asta@asta.edu.au

Figure 1. ASTA's call for expressions of interest.

From the 22 applications that were received, seven projects were selected, one from each state and the ACT. The selected projects varied from studying the biodiversity of designated areas in metropolitan regions, to monitoring the air-quality in a semi-rural area containing an operating mill (see Appendix B.) The trial of the ASTA Science Awareness Raising Model took place during 2002. The successful trial projects were provided with the draft ASTA Science

Awareness Raising Package, a grant of up to $5,000 and support from ASTA. The actual community projects were completed during the first semester of 2002, with the evaluation occurring during the latter half of the year. The refined ASTA Science Awareness Raising Package was completed by the beginning of 2003.

1.3 Statement of the Problem

There is no doubt that the ASTA Science Awareness Raising Project was an ambitious and challenging project. At a fundamental level, it sought to "identify, document and promote scientific literacy in ways that are connected with the real life circumstances of the community" (Rennie & Williams-Pearse, 2002, p. 4). Although there has been much discussion and agreement about the need for scientific literacy, it is widely agreed that to realise this goal still remains a significant challenge (Bybee, 2001; Shamos, 1995). Complicating this challenge is that the term scientific literacy has different meanings and interpretations for different people and therefore remains an ill-defined and diffuse concept (Laugksch, 2000). The first challenge of the Project was to *create* a Model that would increase science-awareness within a diverse range of communities, with this debate in mind. Secondly, it had to *demonstrate* that the activities associated with the Model have a measurable impact on people's awareness of science (Rennie & Williams-Pearse, 2002). As other community-based science–related projects had not done much in the way of evaluation, apart from "bums-on-seats", there was little guidance from the literature (Rennie & Williams-Pearse, 2002). Adding to these conceptual problems were the practical problems associated with running a project that engaged schools and communities in a science-related venture, and coordinating an assessment of its impact on the wider community, particularly as the community based projects were to occur over a short time span of one term. In summary, the ASTA Project was an innovative venture that had many hurdles to overcome to be deemed successful.

1.4 Purpose of the Study

In terms of evaluating the ASTA Science Awareness Raising Model and its approach to increasing science-awareness in the community, the ASTA Science Awareness Raising Project took two approaches. Firstly, the impact was measured at the community level, primarily by pre- and post-project interviews. Secondly, to provide additional information, project reports and feedback from the Local Leaders and the STA Coordinators were sought. This method of evaluation, although practical for allowing assessment across all the trial projects, had several drawbacks. At the outset, there was a greater focus on the outcomes of the community-based projects rather than the processes involved. This meant that in terms of evaluating the ASTA Science Awareness Raising Model, detail can be lost on how it was utilised and adapted by the communities, and what did or did not work. In addition, it may be possible that other unexpected outcomes of the projects may have been missed by a set pre- and post-project measurement. Further, project reports and feedback are subjective accounts, and as such are the personal opinions of several key people.

The purpose of this study was to explore how one individual community adapted the ASTA Science Awareness Raising Model and carried out their project. By focusing in-depth on one of the trial projects, it attempted to provide more detailed, context-dependent information than can be achieved by looking across the diverse range of community projects. This study aimed to focus on process rather than outcomes, to understand how an individual project was carried out, which may in reality have differed significantly from what ASTA or the authors of the Model had envisaged. By focusing on process rather than outcomes, this case study can provide valuable information irrespective of whether the Mt Capital Native Grasses Project is deemed to be successful. A case study also provides the opportunity to gather the opinions of the variety of people involved with the project, and to understand their experiences and perceptions in working together on the

project. Although still a subjective account on behalf of myself, the researcher, a non-participant's interpretation of events may also provide additional insight into the implementation of the community-based project.

1.5 Rationale for the Study

A Case Study

The research in this thesis takes the form of a case study that documents the Mt Capital Native Grasses Project, a school-community partnership. I was involved with the ASTA Science Awareness Raising Project during my previous employment at Curtin University of Technology. In particular, I assisted in the development of the ASTA Science Awareness Raising Model and Package. During the trial of the ASTA Science Awareness Raising Model, I was completing a Master of Science Communication degree at the Australian National University in Canberra, ACT. I chose to complete an in-depth study of one of the trial projects to fulfill my sub-thesis requirement, and therefore the logical choice was the ACT Mt Capital Native Grasses Project. In this regard, the project could be observed first-hand, and a relationship could be developed with the members of the CRC over the duration of the project. It should be noted, however, that the work presented in this sub-thesis, including the literature review, was undertaken in its entirety as part of my degree and not during my previous employment.

By looking in depth at one of the trial projects, this study sought to reflect on the success of the ASTA Science Awareness Raising Model and its approach in engaging schools and their communities in a science-related project with the aim of increasing science awareness. Therefore, in the case study of the Mt Capital Native Grasses Project, there were two main objectives: to describe the implementation of the Project and adaptation of the ASTA Science Awareness Raising Model; and to evaluate the Mt Capital Native Grasses Project in terms of the aims of the ASTA Science Awareness Raising Project.

ACT Mt Capital Native Grasses Project

The trial project run in the ACT looked at the regeneration of native grasses on Mt Capital. Mt Capital is an area of approximately $2km^2$ that was used for grazing until 1996, when it became a reserve of Canberra National Park (see Figure 2). It is now used by local residents as a recreational area and has a sparse covering of very old eucalypts and a mainly introduced groundcover of pasture grasses and weeds such as thistle. According to their nomination form, the Mt Capital Native Grasses Project was to focus on native grass propagation and regeneration. The Project was to involve a partnership between primary and secondary schools, local business, Landcare, the Australian National Botanical Gardens and the Friends of Mt Capital, a local action group. They planned to use science to look at the ecosystem before and after planting native grasses, and reflect on the effects of farming on biodiversity. The predicted outcomes of the project included a display of the students' work at the local shopping centre and media coverage.

1.6 Research Questions

This case study explored the success of the ASTA Science Awareness Raising Model in engaging schools and their communities in a science-related project with the aim of increasing science awareness, by focusing on one of the trial projects: the Mt Capital Native Grasses Project. It sought to answer several research questions

1. What were the aims of the Mt Capital Native Grasses Project and were these achieved? What activities occurred during the Project? What were the scientific outcomes of the Project? Were there any unexpected outcomes of the Project?

2. How did the community use the ASTA Science Awareness Raising Package to carry out their project?

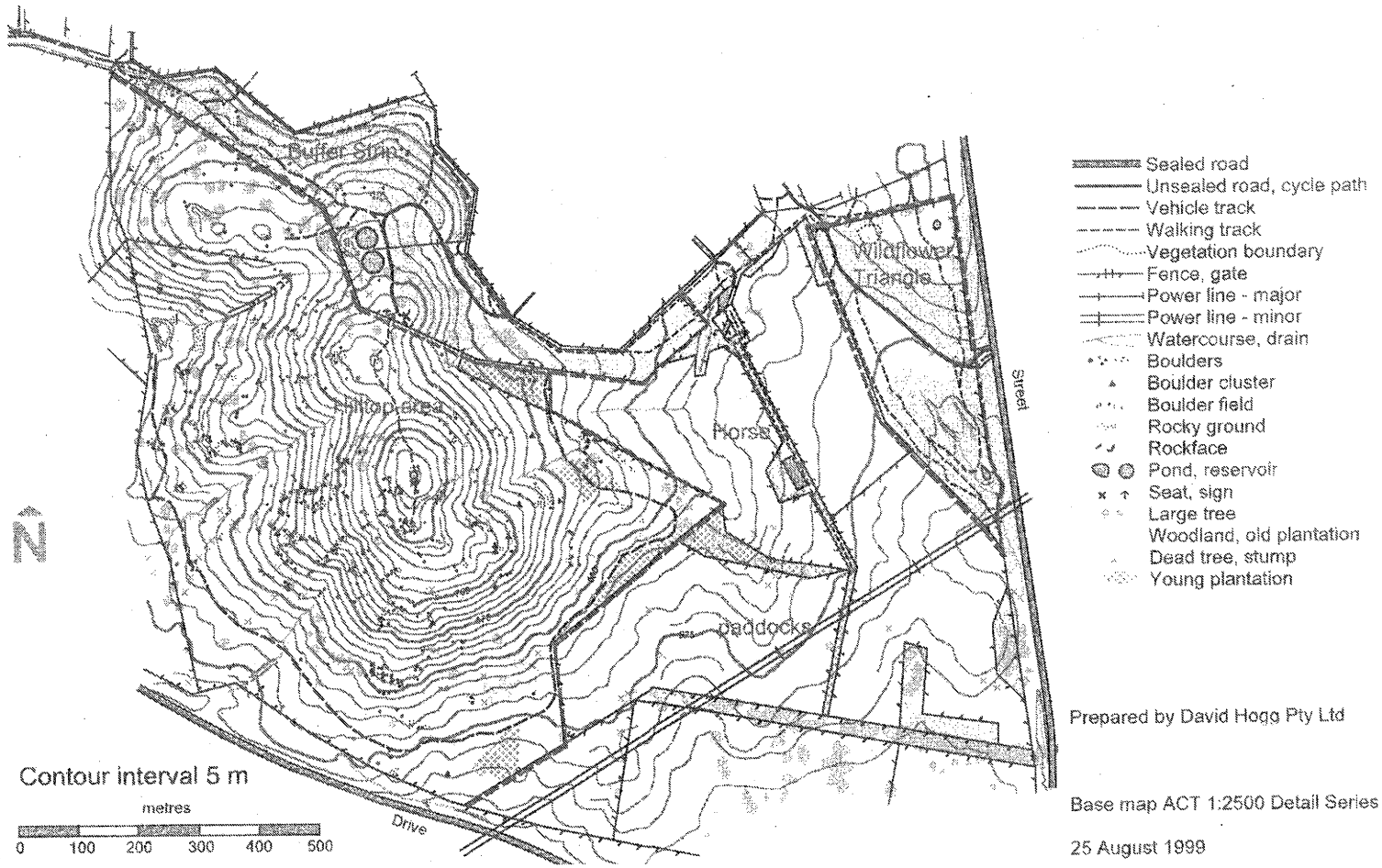


Figure 2. Map of Mt Capital area.

3. How did people get involved? Why did people/associations become involved, and what did they gain from being involved? What skills/knowledge did people/associations bring to the Project? How did they work together - share knowledge, make decisions?

4. How did the Mt Capital Native Grasses Project help people to be more aware of science in ways that helped them to become more scientifically literate?

5. What were the aims of the ASTA Science Awareness Raising Project? Were these achieved with respect to the Mt Capital Native Grasses Project? What had an impact upon this?

1.7 Significance of the Study

The purpose of field-testing the ASTA Science Awareness Raising Model was to refine the Package so that it could become available as a resource to be disseminated to schools and communities in the future. Unfortunately, this study was completed some time later and therefore was not able to inform the revision of the ASTA Science Awareness Raising Model. However, *The ASTA Science Awareness Raising Model: An Evaluation Report* recommended that not only should the Model and Package become available, but "that the Commonwealth continue to document current community/industry projects and initiatives to create synergies and interaction between those projects and the ASTA Science Awareness Raising Model and Package" (Rennie & ASTA, 2003, p. 11/121). This case study provides further documentation and detail on the use of the ASTA Science Awareness Raising Model and Package in the case of the Mt Capital Native Grasses Project. In 2004, through a project known as School Community Industry partnerships in science (SCIps), ASTA made the Package available to the wider community. Therefore, this case study continues to be relevant.

According to Yin (1994) the significance of a case study relates to whether:

- Individual case or cases are unusual and of general public interest
- The underlying issues are nationally important, either in theoretical terms or in policy or practical terms
- Or they are both of the preceding (p. 147)

A comprehensive review of the literature and of science-awareness-raising activities during the development of the ASTA Science Awareness Raising Model revealed that there were community science projects taking place, but there was little in the way of documentation of those projects. Further, there was even less information available of how to assess their success or impact within the community, or even that there were often attempts to do so. This study sought to address this void. In addition, it also sought to add to the discussion on what it means to raise science-awareness within the community.

1.8 Limitations of the Study

The Mt Capital Native Grasses was one of seven projects that occurred as part of the trial of the ASTA Science Awareness Raising Model. There is no doubt that the Project in this study was unique with respect to the other six projects. It was unique in terms of the type of project, the locality in which it occurred, the people it involved, the outcomes that were anticipated from the project and when it occurred. As the Mt Capital Native Grasses Project was unique, the ability to generalise from the findings on this one case study may appear limited. Indeed, as discussed in "3.3 The Research Design", this is a common criticism of the case study strategy. The purpose of this study, however, is to reflect more broadly on the success of the ASTA Science Awareness Raising Model in engaging schools and their communities in a science-related project with the aim of increasing science awareness. To be able to do this, this study sought to develop propositions and generate recommendations that could

potentially apply to other cases of science-related school-community projects (as recommended by Punch, 1998).

1.9 Overview of the Study

This sub-thesis is written in five chapters. This first chapter has given the background information and a brief introduction to the case study including its purpose, rationale and objectives. The second chapter reviews the literature that relates to scientific literacy and raising science awareness in the community. The third chapter details the design and implementation of the case study. The fourth chapter reports the results and analysis of the case study evidence in the form of a rich description of the Mt Capital Native Grasses Project followed by an evaluation in terms of the aims of the ASTA Science Awareness Raising Project. The fifth and final chapter presents: a summary of the case study including its findings; the conclusions arising from the findings; and a set of recommendations for practice and further research.

CHAPTER 2: REVIEW OF RELATED LITERATURE

2.1 Introduction

This case study explores the success of the ASTA Science Awareness Raising Model, which is based on a concept of scientific literacy, and attempts to increase science awareness within the community by engaging people in a science-related project. This chapter reviews the literature related to this study by focusing on three specific areas. Firstly, this chapter reviews the literature on the concept of scientific literacy, from its historical beginnings to more contemporary definitions. It acknowledges the paradigm shift from the "deficit model" to a "contextual model" of the relationship between the public and science, and the implications it had for the concept of scientific literacy. Secondly, this review focuses on recent approaches aimed at raising science awareness, both within schools and within the community, in particular the growing movement to actively engage people in science-related projects. It notes the increasingly documented partnerships between schools and communities to address science-related issues of concern in their local area. Thirdly, this chapter reviews the literature on evaluation; the efforts to measure the impact of science awareness-raising projects on participants' learning.

2.2 Historical Background

Although the term "scientific literacy" was first coined in the late 1950s, Hurd (1998) argues that "the cultural roots of scientific literacy go back in history to the introduction of modern science into Western Civilization in the 1500s" (p. 407). Shamos (1995) points out that the interest in, and concern of the elements of the concept of scientific literacy, were apparent at the beginning of the 20th century, with the idea that the public should have some knowledge of science. It was during the 1950s and 1960s, however, that the concept of scientific literacy as a goal of science education really began to surface

(Shamos, 1995). The term is believed to have been introduced into the science education literature in 1958 by Paul DeHart Hurd, who used scientific literacy to refer to the new goals of science education (Laugksch, 2000). Hurd (1998) thought the phrase scientific literacy could be useful in focusing the burgeoning debate about the purpose of science education in communicating "the contributions that science makes to public life and the common good" (p. 408). Despite being characterised by a multitude of varied definitions and interpretations, by the late 1980s it had become the catchword of the science education community (Shamos, 1995). Scientific literacy had also become "the centerpiece of virtually all commission reports deploring the supposed sad state of science education" and the goal of science education reform (Shamos, 1995, p. 82).

It was during the 1980s that the scientific literacy of adults and the cognitive domain of public knowledge also started to receive much attention internationally (Laugksch, 2000; Rennie & Stocklmayer, 2003). In influential publications, in both the United Kingdom and United States, well-known educators, scientists, and public intellectuals bemoaned the low levels of the public understanding of science and what was seen as a "flagging public respect for science and the values it represented" (Turner, 2008, p. 56). In response, strong arguments were put forward in favour of an increased public understanding of science, heralding the birth of the Public Understanding of Science (PUS) movement (Millar, 1996; Turner, 2008). However, as Jenkins (1994) explains, concern about PUS was not new, as it was "something of a long-standing complaint from the scientific community that 'the public' does not understand the nature of the scientific endeavour and consistently undervalues and misrepresents what is involved in 'being scientific'" (p. 601). In the 1980s, the movement was characterised by the attempt to quantify the public understanding of science, primarily by the use of surveys. The movement also led to campaigns to improve the public understanding of science, including the growth of interactive science centres and a greater

willingness by scientists to write and talk about science (Osborne, Driver & Simon, 1998).

The continuing concern and debate about scientific literacy and how to achieve it shows little sign of slowing down or reaching resolution (Hodson, 2003). This debate has been complicated by the fact that the term scientific literacy has different meanings and interpretations for different people and therefore remains an ill-defined and diffuse concept (Laugksch, 2000). According to Sutman (1996), "the literature is filled with an array of definitions and detailed analyses" for scientific literacy (p. 459). After looking at the literature on scientific literacy, Laugksch (2000) concluded that there were a number of factors that can influence interpretations of the concept. In the following section, several of these factors will be discussed including the different conceptual definitions of the term, the different purposes for advocating scientific literacy, and different ways of measuring it. As the literature is replete with attempts to define the concept, only some of the most commonly cited definitions will be included in the discussion. (For a more detailed description of definitions and interpretations in chronological order, see Laugksch, 2000.)

2.3 The Concept of Scientific Literacy

Definitions of Scientific Literacy

When Hurd introduced the term scientific literacy into the literature, he did not attempt to define it "except very broadly as knowledge of science and the scientific enterprise" (DeBoer, 2000, p. 587). Once the term was adopted by the science education community, early definitions of scientific literacy tended to prescribe extensive lists of skills or attitudes (Miller cited in Burns, O'Connor, Stocklmayer, 2003). Shen (1975) in an attempt to define the concept, divided the list of "activities" that corresponded to scientific literacy into three categories: practical, civic, and cultural. Practical science literacy,

he discussed, was scientific knowledge that was needed to solve practical problems, and he argued that this was the category that was most urgently required. Civic science literacy enables citizens to be aware of science and science-related issues and to think about and make decisions in a democratic process (Rennie & Williams, 2002). Cultural science literacy is the desire to know something about science as a major human achievement. Shen recognised that these three categories of science literacy were not mutually exclusive, but are sufficiently distinct with respect to objective, audience, contents, format and means of delivery.

In 1983, Miller suggested a concept of scientific literacy that was also well-bounded, and consisted of three dimensions: an understanding of the norms and methods of science (i.e. the nature of science); an understanding of key scientific terms and concepts; and an awareness and understanding of the impact of science and technology on society (Laugksch & Spargo, 1996). Miller's definition of scientific literacy was influential for two reasons: first it proposed a particular and multidimensional model that comprised an important consolidation of the concept; and secondly, it also suggested a way of measuring scientific literacy (Laugksch, 2000). Such extensive, wide-ranging interpretations of scientific literacy were criticised by Shamos (1995) in his controversial book *The Myth of Scientific Literacy*. Shamos argued that efforts to achieve scientific literacy are futile and a waste of valuable resources. For example, he claimed that empowering individuals to make rational, independent judgments on science-related social issues is impractical. Instead the most important thing is to give people access to responsible, expert advice on such issues (DeBoer, 2000). Alternatively, Shamos calls for "scientific awareness":

> What we seek is a society that a) is aware of how and why the scientific enterprise works and of its own role in that activity, and b) feels more comfortable than it presently does with science and technology (p. 219).

Jenkins (1997a) contended that to dismiss scientific literacy as a myth indicated that Shamos has missed the central point; that scientific literacy is a slogan rather than a "prescription for action". As a slogan it is "something of a rallying cry for key ideas, serving as a convenient means of generating political, educational, social or financial support" (p. 30). Therefore, the meaning of the term does not need to be explained, as it is this imprecision and ambiguity of slogans which allow them to play a significant role in bringing about change. He also points out that slogans sustain multiple meanings and interpretations, which change over time and undergo some shift in their relative importance. Such meanings and interpretations reflect different rationales and they show a marked dependence on context (Jenkins, 1997b).

Koballa, Kemp and Evans (1997) believe it is helpful to consider scientific literacy in the context of three dimensions:

> The first dimension consists of the levels of scientific literacy, ranging from illiteracy to the highest levels of science understanding. The second dimension is scientific literacy's multiple domains, implying that a person may be literate in biology but not in physics or the history of science. The third dimension is the value attached to pursuing scientific literacy, both by the individual and the communities to which the individual belongs (p. 28).

The authors claim, that when taken together these dimensions constitute a three-dimensional framework they refer to as the "scientific literacy spectrum". Each person has a scientific literacy spectrum that is changing "as the person uses, learns, or forgets science knowledge and skills" (p. 28). Koballa et al. (1997) observe that scientific literacy is a lifelong pursuit, recognising that as the content of knowledge embodied by modern science is vast, it makes "it virtually impossible for any person to achieve the highest level of scientific literacy in all of the domains" (p. 29). The multi-dimensional concept of scientific literacy proposed by the authors adds further complexity

to the already difficult concept of scientific literacy, as it includes levels, domains, dimensions and profiles.

From this limited discussion of how the concept of scientific literacy has been perceived, debated and evolved over time, it can be see that scientific literacy has a complex and dynamic nature (Koballa et al., 1997). Some in the science education community are prepared to accept that it is a broad concept, encompassing many historically significant educational themes that have shifted over time, and that it may be no more than a useful slogan to rally educators to support more and better science teaching (Bybee cited in DeBoer, 2000). Conversely, others argue that a persistent lack of consensus has diminished the usefulness of the concept (Laugksch, 2000). They believe that if science education reform movement views scientific literacy as their central goal, and teachers are to try to help students achieve it, there needs to be a greater degree of consensus of what constitutes scientific literacy (Koballa et al., 1997). However, DeBoer (2000) believes there is some common ground:

> The one specific thing we can conclude is that scientific literacy has usually implied a broad and functional understating of science for general education purposes and not preparation for specific scientific and technical careers. Scientific literacy defines what the public should know about science in order to live more effectively with respect to the natural world" (p. 594).

Arguments and Rationales for Scientific Literacy

Similar to the surplus of definitions that exist in the literature, there are many and varying arguments for increasing scientific literacy and its closely related notion of PUS. In 1987, Thomas and Durant grouped the different arguments which could be found in the literature on PUS into five categories; economic, utility, democratic, social and cultural (Millar, 1996). The economic argument emphasises the connection between the level of PUS and the nation's economic wealth, whilst the utility argument claims that understanding science is useful for practical reasons. The democratic argument asserts that

understanding is "necessary if any individual is to participate in discussion, debate and decision-making about issues which have a scientific component" (Millar, 1996, p. 9). The social argument claims that it is important to maintain links between science and the wider culture, to prevent "alienation" of much of the public from science and technology. Whereas the cultural argument asserts that science should be appreciated and understood as one of the major achievements of our culture. In Millar's discussion of Thomas and Durant's five different arguments, he then goes on to explain how each argument has its problems. For example, with regard to the utility argument, often scientific knowledge has to be reworked and reconstructed to enable it to be used to guide practical action.

Jenkins (1997b) proposes that the arguments for scientific literacy "can be categorized in ways that reflect the various advocates who seek to promote such literacy in curriculum, institutional or other terms" (p. 31). In addition to the arguments given by Thomas and Durant, he includes those for strengthening the support for science by the wider public. People involved professionally in science wish to disseminate a better understanding of their day-to-day activities to the wider public to gain support for their work, leading more broadly to both political and financial support (Jenkins, 1997a). For other advocates, he asserts, their case for increasing scientific literacy "rests principally upon the contribution which science and technology can make not only to the creation of wealth but also to sustainable development" (p. 18).

In a similar vein, Laugksch (2000) discusses that the purpose for promoting scientific literacy is not only dependent on the benefits envisaged, but is also influenced by ideological and philosophical considerations. However, he groups the arguments into two larger positions; a macro and a micro view. The macro view relates to the alleged benefits that accrue to the nation, science or society, including economic and democratic gains. The micro view relates to the benefits of scientific literacy for the individual and includes

arguments that are concerned with the intellectual, aesthetic, and moral benefits. These macro and micro views are not mutually exclusive, as overlap between the various arguments can occur, especially between the interests of the nation and that of the individual. McEneaney (2003) discusses three logics "that support the embrace of scientific literacy as a goal" but also recognises that they are characterised by hybridity, interweaving and blurring. In a similar way to Millar, she includes economic and cultural logics, but includes the democratic argument under the banner of "political logics supporting the push for scientific literacy" which also includes political support for investing in science (p. 222).

Measuring Scientific Literacy

With the world wide concern about scientific literacy, it is not surprising that once a definition for the concept started to be outlined that attempts were made to measure it within the population. As Rennie and Stocklmayer (2003) explain, the very notion of scientific literacy implies some foundation knowledge of science that may be measurable. As the general public and current students at school are two separate but related populations, the possibility exists of measuring the science understanding in each of them (Fensham & Harlen, 1999). Measuring students' learning is a standard aspect of school science and much work has been carried out by the science education community in ascertaining students' views and knowledge in each of the dimensions of scientific literacy (Laugksch & Spargo, 1996). This includes international studies of school learning of science, such as the Organization for Economic Cooperation and Development's (OECD) Programme for International Student Achievement (PISA) project which began in 2000, surveying the majority of 15 year olds in 32 OECD countries (Fensham & Harlen, 1999). Through these studies there has been an accumulation of evidence that little scientific understanding is actually assimilated by most students, with many common misconceptions persisting in their understanding (Millar, 1996).

During the 1980s, the PUS movement concentrated its efforts towards measuring and analysing the public's content-knowledge of science as well as its attitudes of confidence, interest and support (Turner, 2008). This was enabled by Miller's multi-dimensional model of scientific literacy, which allowed measurement in a widely applicable, and reasonably comparable, way in large-scale surveys (Laugksch & Spargo, 1996). Indeed, in 1983, Miller surveyed more than 1000 adults in the United States asking them to respond true or false to a number of "factual" statements (Fensham & Harlen, 1999). From the results, Miller concluded that the great majority were scientifically illiterate (Fensham & Harlen, 1999). A similar survey was conducted by Durant and colleagues in 1989, who asked members of the public both in the Unites States and Britain questions about general science content and the nature of science (Rennie & Stocklmayer, 2003). They too found what they considered disappointing results, in that most of the public were found to understand 'not much' science (Rennie & Stocklmayer, 2003). The measurement of the public understanding of science became an established activity internationally, with much the same outcome: results that were commonly regarded as disappointing in that they showed little understanding and many potential serious misunderstandings of basic science ideas (Fensham & Harlen, 1999; Jenkins, 1997b; Millar, 1996).

2.4 A Paradigm Shift

The "Deficit Model"

The measurement of people's scientific literacy has come under much scrutiny and criticism. Part of the criticism is related to the nature of scientific literacy as a concept. Many argue that an absolute definition of scientific literacy is very difficult to identify and therefore an impractical idea (Laugksch, 2000). Furthermore, as scientific literacy is essentially a socially defined concept, it follows that it differs for different eras in time, geographical regions, and

communities or social conditions (Laugksch, 2000). It is logical then that a test of scientific literacy is not possible, because there is not a "body of knowledge" that can legitimately define it (DeBoer, 2000). Another criticism is that quantitative measures have focused on abstract pieces of information that people are not necessarily required to use within the context of their everyday lives (Jenkins, 1994). As Roth (2007) states:

> arguments that lament lack of scientific knowledge generally overlook or consider irrelevant that (a) we do not need to know anything about a combustion engine to drive a car or use a lawnmower, and (b) children often display tremendous technological and other literacies without knowing basic facts (p. 378).

Arguing that people need to know a defined body of knowledge presupposes that the public should understand science on scientists' terms, with an implicit assumption that the ignorant public needs to be "informed" about science. In 1993, Wynne first coined the term "deficit model" to describe this approach to scientific literacy (Jenkins, 1994). The deficit model is asymmetrical, it depicts communication as one-way flow from science to its public, where the public are a passive recipient, and science must act to accommodate the public's limited experience and cognitive capacities (Gross, 1994). Further objections to the deficit model that have been espoused by authors such as Gross (1994) and Jenkins (1994) include that it denies that scientists themselves are often ignorant of scientific knowledge outside their own specialty or that they even necessarily agree among themselves about the procedural aspects of the scientific endeavour.

The "Contextual Model"

A different approach to investigating the relationship between the public and science was taken by Layton, Jenkins, Macgill and Davey (1993). They carried out a number of detailed qualitative case studies of groups of adults who were in situations where they had to grapple with a variety of science-related

issues. In such circumstances, the scientific knowledge that people did or did not have was seen as less important. Rather, the questions that the authors found relevant were: what people mean by science; to identify their sources of scientific information and advice; to explore their rationale for seeking such information/advice; and to investigate how they receive, evaluate and deploy it (Jenkins, 1994). Findings of these studies revealed that the relationship of lay citizens and other non-experts to science is much more complex than that normally captured by quantitative surveys (Jenkins, 1997b). They found that any communication between expert and the lay public is a complex and highly contextual process (Burns et al., 2003). This led Layton et al. (1993) to propose an interactive or "contextual model" for the relationship between the public and science. The contextual model emphasises *interaction*, it is symmetrical in that it depicts communication as a two-way flow between science and its publics (Gross, 1994). These studies had serious implications for the PUS movement, in that in the 1990s it passed through what some have called a "paradigm shift", with many adopting the contextual model over what was considered an out-dated, inaccurate deficit model (Turner, 2008).

The contextual model or paradigm considers attitudes towards, and understandings of, science to be shaped primarily by an individuals' circumstances. This includes their experiences, real-life encounters with science and with experts, and particular needs, expectations and culture (Turner, 2008). It recognises that the interaction between scientists and non-scientists is much more complex, dynamic, and interactive than the traditional opposition between "scientific expertise" and ignorance and rejection of scientific knowledge may lead us to believe (Irwin and Wynne cited in Roth & Lee, 2002). The contextual model argues that selective ignorance can be functional and deliberately socially constructed (Layton et al., 1993; Turney, 1996). That it may be necessary for coping with day-to-day business by allowing people to focus more effectively on a specific field of action. Individuals do well without knowing science and may feel comfortable in that the relevant knowledge is someone else's responsibility and can be obtained if

and when required (Jenkins, 1994; Layton et al., 1993). Qualitative studies show that when people do require scientific knowledge for decision-making or action, they often show a remarkable capacity to locate sources, and assimilate and use scientific knowledge (Wynne, 1991). This suggests that the democratic argument for scientific literacy, where people need scientific knowledge to take part in important personal and social decisions, is exactly the wrong way around (Turney, 1996). Instead, when people are sufficiently motivated and see an opportunity to participate, then understanding will follow.

Scientific knowledge is not encountered free of its social and institutional connection, rather it is a product of a particular cultural, historical, economic, and political context and carries with it a programme, an agenda, and a philosophy (Jenkins, 1999; Roth, 2007). Within the contextual model, it is recognised that where experts come from, the nature of their priorities and how they communicate their knowledge are as important to the acceptability of that knowledge by non-experts as the internal validity of the science (Layton et al., 1993). Further, it concedes that the scientific knowledge which is accessible to people is rarely usable without being reworked, restructured and recontextualised (Layton et al., 1993). Recontextualising often involves integrating relevant scientific knowledge, with other, situation-specific knowledge's and with judgments of various kinds (Jenkins, 1994). As Jenkins (1999) states:

> In the everyday world of the citizen, science itself emerges not as coherent, objective and unproblematic knowledge, but as uncertain, contentious and often unable to answer many important questions with the required degree of confidence (p. 704)

Many argue that "citizen thinking", that is, everyday, common-sense thinking, may offer a more comprehensive and effective basis for action (Roth & Lee, 2002). Citizen thinking is practical knowledge that people construct during their personal, working and social lives (Jenkins, 1997b). It is tested

and validated against their individual and collective experience and unlike scientific knowledge, it is well-adapted to decision-making in an everyday world where uncertainty, contingency and a range of uncontrolled factors are ever present (Jenkins, 1999). In their qualitative studies, Layton et al. (1993) found that everyday practical thinking to be decidedly more complex and certainly less understood than "scientific thinking". Citizen thinking can translate, transform or resist science communication (Silverstone, 1991).

Changing Views of Science and Scientific Literacy

At the same time this paradigm shift was occurring, commonly held views about science were being challenged as never before (Jenkins, 2000). Notions of objectivity and truth were replaced with the recognition that science is sometimes uncertain, contentious and unable to provide clear, unambiguous answers to important questions (Hodson, 2003). This called into question the authority invested in scientific knowledge (Jenkins, 2000). With a change in the power dynamic, the relationship between the public and science was also transformed. Rennie and Stocklmayer (2003) explain:

> Profound changes have taken place over the past five years in the way in which the world of science views the public... with extraordinary speed the tone of debate in Europe has changed to one of dialogue, openness and accountability (p. 765)

The focus moved from what the scientific community believes should be widely known and appreciated about science, to understanding how the public interacts with science in their everyday life. Miller (1992) argues that as a result, the science education community understanding of the public understanding of science has become more scientific and more comprehensive.

Although the contextual model came to dominate in the late 1990s, it by no means supplanted the deficit model, and each is apparent in different approaches to scientific literacy (Turner, 2008). For example, Laugksch (2000)

argues that when it comes to measuring scientific literacy, that each of the two models has its limitations and uses, and an approach should be chosen that is appropriate to the aims of a study. Of course, the contextual model had implications for the concept of scientific literacy. Although there is disagreement about whether scientific literacy is an appropriate goal for the general public, there is broad-based agreement that there is benefit in moving the population as a whole toward greater awareness and appreciation of science (Hinman, 1999). Contemporary attempts at defining scientific literacy reflect these changing ideas; they are more holistic and recognise that it is an ideal, a goal, and that almost everyone is scientifically literate to some degree. They emphasise "engaging with science at the interface of society", they de-emphasise knowing and focus on "ways of thinking and acting" (Burns et al., 2003; Murcia, 2007). The definition by Goodrum et al. (2001), which the ASTA Science Awareness Raising Model is based upon, is a fitting example of such contemporary definitions (see 1.2 Background to the Study). For convenience, it is repeated here:

> Scientific literacy is a high priority for all citizens. Scientifically literate people are interested in, and understand the world around them; engage in the discourses of and about science; are skeptical and questioning of claims made by others about scientific matters; are able to identify questions, investigate and draw evidence-based conclusions; and make informed decisions about the environment and their own health and well-being. (p.455)

Other Terms and Their Relation to Scientific Literacy

At this point, it is important to acknowledge that in addition to scientific literacy, a number of other related terms are often used in the science education literature. Terms that have been included in this review so far include science literacy, awareness of science and public understanding of science (PUS). It is necessary to discuss how these terms relate to scientific literacy but recognise that they are distinct concepts, as often they are incorrectly used interchangeably (Burns et al., 2003). The use of PUS has

already been discussed and relates to the movement that first surfaced in Britain. Scientific literacy and PUS are usually regarded as being synonymous, with the former used in the United States and the latter in Britain (Laugksch, 2000). However, as Burns et al. (2003) point out, they do have different philosophies, approaches and emphases. PUS, as the name implies, focuses on understanding, and therefore differs from contemporary definitions of scientific literacy which deemphasise knowing. *Science* literacy was the term used by Shen in his early tripartite definition and continues to be used interchangeably with scientific literacy. Authors such as Maienschein (1999), however, distinguish between the two, with scientific literacy as the democratic having of creative, scientific "habits of minds" by everybody and science literacy as the having of particular scientific knowledge by trained experts. The concept of having an "awareness of science" is predominantly about having a set of positive attitudes toward science that are evidenced by a series of skills and behavioural intentions (Gilbert, Stocklmayer and Garnett cited in Burns et al., 2003). An awareness of science may be considered a prerequisite to scientific literacy, that is, intent to engage with science (Burns et al., 2003).

2.5 Increasing Scientific Literacy and Science Awareness

Overview

Coupled with the ongoing concern of scientific literacy, were efforts to increase it, or as Hinman (1999) phrases it, to move "the population as a whole toward greater awareness and appreciation of science" (p. 241). Scientific literacy has been widely claimed to be a desired outcome of school science education and there has been various ideas put forward and carried out to this end (DeBoer, 2000). However, as Fensham and Harlen (1999) point out, school science has only been a serious part of general secondary education since the 1960s. Prior to this, the adult public's awareness of

science, where it did develop, was not due to school experiences, but to popularisers of science (Fensham & Harlen, 1999). The promotion of scientific literacy outside of formal education continues to be recognised as playing an important part of the picture. As Shamos (1995) argues, scientific literacy is not merely a matter of formal education, widespread acceptance by the wider public of the idea that becoming and remaining literate in science may be in one's self-interest, is also needed. An examination of the various ways in which scientific literacy has been promoted in and outside of school science education over the years is outside the scope of this review. This review will focus on recent approaches to increasing scientific literacy that have been documented which exhibit commitment to the contextual approach and contemporary conceptions of scientific literacy.

In Schools

Recent reform efforts in science education have clearly articulated a vision of scientific literacy that moves beyond the acquisition of disparate facts and figures, and the preparation of some students to enter science careers (Fusco, 2001; Hampton & Licona, 2001). More so, science education is looking to prepare *all* students for the kind of scientific literacy necessary for responsible citizenship and to effectively participate in the real world (Holbrook & Rannikmae, 2007). Sadler (2004) claims that as science pervades nearly all aspects of modern society, and to ensure the proper functioning of such a society within the context of democracy, its citizens must be capable of considering and resolving scientific issues. Similarly, Holbrook and Rannikmae (2007) propose that abilities such as socio-scientific decision-making and scientific problem-solving are more important for enhancing scientific literacy, than a thorough basic understanding of fundamental content knowledge. McDonald and Dominguez (2005) agree:

> if we are to take the goal of scientific literacy seriously then we need to empower students to make their own decisions by providing them with accurate and comprehensive information and

> intellectual tools to apply scientific information to their own lives (p. 19)

Roth and Lee (2004) argue that a central fallacy of the common approach to science education is its focus on laboratory science as the touchstone against which science teaching and learning should be compared. They believe that rather than privileging disciplinary science, we ought to foster situations that allow the negotiation of different forms of knowledge geared to particular problems as these arise in the daily life of a community. Rather than trying to bridge the gap between formal education and everyday life, educators should involve students in the real thing (Roth & Lee, 2004).

As a result of such thinking, there has been a trend in science education towards issue-based teaching, where students are engaged in investigating a scientific problem of relevance to the community (Holbrook & Rannikmae, 2007). A constructivist approach to classroom science supports this practice because students learn science as active constructors, rather than passive recipients, of knowledge (Fusco, 2001). Holbrook and Rannikmae (2007) propose such a model of science education; they believe this approach will help prepare students for the kind of scientific literacy necessary for responsible citizenship. Their model places socio-scientific issues as a starting point for science learning, and contend that teaching of science subjects should occur through context-based situations. At the foundation of their model is activity theory which:

> is based on the interlinking of knowledge and social practice through establishing a need (relevant in the eyes of the students), identifying the motives (wanting to solve scientific problems and make socio-scientific decisions) leading to activity constituted by actions (learning in school towards becoming a scientific literate, responsible citizen) (p. 1353)

The model proposed by Holbrook and Rannikmae (2007) promotes "education through science" rather that "science through education", suggesting that no content is fundamental but rather the content needed for

enhancing scientific literacy is dependent on the culture and society in which the science education is being implemented. A number of different labels have been applied to methods which are essentially based on the same approach to science education, including Project-based Learning (PBL), Project-based Science (PBS), Community-based Education (CBE), and service learning (Flanagan & Draper, 2006; McDonald & Dominguez, 2005; Nelson, 2004; Tompkins, 2005).

Project-Based Learning (PBL) is discussed by Flanagan and Draper (2006), who believe that it transforms teaching from "teachers telling" to "students doing". They define PBL as "engaging learning experiences that involve students in complex, real-world projects through which they develop and apply skills and knowledge" (p. 15). Project-based science (PBS) is based on the same premise, of providing opportunities for students to engage in sustained inquiry in meaningful contexts, and to make connections between school science and the community (Nelson, 2004). Tompkins (2005) believes that Community-based Education (CBE) differs slightly from other approaches in that "students are engaged in the public domain" (p. 34). They form partnerships with other stakeholders in the community, and students function as community members to create a product, service, or process of value for the community (Tompkins, 2005). Service learning is defined as a method under which students learn and develop through active participation in thoughtfully organised service experiences that meet actual community needs and are co-ordinated in collaboration with the school and community (McDonald & Dominguez, 2005). Service learning combines meaningful community service with academics, personal growth, and civic responsibility. McDonald and Dominguez (2005) describe an example of service learning where students were involved in an Action Team Service Project. They had to identify a current environmental/science issue, conduct background research, use research to make informed decisions and problem solve, apply their knowledge to develop an action plan and then develop skills to carry out their action plan. It is this end result of action in many issue-based projects which

has led others such as Jenkins (1994) to term the approach "science education for action". This is reminiscent of Layton et al. (1993) "science for social purposes" which emphasises the importance of context, and of knowledge for action, rather than for its own sake (Jenkins, 1994).

A large number of schools are embracing the environment as the focus of study, as it lends itself well to issue-based learning (Flanagan & Draper, 2006; McDonald & Dominguez, 2005). This is because environmental issues expose with particular clarity the complex interactions among social, economic, personal and other value positions that are associated with it (Jenkins, 1994). Many examples of school-based environmental projects can be found in the literature with the majority of them concerned with the health of local waterways, or investigations of local plant and animal populations. Tompkins (2005) reported on a project that involved students in investigating the health of a local waterway in New York State. Students began by collecting data to assess the general health of a stream. With the help of experts they analysed their data and tried to make sense of their findings. They concluded that the water quality of the stream was good, but that erosion was an issue. After much research and canvassing the opinions of experts, they decided that installation of a "riprap" - the use of large rocks to protect stream banks - was the best solution. They had the riprap installed from funds they had been awarded from a local authority. Through the project, students were involved in sharing with the community through community presentations and writing letters to the local newspaper. Tompkins (2005) found that students of all abilities and backgrounds embraced the project, and took pride and ownership in their role.

Supporters of issue-based learning claim that there are many benefits to this approach. Firstly, it is student driven; it taps students' inherent drive to learn, their capability to do important work, and their need to be taken seriously (Flanagan & Draper, 2006). Hodson (2003) argues that by grounding content in socially and personally relevant contexts, an issues-based approach can

provide the motivation that is absent from current abstract, de-contextualised approaches. When learning is connected, or reconnected, to the real world it is personally relevant, meaningful and memorable, and as a consequence students are able to navigate toward a deeper understanding of science content (Flanagan & Draper, 2006; Hampton & Licona, 2001). Further, when students become involved in research based in authentic community problems they gain a sense of empowerment and ownership of their work and this assists to develop self-concept and self-esteem (Furco cited in McDonald & Kromer, 2005; Hanes & Sadler, 2005). Issue-based learning can provide increased opportunities for active learning, collaborative learning, and opportunities to explore career options (Furco cited in McDonald & Kromer, 2005; Hodson, 2003). Students can gain an awareness of society and direct experience of the situatedness of scientific and technological practice (Hodson, 2003). Problems associated with this approach are discussed by Jenkins (1994) who believes at the very least it presents severe problems for assessment. He gives the example of work carried out by Posch, who quoted a group of Austrian students that regarded grading by their school of their environmental work as "a devaluation" of what they had done.

In the Community

With widespread recognition that past efforts to educate the wider public about science have made virtually no difference, at least in terms of relatively crude indices of "scientific literacy", there has been greater willingness to commit to the contextual approach (Turney, 1996). Many people who are involved in promoting scientific literacy in out-of-school settings are recognising that "we can arouse curiosity, we can awaken self-interest, but we cannot create lifelong learning by force-feeding a concentrated dose of science" (Hinman, 1999, p. 242). As Layton argues, no one will deliberately enter a situation where they are treated as ignorant and willingly ask to be informed, unless they have very good reasons for doing so – the motivation must be real (Sjøberg, 1997). In recognition of this, there has been more

attention paid to the role people play in determining what science they are willing to learn and how they learn it (Rennie & Stocklmayer, 2003). This has led to the notion of "engagement", both in terms of how science interacts with the public, and how and why people engage with science (Rennie & Stocklmayer, 2003). Increasingly the term "public engagement with science and technology" (PEST) is being seen as a more appropriate concept than PUS for the future of the community learning of science. Efforts to increase PEST have taken a number of forms including, but not limited to, free-choice learning institutions such as science centres or museums, "dialogue events" such as public debates, media such as newspapers and television, science weeks and festivals, as well as community educational programmes and citizen-science projects (Lehr, McCallie, Davies, Caron, Gammon & Duensing, 2007). A search for community-based science programs in Australia by Rennie & ASTA (2003) found a wide range of events, from 400 organised events as part of National Science Week, to a variety of government and community group collaborations on environmental projects such as FrogWAtch (coordinated through the Western Australian Museum).

With the concept of engagement in mind, there is a growing movement to actively involve the community in science-related projects (Brossard, Lewenstein & Bonney, 2005; Trumbull, Bonney, Bascom & Cabral, 2000). Projects which involve individuals gathering data for the use of scientists are often referred to as citizen-science projects. These types of projects provide individuals of all ages an opportunity to participate in real scientific research and to interact with scientists in the process (Brossard et al., 2005). The concept of "citizen scientists" is not new, with the National Audubon Society's Annual Christmas Bird Count dating back to at least 1900, with currently about 60,000 to 80,000 participating each year (Cohn, 2008). A growing movement, however, has led to an increase in the number of studies that use citizen scientists, the number of volunteers enlisted in the studies and the scope of the data they are asked to collect (Cohn, 2008). In 2007, scientists who track citizen-science studies had found more than 200 research projects

being conducted by researchers in North America alone, with some observers believing there may actually be thousands (Cohn, 2008). Collaborations between scientists and volunteers have the potential to broaden the scope of research and enhance the ability to collect scientific data (Cohn, 2008). As well as increasing their knowledge on the subject under investigation, it is assumed that participants will increase their understanding about the process of science through this engagement in authentic science (Trumbull et al., 2000). However, very little research on the impact of participating in citizen-science projects has been carried out (Trumbull et al., 2000).

Several citizen-science projects run through the Cornell Laboratory of Ornithology (CLO) have undergone evaluation. In 1994, Trumbull et al. (2000) examined the unsolicited letters written by more than 700 participants who took part in a CLO Seed Preference Test. The Seed Preference Test involved citizen scientists in counting birds visiting three different types of bird seeds to answer the question; What kinds of seeds do birds prefer to eat at ground feeders? Their tentative results indicated that participants had engaged in thinking processes similar to those that are part of science investigations. The authors concluded, however, that "we cannot state that participation in a citizen-science project caused this thinking, but we can say that participation provided a forum in which participants engaged in these habits of thought" (p. 265).

The Birdhouse Network, also run through the CLO, underwent evaluation by Brossard et al. (2005). Participants involved in the Birdhouse Network project were "asked to put up one or more nest boxes in their yards or neighbourhoods, then to observe and report data on the nest boxes and their inhabitants" (p. 1102). As well as increasing their knowledge about bird biology, science and the scientific process, the organisers hoped that participants would gain more positive attitudes toward science and the environment. The purpose of the evaluation by Brossard et al. (2005) was to assess the effects of the project, and to compare the knowledge and attitudes

of the participants with available national norms. The authors intended that the latter would create instruments that would allow for valid comparisons across other citizen-science projects. Brossard et al. (2005) found that by participating in the Birdhouse Network project, people increased their knowledge about bird biology, but there was no increase in their understanding of the scientific process, or changes in their attitudes toward science and the environment. However, although the scales used by the authors were well documented in the literature, complications in sampling meant that the results were not as reliable and comparable as the authors had originally intended. The authors concluded that citizen-science projects that hope to increase understanding of the scientific process should be framed in a way that makes participants particularly aware of the scientific process in which they are becoming involved.

Another bird-related citizen-science project, the Neighbourhood Nestwatch Program, is run through the Smithsonian Environmental Research Center (Evans, Abrams, Marra, Roux, Salmonsen & Reitsma, 2002). The Neighbourhood Nestwatch Program began in 2000, and involves participants in collecting data that can help researchers understand the population dynamics of eight species of birds along an urban to rural gradient in the Washington DC area (Evans et al., 2002). This project differs from those run by the CLO in that it involves people not only in collecting data, but also in the processes of decision-making, analysis and drawing conclusions. This is enabled by participants staying involved in the project over several seasons, and by encouraging more contact between participants and scientists, with participants providing input and feedback. In the second year of the project (2001), Evans et al. (2002) collected both quantitative and qualitative data to assess whether the program had the potential to improve scientific literacy and to influence participants' "sense of place". Sense of place was defined by the authors as the participants' relationship with the local landscape. People's sense of place was found to increase as a result of participating in the project, with positive changes in how participants perceived their property, and their

behaviour towards the environment. The authors also reported that "qualitative analysis suggests that a great deal of learning is occurring and that currently the majority of it is bird/ecology content-based rather than process based" (Evans et al., 2002, p. 4). Evans et al. (2002) concluded that clearly two of the most important factors that influence scientific literacy in their study were the initial motivation and interest of the participants, and the interactions between research staff and participants. This would suggest that for citizen-science project, a greater partnership between the scientists and participants, beyond people just sending in their collected data, is important for increasing scientific literacy/awareness.

On the other end of the spectrum of partnerships and participation, are the action groups formed by community members to tackle issues that are prevalent in their community. There are numerous projects occurring in all countries around the world confronting issues often associated with the environment, of which land and water use, animal and plant populations, and pollution are just a few. Although not organised as PEST activities, but rather as "grassroot" attempts to address local issues, they often engage community members in the processes of science and encourage partnerships between scientists and non-scientists. They are potentially significant avenues for PEST, as if the issue is sufficiently important to people, their motivation and therefore potential for learning, will be increased (Turney, 1996). Although there are many such projects that exist, and their purpose and activities are often well described, very little is documented about their outcomes in terms of science learning of participants (Boyer & Roth, 2006; Rennie & Williams-Pearse, 2002).

Boyer and Roth (2006) studied a community-based eelgrass stewardship group to investigate learning and teaching that occurs through ordinary, everyday participation in environmental action. The authors concluded that such settings provide rich opportunities for learning that are for the most part not available in homogeneous settings such as schools. Boyer and Roth (2006)

argue that the sociomaterially heterogenous and complex nature of such environments allow individuals to participate in a number of ways and that their learning is supported by collective action. The environment is socially heterogenous as it is made up of young and old people with differing expertise, and materially heterogenous with resources such as field guides, people, the environment etc. This they believe, leads to unfolding possibilities where participants may engage in different actions and participate in different ways, including both as teacher and as learner. Collectively the group support learning by expanding the opportunities for action of the individual.

School-Community Partnerships

Partnerships between schools and communities to address issues of concern in their local area are increasingly documented in the literature. Whereas the science-related projects run by schools (see *In Schools*) may require assistance by members of the community, they are organised primarily within the school environment. School-community partnerships are being distinguished here, because they involve greater collaboration in terms of planning and execution, from the beginning to the end of a project. Like school projects, they too have been given many labels, including student-scientist partnerships, community collaborations, and mutual benefit partnerships, just to name a few. The benefit of such an approach is seen to be the explicit linking of learning in schools to life in the community. As Bouillion and Gomez (2001) comment:

> Schools are *in* communities but often not *of* communities. That is, teaching and learning are often disconnected from the day-to-day life of the community, and students don't see how the skills they acquire in school have currency in business, at home, and in other communities beyond school (p. 878) (original emphasis)

Projects that partner schools and communities dissolve that 'disconnect' and involve students in shared activities situated in real-world cultural contexts (Fusco, 2001). Gallagher and Hogan (2000) discuss that such projects involve multiple generations working on a topic of common concern to their

community. They argue that evidence of the benefits of an intergenerational, community-based approach to science education is emerging in various parts of the world.

Donahue, Lewis, Price and Schmidt (1998) discuss a model for school-community partnerships called student-scientist partnerships. The term arose through the Global Rivers Environmental Network (GREEN), an education initiative which was born from a single high school project concerned with water quality of a nearby river in Michigan in 1984 (Donahue et al., 1998). By 1998, GREEN grew to involve over 130 countries in watershed education and sustainability (Donahue et al., 1998). The initiative is "committed to improving the field of education through student-based scientific research and the development of innovative tools and partnerships for environmental investigation and education" (Donahue et al., 1998, p. 16). The network identified four essential features of "successful" student-scientist partnerships: (a) use an inquiry-based approach to education, (b) build around authentic, community-based investigations, (c) let students be scientists and, (d) allow scientists to be educators. As the name suggests, the focus is on the partnerships between students and scientists, and the scientists become personally involved in the educational process. The authors give an example of a GREEN project that occurred in 1989, which involved ninth grade science students in northern Sydney who succeeded in getting the issue of pollution of a creek on the local political agenda. Donahue et al. (1998) comment:

> The Australian example illustrates how scientific literacy can be enhanced and reinforced when student partnerships develop with scientists and experts from universities, businesses, local governments and community organizations. Students experiencing inquiry-based education learn science in the context of the real world, including the political, cultural and economic aspects of scientific research (p. 18).

Campbell (2007) defines community collaborations as circumstances that partner teachers, students and community members in an effort to better understand the natural world. Participants are engaged in projects that require them to create, design, collect data, analyse data, make conclusions based on data, and share their conclusions with wider audiences (Campbell, 2007). As such they move beyond participants as "databots"; that is collecting data by following the procedures of others without understanding the basis of the procedure, to producers of knowledge (Polman and Pea cited in Campbell, 2007). Dori and Tal (2000) report on a collaborative community project run in a village in the north of Israel over a period of three years. Small groups consisting of students, parents and "experts" were to design, manufacture and promote an industrial product with environmental awareness, to address a real-life problem in the community. The products were displayed at an exhibition evening open to the wider community. The authors assessed the effect of the learning process formally by students' responses pre- and post-project to case study assignments and the Children's Environmental Attitude and Knowledge Scale questionnaire. Informal assessment took place by expert evaluation of the product at the exhibition as well as open-ended interviews with students and parents. Dori and Tal (2000) found this innovative model of a collaborative community project to be fruitful, and attractive to students, teachers and parents. One obvious drawback of the model is the amount of time and commitment required by teachers, experts and parents.

Another model for school-community partnerships, called mutual benefit partnerships, is discussed by Bouillion & Gomez (2001). Similar to student-scientist partnerships, the authors list four essential design features of mutual benefit partnerships: (a) a "real world" community-based problem that is currently unsolved and of consequence, (b) school-community or school-business partnerships, (c) problem-based learning, and (d) student-developed products considered mutually beneficial to project participants. Bouillion & Gomez (2001) present an example of this approach through the case study of

the Chicago River Project. The problem of pollution of a local riverbank along the Chicage River partnered teachers and students of fifth grade, with several external organisations and individuals, to see if something could be done. The "product" of the project was a restored riverbank, which was considered as being of mutual benefit to all project participants. Reported outcomes included an increase in student learning of science concepts and skills, an increase of student interest in science, and in increase in students' sense of efficacy in doing science - students felt empowered. Bouillion and Gomez (2001) also found that the complex and open-ended nature of the problem challenged the role of the teacher as the authority or source of answers, encouraged consideration of different perspectives and sources of knowledge, and expanded the notion of what counts as science. In addition, they found that by using partnerships involving diverse experiences, shared interest and mutual benefit, the project was able to both highlight the diverse range of people who can participate in science, and bring together distributed sources of knowledge.

Summary

It is recognised that efforts to raise science awareness need to involve both formal school education and community education outside of schools. In schools, contemporary approaches to scientific literacy have led to issue-based learning, where students are engaged in investigating a scientific problem of relevance to the community. Concurrently, outside of schools, with the interest in the public's "engagement" with science, there is also a growing movement to actively involve the community in science-related projects. In particular, partnerships that connect schools and their community to address science-related issues of concern in their local area are increasingly documented in the literature. Although requiring large investments in terms of time and motivation, they are believed to provide many benefits in terms of student learning. However, the benefits for students and also for community participants are yet to be fully explored.

2.6 Evaluating the Effectiveness of Science Awareness-Raising Projects

As previously mentioned, there is very little documented in the literature on the impact of science awareness-raising projects on participants' learning. The citizen-science projects discussed in this review had undergone some type of measurement, but often it was limited, and the results tentative. The Neighbourhood Nestwatch Program run through the Smithsonian Environmental Research Centre had more extensive information collected by Evans et al. (2002), including both quantitative and qualitative data. The authors were able to report changes in both participants' content-based knowledge and attitudes to the environment around them. The ethnographic study of a community-based eelgrass stewardship group by Boyer and Roth (2006) provided a rich source of information that implied there was much potential for learning by participating in environmental action. The cases of school-community partnerships discussed in this review (e.g. Bouillion & Gomez, 2001 case study of the Chicago River Project), reported outcomes only in terms of those for students, not for the community members involved in the projects. Boyer and Roth (2006) comment that learning settings such as social and environmental action groups, or cases of students collecting data for local community groups, remain largely understudied in the context of science education. Similarly, Evans et al. (2002) and Brossard et al. (2005) point out that relatively few data are available regarding the science education outcomes of citizen science projects, even though they are rapidly increasing in number. This rarity of published data is due in part to the difficulty of isolating the effects of specific education projects among a host of influences which all may shape personal knowledge and attitudes (Brossard et al., 2005; Trumbull et al., 2000).

In their review of recent evaluations in the literature, Brossard et al. (2005) identified two important issues facing researchers. Firstly, because learning in out-of-school settings is under theorised, evaluations are often performed without a conceptual framework. The authors believe that by drawing on

appropriate theoretical frameworks, researchers and practitioners could develop hypotheses that would help in implementing sound evaluation plans. Secondly, Brossard et al. (2005) found that few evaluations rely on standardised scales, which makes comparisons between different science awareness-raising projects difficult. In addition, they found that evaluators rarely compare their results to baseline data, which documents the general public's knowledge and attitudes to science, so the effectiveness of the project is measured in relative terms only. Evaluations often tend to include a questionnaire, interview, or data-analysis technique that gives an immediate indication of success (Edwards, 2004). Long-term studies, however, are particularly problematic, and even rarer in the literature (Edwards, 2004).

Gascoigne and Metcalf (2001) discuss that current evaluation processes are a weakness in many programmes and projects designed to increase public awareness of science. Furthermore, the authors continue, whenever inadequate evaluation exists, it often undermines the credibility of much of what science communicators strive to do in these programmes. In their review of community-based science programmes in Australia, Rennie & ASTA (2003) found many had no evaluative element included, whilst others judged success by the number of participants, or reported little other than that the participants enjoyed the activities. As Edwards (2004) comments, reports of awareness-raising projects can often contain many general statements of success, but that these cannot be readily used as evidence without being tied to the specific. Gascoigne and Metcalf (2001) list two considerations they consider central to an evaluation process. Firstly, that evaluation should be built into a project from the start, and secondly, that baseline data should be used as a measure of where the population is before the project is run. Even back in the 1970s, Shen (1975) was calling for an increase in "survey research to determine the effectiveness of selected science-literacy projects by measuring the level of science literacy both before and after a project's implementation" (p. 51).

Despite the lack of effective evaluation for many science awareness-raising projects, many such as Miller argue that it is essential:

> A broad and deep appreciation of the success of public-awareness-of-science initiatives is important if we are to improve on a checkered track record of increasing the public's awareness, appreciation and opinion of science (Edwards, 2004, p. 260)

It seems obvious that the proponents of such activities need to be able to show they have made a difference - that the activities they have designed and put into action have led to the desired outcomes (Gascoigne & Metcalf, 2001). Indeed, an organised approach to evaluation would allow for some very useful information to be obtained, both for the current project and for the future of all science awareness-raising projects (Edwards, 2004).

2.7 Summary

From it origins in the 1950s, the term "scientific literacy" has remained a controversial concept. It has been plagued by continued debate over its meaning, how to achieve it and whether it is an appropriate goal for the general public. There is general agreement, however, that to move the population as a whole to greater awareness of science would be beneficial. The paradigm shift to the "contextual model" and the current emphasises on "engagement" of the public with science, have led to more holistic concepts of scientific literacy which deemphasise knowing and focus on "ways of thinking and acting". With this in mind, in the effort to increase science-awareness there has been a growing movement towards engaging students and the general public in science-related projects. Furthermore, projects that partner schools and communities to address issues of concern in their local community are being celebrated as a way to dissolve the disconnect between learning in schools and community life. Although these school-community collaborations are increasingly documented in the literature, attempts to determine their impact on participants' learning are not commonplace. Such

evaluations are necessary if the claims of proponents are to be justified, and this approach to raising science-awareness in the community is to develop.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

The case study method was chosen as the most appropriate method to document and evaluate the Mt Capital Native Grasses Project. The reasons for this, and the characteristics of the case study method as a research strategy, are discussed in this chapter. The CRC, the group formed to drive and co-ordinate the activities of the Project, is central to the Mt Capital Native Grasses Project and therefore the research design was based on collecting evidence of its activities. The case study method allows for evidence to be collected from a variety of sources and the procedures used to collect, process and analyse this data are discussed. The attempts to address verification within this case study, and the limitation of the research methodology are also discussed.

3.2 The Research Methodology

Choosing the Case Study Method

> Sometimes we simply have to keep our eyes open and look carefully at individual cases - not in the hope of proving anything, but rather in the hope of learning something! (Eysenck cited in Flyvbjerg, 2004, p. 422)

Merriam (1988) discusses the usefulness of case studies for studying educational innovation and evaluating programs. She argues that case studies can be used to examine "educational processes, problems, and programs...to bring about understanding that in turn can affect and perhaps even improve practice" (p. 32). In choosing a research method, the researcher needs to be mindful of the nature of the research problem and the questions being asked (Merriam, 1988; Yin, 1994). As discussed by Flyvbjerg (2004), "good social science is problem-driven and not methodology-driven, in the sense that it employs those methods that for a given problematic (sic) best

help answer the research questions at hand" (p. 432). Whilst other types of qualitative research approaches such as grounded theory and ethnography were explored, the case study method was chosen as the most appropriate method to document and evaluate the Mt Capital Native Grasses Project. There are several reasons why a case study is the best method for this study. The research problem is a contemporary issue. I was able to observe the Mt Capital Native Grasses Project as it progressed, in its so called "natural setting", embedded in its social context. It is the importance of the context, and the inability to separate the variables from their context for study, that means that the researcher can have little control over the research situation. It is the lack of control over behavioural events that makes the case study, as a form of descriptive, non-experimental research, the logical strategy (Merriam, 1988).

As is often the situation in case studies, the research questions in this study took a "how and why" form, in that they were focused on process rather than just on outcomes (Creswell, 1994; Merriam, 1988; Yin, 1994). The desired outcome of the research questions was to provide a detailed study of the Mt Capital Native Grasses Project. It aimed to incorporate both qualitative and quantitative data to give a "rich and holistic account of a phenomenon" (Merriam, 1988 p. 32). It is the desired end product of a descriptive account that also indicates the case study approach as the appropriate research strategy (Merriam, 1988). In addition, the Mt Capital Native Grasses Project was a "bounded system", in that it occurred over a set number of weeks with a defined number of actors, lending itself well to a case study design (Merriam, 1988).

Case Study Defined

The reasons for selecting the case study method and the philosophical assumptions underlying the method have been discussed above. At this point it would be useful to define the term "case study", as it is applied in this

study. Yin (1994) describes it as a "comprehensive research strategy" and emphasises that is should not be seen as a "data collection tactic or merely a design feature" (p. 13). Although researchers tend to agree that the case study is a research design in its own right, there have been varying attempts at trying to define what exactly it is. Most notably, Yin (1994) gives a technical definition for case study that reflects the logic of the case study design. His definition has two parts: the first of which includes the scope of the case study; and the second which covers the data collection and data analysis strategies. Yin states:

1. A case study is an empirical inquiry that
   - Investigates a contemporary phenomenon within its real-life context, especially when
   - The boundaries between phenomenon and context are not clearly evident
2. The case study inquiry
   - Copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result
   - Relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result
   - Benefits from the prior development of theoretical propositions to guide data collection and analysis (p. 13).

In his definition, Yin emphasises two main characteristics of case studies that distinguish them from other research strategies. Firstly, that context is central in the study of the case, and that the phenomenon under study is embedded within this context. Secondly, to have "an all encompassing method" where the approach to data collection and analysis is incorporated into the design, and reflects the contextual conditions of the case study (p. 13).

Yin's definition also refers to the use of multiple sources of evidence. In case study research, evidence may be collected through a variety of sources such as interview, documents, artifacts and observation. As multiple sources of data are used, multiple data collection methods are likely to be used during

case study research. As such, a case study does not claim any particular methods for data collection or data analysis, but rather uses a multi-method approach to accumulate data on the same issue (Gillham, 2000; Merriam, 1988). This unique ability to deal with a full variety of evidence is considered one of its strengths and a key characteristic of case study research (Yin, 1994).

After reviewing the available literature, Merriam (1988) defines the qualitative case study in terms of four essential characteristics: particularistic, descriptive, heuristic, and inductive. By particularistic, Merriam (1988) means that case studies "focus on a particular situation, event, program, or phenomenon" (p. 11). As Stake (1995) argues, the qualitative case study researcher sees the uniqueness of individual cases and contexts as important to understanding the phenomenon under study. It is this specificity of focus, the study of the particularity of the case, which provides such richness of information. That case study research does provide such rich "thick" description is why it has been defined as descriptive by Merriam and other researchers (Stake, 1995; Yin, 1994). It is through this thick description, a term coined for describing "complete, literal description", that case study researchers hope to develop an account which allows the reader to almost have their own experience of the case, a kind of vicarious experience (Merriam, 1988; Stake, 1995). It is believed that this will facilitate the reader to establish an empathetic understanding for the case and therefore be able to interpret it within the context of their own experiences (Stake, 1995).

That case studies are heuristic, in that they are able to "illuminate the readers' understanding of the phenomenon under study", is the third characteristic used by Merriam to define case studies (Merriam, 1988, p. 13). The last characteristic is that they are inductive, that "generalizations, concepts, or hypotheses emerge from an examination of the data" and that it is impossible to identify all the important variables at the beginning of the study (Merriam, 1988, p. 13). That is not to say that studies do not benefit from the prior development of theoretical propositions but rather that these may be

reworked continually through the progress of the study (Yin, 1994). As Creswell (1994) describes, the theory "emerges" from the data.

In summary, a case study is a research strategy that investigates a contemporary phenomenon with its context. It usually involves a multi-method approach to collect evidence from a variety of sources all bearing on the same issue. The end product is a rich description of the case, which honours its uniqueness and integrity, and encourages the reader to grapple with the issues to develop their own understanding of the phenomenon. It should be emphasised, however, that a case study is an interpretive account on behalf of the researcher based on the evidence collected (Merriam, 1988). As such "is a subjective statement which its author is prepared to justify and defend" (Ruddock cited in Merriam, 1988 p. 187).

Philosophical Assumptions

Case study research, as it is applied in this study, lies within the broad tradition of qualitative research and in particular naturalistic inquiry (Merriam, 1988). That is to say, the philosophical assumptions underlying the case study draw from the qualitative research paradigm, but case study research should not be confused with "qualitative research" per se (Merriam, 1988; Yin, 1994). As noted by Yin (1994), case studies "can include and even be limited to quantitative evidence" (p. 14). Merriam (1988) believes that there are several characteristics of qualitative research that feature prominently in case study research. Firstly she stresses that there is a primary concern "with process rather than outcomes or products" (p. 18). It is this focus on process that leads to "how" and the "why" research questions rather that the "what". Gillham (2000) also talks about focus on process in case study design and what he calls the "qualitative element". He believes that the naturalistic case study researcher has greater concern with (but not limited to) how people understand themselves and their setting, people's feelings or perceptions, or their experiences of what is going on. This follows on to the

second characteristic discussed by Merriam (1988) - meaning. Qualitative researchers are interested in "how people make sense of their lives, what they experience, how they interpret these experiences, how they structure their social worlds" (Merriam, 1988, p. 19).

The third characteristic of qualitative research that Merriam (1988) believes features strongly in case studies, is the importance of the researcher as the primary instrument for data collection and analysis. Consequently, the researcher must acknowledge their personal role and how this influences the evidence that is collected. The fourth prominent characteristic Merriam (1988) believes is shared by qualitative research and case study research is that it usually involves fieldwork. Stake (1995) ties together these two last characteristics, that of the personal role and the use of fieldwork, in discussing qualitative case study research. He states that "standard qualitative designs call for the persons most responsible for interpretations to be in the field, making observations, exercising subjective judgment, analysing and synthesising, all the while realizing their own consciousness" (p. 41). Case study research is considered naturalistic inquiry as there is no attempt to manipulate variables or administer treatments, rather the researcher seeks "to observe, intuit, sense what is occurring in a natural setting" (Merriam, 1988, p. 17).

3.3 The Research Design

The Design

The work of Yin (1994), Merriam (1988) Stake (1995) and Gillham (2000) was used to inform the research design of this case study. According to Merriam (1988), case studies can take several forms including ethnographic, historical, psychological, descriptive, interpretive or evaluative. The case study of the Mt Capital Native Grasses Project is a combination of the descriptive and evaluative. Firstly, it sought to generate a comprehensive and accurate

description of the Mt Capital Native Grasses Project, including how the ASTA Science Awareness Raising Model was adapted. In this research, "the case" as a bounded system was the Project, and as such is the unit of analysis. The focus of this study, in terms of data collection, is the CRC and its activities. Evidence was collected from a variety of sources including project documentation, direct observation of CRC meetings, and interviews with CRC members. Whilst observation was used to record events and behaviour first-hand, interviews were used to ascertain members' accounts of their experiences and their opinions about events. In addition, physical artifacts arising from the Project were also included as evidence.

As the Mt Capital Native Grasses Project was part of a larger trial to field-test the ASTA Science Awareness Raising Model across Australian states and territories, data was also collected by ASTA. Their aim was to measure the impact the project had at the community level, which was an essential goal of the ASTA Science Awareness Raising Project. It aimed to:

> Promote greater understanding in the educational and broader community of why science is important, why time is spent on it at school and why scientific literacy is a desirable outcome of schooling. (Rennie & ASTA, 2003, p. 1/2)

ASTA chose two methods to collect data from the community: pre- and post-project interviews with a representative sample of the community; and letter surveys to parents of school children and their neighbours. Details of their survey can be found in Rennie and ASTA (2003). Rather than replicate this measurement, the decision was made to use the data from ASTA to complement my data collection. This decision was influenced by a number of factors, including the availability of resources and ethical considerations. As only six letter surveys were returned, however, with only four respondents reporting having heard of the Mt Capital Native Grasses Project, those results are not included in this case study.

The second objective of the case study was to evaluate the Mt Capital Native Grasses Project in terms of the aims of the ASTA Science Awareness Raising Project. Documents and reports from ASTA were analysed to compile a statement of the aims. The outcomes of the Mt Capital Native Grasses Project are then discussed in light of these aims.

Addressing Verification

As in any empirical research, verification is a major concern in qualitative case study (Merriam, 1988; Yin, 1994). In addressing verification, Yin (1994) discusses the four design tests that can be used to judge the quality of a research design. These include the issues of construct, internal and external validity as well as reliability. The tactics undertaken to address each of these issues are discussed below, as to make explicit the steps to verify this study.

The issue of construct validity refers to "establishing correct operational measures for the concepts being studied" (Yin, 1994, p. 33). That is, that the data collection and analyses methods are appropriate for what you want to investigate. As suggested by Yin (1994), three tactics were used to address construct validity in this study. At the point of data collection, multiple sources of evidence were used and a chain of evidence maintained. In addition, a draft of the case study findings was sent to members of the CRC to be reviewed, the process of which is referred to as "member checking" (Stake, 1995).

Internal validity relates to the extent that the findings of a study relate to reality (Merriam, 1988). Yin (1994) writes that the concern over internal validity in case study research may be extended to the broader problem of making inferences. That is, questions of whether an inference is correct, that evidence is convergent, and that rival explanations and possibilities have been considered. Merriam (1988), Stake (1995) and Yin (1994) identify many tactics for addressing internal validity. For example, Merriam (1988) writes:

> The question of internal validity...is addressed by using triangulation, checking interpretations with individuals interviewed or observed, staying on-site over a period of time, asking peers to comment on emerging findings, involving participants in all phases of the research, and clarifying researcher biases and assumptions. (p. 183)

In this study, I attempted to address internal validity by using member checking, making explicit my background and biases, and the use of triangulation. Case study is known as a triangulated research strategy in that it uses multiple sources of evidence to develop converging lines of inquiry (Tellis, 1997; Yin, 1994). As Yin (1994) argues, this means that "any finding or conclusion in a case study is likely to be much more convincing and accurate if it is based on several different sources of information" (p. 92). This is only one practice of triangulation, labelled methodological triangulation. Other strategies, such as investigator and theory triangulation, also exist. To address these later strategies, the research findings and emerging theories were discussed with my supervisor, and Professor Léonie Rennie, the educational researcher who was involved with the larger ASTA Science Awareness Raising Project. I am mindful, however, of the caution of Merriam (1988) in that it should not be expected that triangulation will automatically produce some nicely integrated whole. Rather, as Mathison (1988) suggests, triangulation can be used to provide "more and better evidence" and that inconsistent and contradictory findings provide useful information, not just convergence. As Gillham (2000) suggests, if the data do not converge it does not mean that one set of data is wrong, rather "that the picture is more complicated than we expected" (p. 13).

The term external validity is the extent to which the findings of a case study can be generalised to other situations (Merriam, 1988). The ability to generalise the findings of a case study, in particular a single-case study, has been the subject of much debate (Merriam, 1988; Tellis, 1997; Yin, 1994). There has been frequent criticism that the results are not widely applicable in

real life (Tellis, 1997). Yin (1994) refutes the criticism by arguing that case studies rely on analytical generalisation rather than statistical generalisation as is the case with survey research. In analytical generalisation, he writes, "the investigator is striving to generalise a particular set of results to some broader theory" (p. 36). In the same vein, Stake (1995) argues that:

> people can learn much that is general from single cases. They do that partly because they are familiar with other cases and they add this one in, thus making a slightly new group from which to generalize, a new opportunity to modify old generalizations. (p. 85)

He explains that this can be done by providing readers the opportunity for vicarious experience. As suggested by Stake (1995), this study attempted to provide this opportunity be emphasising time, place and person in the narrative, as well as providing enough raw data prior to interpretation so that readers can consider their own alternative interpretations. I concur, however, that "the real business of case study is particularization, not generalization" (Stake, 1995, p.8). That is, what is to be learnt from individual cases is centred on their uniqueness.

3.4 Instrumentation

Merriam (1988) writes that "in a qualitative case study, the investigator is the primary instrument for gathering and analyzing data" (p. 36). As a consequence "all observations and analyses are filtered through one's worldview, one's values, one's perspective" (Merriam, 1988, p. 39). This necessitates that the researcher's background, assumptions and biases should be made explicit at the outset of the study (Creswell, 1994). My perceptions of the Mt Capital Native Grasses Project would have been influenced by my previous involvement with the ASTA Science Awareness Raising Project. In my former employment as a Research Associate at Curtin University of Technology, I was involved in the planning stages of the ASTA Science Awareness Raising Project, in particular in the development of the ASTA

Science Awareness Raising Model. My work supervisor was engaged by ASTA as the educational researcher who developed the ASTA Science Awareness Raising Model. My role involved reviewing the literature and co-creation of the ASTA Science Awareness Raising Model and the ASTA Science Awareness Raising Package. During the planning stage, I was also involved in the selection of the communities to be included in field-testing the ASTA Science Awareness Raising Model. During the trial in 2002, I was employed to undertake phone interviews of community members as part of the data collection for ASTA. This included all the trial projects throughout Australia, as well as the Mt Capital Native Grasses Project.

As I was involved in the development of the ASTA Science Awareness Raising Model, I had expectations of how a school-community partnership would adapt it to run a science-related project. Although I tried to remain objective, these expectations would bring certain biases to my role as a case study researcher, in particular with respect to how closely the CRC chose to follow the ASTA Science Awareness Raising Package. As I had prior knowledge of the ASTA Science Awareness Raising Model and of ASTA's objectives with regards to the project, I would have interpreted my experiences as a researcher within this frame. This prior knowledge also meant that I had access to information that the CRC would not have had. As the CRC was aware of this, it may have created a power dynamic during my observations that could have influenced the behaviour of the members of the CRC.

As I did have prior knowledge of the ASTA Science Awareness Raising Project, it emphasised the need to make a decision about my role during data collection, particularly during observation of the CRC meetings. As I believed that my prior knowledge could seriously alter how the community ran the Project and therefore the outcomes of Mt Capital Native Grasses Project, I chose to be a non-participant observer. This became difficult when the CRC was not sure how to proceed on an issue and was looking for clarification.

For example, during the CRC field trip to Mt Capital I was asked a direct question about project dates. I did respond to the question as I believed that it would not have a great impact on the project and not to do so would affect my relationship with the group. Generally, however, I attempted to remain a passive observer, remaining silent during the CRC meetings and not actively participating in project activities. Similarly, I was cognisant of remaining a non-judgmental, empathic listener whilst interviewing members of the CRC.

3.5 Sample and Population

The CRC and its activities are the focus of this study in terms of data collection. The CRC, as defined in this study, consisted of nine members, who were people who attended at least one meeting of the CRC. This differed from the CRC's own description in its final report, who listed themselves as having ten members. The CRC included the Local Leader, who was the Principal at the local primary school and a teacher from the same primary school, the Principal and a teacher from the local secondary school, two community representatives who had children at the schools, the President and another representative from the community interest group - Friends of Mt Capital, and the STA Coordinator.

The community in which the Mt Capital Native Grasses Project took place is a suburb of Canberra. It is a metropolitan centre with a small shopping/business precinct.

3.6 Data Collection Procedures

Ethical Considerations

I attended the first CRC "meet and greet", which occurred in April, 2002, to introduce myself and talk about this study. At this time, verbal and written permission was given by all the attending members of the CRC to observe

and record the meetings which were due to start in May (see Appendix C). Approval from the University's Human Research Ethics Committee to conduct this research was applied for in April and granted in May, 2002 (see Appendices D & E, respectively). Subsequently, written permission was sought from each individual member of the CRC. Each member was asked to complete a consent form and they were given an information sheet detailing what would be involved, and the contact details of myself and the University's Human Ethics Officer (see Appendices F & G, respectively). The consent form requested permission to observe the CRC meetings and tape-record them, and also to collect and use documentation that was produced by the CRC or its related activities.

The CRC members were advised that their participation in the research was entirely voluntary and they could choose to withdraw their permission at any time. After the Mt Capital Native Grasses Project was completed and the final CRC report was submitted, individual consent was sought to gain volunteer participants for interviews. This occurred via email. The CRC was advised that all information collected would be kept confidential and that in reporting, I would seek not to reveal individual identities. Members were advised that if I considered that a particular comment would identify a person, that the individual would be approached for permission to include the comment.

At the time of data collection, ASTA gave verbal permission for me to undertake the case study research and all that it involved. Formal written permission was requested and granted by ASTA in July, 2009 (see Appendices H & I, respectively).

Documentation

Documents were collected at several stages and from different sources. Firstly, I had access to documents through my previous employment at Curtin University of Technology during the planning stage of the ASTA Science Awareness Raising Project and development of the ASTA Science

Awareness Raising Model. The majority of these documents were produced by ASTA, and by myself and my previous work supervisor. They also included, however, the initial applications from the Mt Capital Native Grasses Project and other trial projects throughout Australia. Secondly, I collected documents produced by the CRC throughout the duration of the Mt Capital Native Grasses Project. This included the project planning documents and meeting minutes, mid-project and final reports, STA Coordinator focus questions and correspondence within the CRC. Documents written by ASTA during the trial of the ASTA Science Awareness Raising Model that were relevant to the Mt Capital Native Grasses Project were also sourced. The report produced for the Department of Education, Science and Training at the completion of the trial; *The ASTA Science Awareness Raising Model: An Evaluation Report,* was accessed from the internet (http://www.dest.gov.au/schools/Publications/2003/index.htm).

Direct Observation

During the course of the Mt Capital Native Grasses Project (2002), the CRC held five meetings and one field trip out to Mt Capital. I was on site to observe all of these gatherings of the CRC. The first two CRC meetings occurred in April (11th and 18th), the following two in May (16th and 30th) and the fifth and final meeting early August (8th). All five meetings took place at the primary school, after school hours. The meetings were held around a table in the staff room and lasted between 30 to 75 minutes. Descriptive field notes were taken during each meeting with the seating arrangement noted. The meetings were audio-taped with permission and later transcribed. Reflective notes were written as soon as possible after the meetings. These after-meeting memos recorded my thoughts and ideas in response to the meetings.

The field trip to Mt Capital occurred in late May (22nd). It involved the two teachers from the primary and secondary school, and the President of Friends

of Mt Capital. The field trip was essentially a scoping excursion; an opportunity for teachers to have a look at the area and ask the Friends of Mt Capital President questions in order to plan the student activities. The field trip occurred around midday on a school day and lasted about 45 minutes. I took field notes, and reflective memos were recorded as soon as possible after the field trip.

Interviews

I approached eight of the CRC members to participate in an interview and all agreed to take part. One CRC member was not approached as they only attended the first CRC meeting and had no further involvement in the Project. The interviews were conducted individually during November and December, 2002, at a time and place convenient to the interviewee. For all CRC members this was either their work place or home. As many of the interviews did occur in workplaces, I had to be sensitive to work responsibilities, and at times the interviews were suspended for respondents to answer the phone. As Merriam (1988) advises, the key to good interviewing is to be a good communicator; to empathise with respondents, establish rapport, ask good questions and listen intently. To encourage these conditions, interviews were informal, assuming a conversational manner, either across a desk or sitting in two opposite seats. Creswell (1994) emphasises that is important to have an advanced plan for the interview but also to remain flexible in being able to clarify or elaborate on any important points. Therefore, interviews were semi-structured, being guided by a common set of questions. The CRC members were asked about their involvement in the Project, in terms of why they got involved and what role they played, as well as their thoughts on how the Project was run and what it achieved (see Appendix J). As well as the common set of questions, respondents were asked additional questions specific to themselves and in response to any answers they may have already given. Respondents were encouraged to express their views no matter what they were. Interviews

lasted between 30 to 45 minutes and were audio-taped with permission and later transcribed. (See Appendix K for a sample interview).

Physical Artifacts

Physical artifacts refer to anything that was made as part of the Mt Capital Native Grasses Project, a type of physical evidence (Gillham, 2000). As the ASTA Science Awareness Raising Model required that projects have a tangible outcome and involve communication with the community, physical artifacts were likely outputs of the Mt Capital Native Grasses Project. It was for this reason that I decided to collect physical artifacts that arose throughout the duration of the project. This included both visual and written forms of communication.

ASTA's Interviews with Community Members

Twenty-three members of the ACT Mt Capital community participated in both a pre- and post-project interview with ASTA. Participants were identified by the CRC as a representative sample of community members. They included parents of school children, interested community members, retirees, business people and service workers in the community. ASTA requested that individuals range from "almost certain to be involved in the project to those who may be involved peripherally" (Rennie & ASTA, 2003, p. 6/39). Local Leaders made a list of 30 people of whom they had already gained permission from to participate in the interviews. Pre-project interviews were conducted during June and July of 2002. A total of 24 people were interviewed with four people unable to be contacted and another two refusing to take part. The post-project interviews took place in September and October, and 23 of the original interviewees participated with one unable to be contacted.

I was one of two interviewers employed to conduct the interviews for the ACT Mt Capital Native Grasses Project and carried out 22 of the 24 pre-project interviews, and all of the 23 post-project interviews. Interviews took place over the phone. ASTA provided interviewers with a detailed set of instructions and a proforma with questions and space to record responses. Interviewees were asked their opinions about science, why science is taught in schools and whether they had heard about the project. The proformas included open-ended questions and fixed response questions where the respondents were asked to rate an issue on a five-point scale. I was provided with both the raw data and the processed quantitative results, along with the coding schematic from the data analysis carried out by ASTA.

3.7 Data Processing and Analyses

A list of the evidence and/or data compiled to inform the case study of the Mt Capital Native Grasses Project can be found in Appendix L. The various sources of evidence were analysed separately and the results compiled to produce an "assembly of evidence" which was used to prepare the rich description. Firstly, transcriptions of the CRC meetings and interviews with CRC members, as well the documents produced by the CRC, were coded according to Tesch (cited in Creswell, 1994). That is, these sources of data were examined to identify key thematic categories and these were given codes and the codes sorted into a preliminary organising scheme. This preliminary scheme was taken back to the data, which was then repeatedly coded as thematic categories and the organising scheme were refined. During coding, exemplar quotes were identified which were indicative of a code and researcher memos were recorded. The data material belonging to each category were assembled in one place for ease of analysis, and this formed the basis of the compilation of evidence. In addition, a content analysis of the CRC meetings was carried out to measure the frequency and variety of codes

so that the content of communication of each meeting could be described (Merriam, 1988).

Secondly, other sources of evidence, such as the documents produced by ASTA, physical artifacts, reflective notes and field notes were examined to provide further information and to look for evidence of triangulation. Thirdly, the results from ASTA's interviews with representative community members pre- and post-project were added to the compilation of evidence. From this compilation of evidence, a descriptive narrative was composed around the first four research questions.

The fifth and final research question asked whether the Mt Capital Native Grasses Project achieved the aims of the ASTA Science Awareness Raising Project. Documents sourced from ASTA were examined to compile a statement of the aims of the ASTA Science Awareness Raising Project. The outcomes of the Mt Capital Native Grasses Project were then examined critically to respond to each aim. Finally, the compilation of evidence was further examined to indicate the possible factors that impacted upon the achievement of aims and these were also described.

A draft of the findings was discussed with Professor Léonie Rennie, and then revised on the basis of her comments. In addition, the resulting draft was emailed to four members of the CRC for whom I was able to find contact details. The email requested that they read the draft and return any comments by two weeks. Comments were not received from any of the contacted members.

3.8 Limitations of the Research Methodology

The limitations of the case study research methodology are discussed here, but it should be noted that those which relate to subjectivism and bias are not distinct to case study research, but also apply to all other research methods

(Flyvbjerg, 2004). As addressed previously in "3.3 The Research Design", there has been frequent criticism that the results from case studies, in particular single-case studies, are not widely applicable in real life. As far as exploring the success of the ASTA Science Awareness Raising Model through this particular case of the Mt Capital Native Grasses Project, there is no doubt that it will be distinct from the other projects run as part of the trial. However, as ASTA's own evaluation looked uniformly across the range of projects carried out nationally, to assess the impact of the Model, this case study will complement their data by providing in-depth analysis of one project.

The case study strategy requires a substantial investment of time on behalf of the researcher to be able to provide the holistic, rich description and analysis of the phenomenon (Merriam, 1988). If this is not possible, a less than full description may result. Guba and Lincoln comment that case study narratives may oversimplify or exaggerate a situation, and they can "seduce" readers into thinking case studies are accounts of a whole when they are "but a part-a slice of life" (Merriam, 1988). As Merriam (1988) also points out, in the case study method the researcher is the primary instrument of data collection and analysis, and therefore essentially all observations and analyses are filtered through their perspective. It is left to the sensitivity and the integrity of the researcher to illustrate the case in an accurate and unbiased manner. The inquiry process and the data collection methods of the case study strategy expand rather than reduce information that has been collected, and the onus falls on the researcher to decide on the amount of description and analysis that takes place (Merriam, 1988). It is possible that the resulting case study product may be too lengthy, detailed or involved and this may act as a deterrent to readers' engagement (Merriam, 1988).

3.9 Summary

The case study method is a comprehensive research strategy that can be used to study contemporary phenomenon that is unable to be separated from it context. It allows for evidence to be collected from a variety of sources to provide a holistic account of a phenomenon. To achieve the first objective of describing the implementation of the Mt Capital Native Grasses Project and adaptation of the ASTA Science Awareness Raising Model, the evidence that was collected included project documentation, direct observation of CRC meetings, and interviews with CRC members. In addition, the data collected by ASTA from interviews with representative community members was also included to complement this evidence. This compilation of evidence was used to compile a rich descriptive account narrative of the Mt Capital Native Grasses Project. In terms of the second objective of the case study, to evaluate the Mt Capital Native Grasses Project with regard to the aims of the ASTA Science Awareness Raising Project, documents and reports from ASTA were analysed to compile a statement of the aims. The outcomes of the Mt Capital Native Grasses Project were then critically examined to address each of these aims. Within this case study, verification was addressed by using multiple sources of evidence, leaving an audit trail, making explicit my own role and biases, member checking and discussing the emerging findings with other researchers.

CHAPTER 4: RESEARCH FINDINGS

4.1 Introduction

This case study of the Mt Capital Native Grasses Project had two main objectives: to describe the implementation of the Project and adaptation of the ASTA Science Awareness Raising Model; and to evaluate the Mt Capital Native Grasses Project in terms of the aims of the ASTA Science Awareness Raising Project. First, a rich description of the Mt Capital Native Grasses Project is presented. Each section relates to one of the first four research questions: the activities and outcomes of the Project; use of the ASTA Science Awareness Raising Package; the people who were involved and how they worked together; and the impact of the Project in terms of raising science awareness in the community. Second, the Mt Capital Native Grasses Project is evaluated by discussing whether the Project achieved the aims of the ASTA Science Awareness Raising Project and what had an impact on the achievement of these aims. This section relates to the fifth and final research question.

4.2 Overview of the Mt Capital Native Grasses Project

Project Aims

The many years of grazing on Mt Capital has significantly altered the vegetation on the hill which is currently a sparsely covered area (see Figure 3). According to the Mt Capital CRC, now that the area is used as a recreational reserve, there is a "wide range of discussion about the vegetation" in the community. This science-related community issue was chosen as the basis for the Mt Capital Native Grasses Project. According to the CRC's Nomination Form, the Project was to focus on native grass propagation and regeneration. However, post-project, its final report stated the main aim of the Project was to raise awareness of science within the community through the study of

native grasses on the hill. This included forming a partnership between local schools and the community, which would allow the participants to experience "working scientifically", and to raise awareness of the scientific expertise that is "embedded" in the local community. The Local Leader discussed with the CRC that it would be more than a planting project, that it was to be a "scientific study" and that they needed "to be able to identify the science that's behind all of this" (CRC meeting; 16/5/02). It was through this emphasis that the CRC members hoped that they would be able to "discover that there's quite a bit of scientific literacy out there ... that people didn't know they have, and hopefully they would [be] more interested in the subject" (Local Leader, CRC meeting; 16/5/02).

Figure 3. View of Mt Capital.

In interview many of the CRC members recognised that in addition to the shared, documented aims of the Project, the different people on the CRC also had their own aims for the Project, which related to their reasons for becoming involved:

> Secondary Principal: Our goal I think was to strengthen the relationship between the schools. I think the main goal of the [Mt Capital] people was to get more community involvement in [Mt Capital].
>
> Researcher: So there were various goals?
>
> Secondary Principal: Yes, because the different stakeholders have their different reasons for taking part.
>
> (Interview; 13/12/02)

The members of the CRC who represented the local schools expressed the desire to demonstrate to the community "that this is the science that is working in the schools at the moment and that the students are involved in a variety of different aspects of science" (Primary Teacher, Interview; 22/11/02).

Project Activities

The Mt Capital Native Grasses Project took place from March to September in 2002 (see Table 1.). During this time, there were five CRC meetings and several other meetings between individual members of the CRC. The project activities involving the students' scientific studies of Mt Capital occurred in June and July. The Project concluded with a display of the students' work at the local shopping centre at the end of July and was celebrated with a student planting session on Mt Capital in August. The CRC prepared a final report and the STA Coordinator completed a series of "STAC Focus Questions" that were sent to ASTA.

Meetings of the CRC

The CRC was comprised of nine individuals: the Local Leader, who was also the Principal of the local primary school; a teacher from the same primary school; the Principal and a teacher from the local secondary school; two interested community representatives who had children at the schools; the President and another representative from Friends of Mt Capital; and the STA Coordinator. (Only one of the community representatives was interviewed as the other only attended the first CRC meeting). The CRC met around a table in the staff room of the primary school. It met on a weekly to monthly basis during the planning stages of the Project with a final meeting held following completion of the main activities. Generally, future meetings were scheduled at the end of each meeting. Only the Local Leader attended all of the meetings, with the other members attending from one to four meetings.

Month	Date	CRC Meeting	Project Activity
2001			
December	3		Mt Capital Native Grasses Project application received by ASTA
2002			
January			Local Leader notified of success to participate in trial
March	15		CRC received ASTA Science Awareness Raising Package
April	11	First	
	15		Primary and secondary principals meet together with their staff to discuss options
	18	Second	
May	16	Third	
	22		Teachers' field trip to Mt Capital with President of Friends of Mt Capital
	28		Primary and secondary teachers' "planning day"
	30	Fourth	
June	11		Students visit Mt Capital for overview and to collect grasses for identification
	24		Students visit Mt Capital for quadrant studies
	30		CRC mid-project report sent to ASTA
July	2		Year 6 visit Year 9 at high school to create "3-point action plans"
	22-26		Student display at local shopping centre
August	8	Fifth/final	
			Students' planting session with ranger and Friends of Mt Capital
September	10		CRC final report and STA Focus Questions sent to ASTA

Table 1. Timeline for the Mt Capital Native Grasses Project

The first meeting, which was held at the beginning of April, involved a "meet and greet" where individual members of the CRC shared what they hoped to achieve with the Project and voiced any concerns they had. As a group, they brainstormed ideas and discussed what could reasonably be achieved within the timeframe. There was much discussion on how to involve students and the community in the Project. Overall, the meeting was very positive with members very keen to get started. The second meeting, a week later, was more focused on project management issues such as planning, the timeline and budget. Since the previous meeting, the principals from the two schools had met and they reported back to the CRC during this meeting. The Friends of Mt Capital President shared her knowledge of Mt Capital and it became apparent that she knew a great deal about the area, including both the fauna and flora. At the third meeting, almost a month later, the Secondary Teacher who had not been involved up to this point, joined the CRC. Most of this meeting involved briefing him on the Project. The Local Leader also reported back on the work she had done on the budget since the last meeting.

By the fourth meeting, at the end of May, there was a change of atmosphere at the meeting of the CRC. The Local Leader became more focused to get things moving, handing out an agenda at the beginning of the meeting for the first time:

> Extremely busy and have you got a copy of the agenda. We need to keep our focus on what we are doing. You can see the planning, that's [the Secondary Teacher] and [the Primary Teacher] presentation. And I've put up a budget for you all to look at, to throw about and spit out and put back. And there's some tasks that we can pass to community members that [the Primary Teacher] and [the Secondary Teacher] have identified. And any other items that you want to discuss. (CRC meeting; 30/5/02)

The two teachers had carried out a field trip to Mt Capital and a "planning day" since the last meeting and they reported their ideas back to the CRC. This took up most of the meeting, as well as discussing the logistics of how

they would carry out their plans and the budget the Local Leader had prepared in response to their plans.

The fifth and final meeting was held at the beginning of August and was essentially a "wrap-up" meeting to discuss what had been achieved and organise for any outstanding tasks to be done. This final meeting was initiated by the STA Coordinator by email, as according to her, the Local Leader had not been keen on having a final meeting because she "didn't want to take up any more of people's time". Only three members attended the meeting and they were positive about the outcomes of the Project.

Meetings outside the CRC

Several meetings were held by the principals and teachers of the schools outside the forum of the CRC. Initially, between the first and second CRC meeting, the principals from both schools met, together with their staff, to discuss options for how their students could be involved in the Project. After the third CRC meeting, the teachers from both schools visited Mt Capital with the President of Friends of Mt Capital to "get more of a feel for it" and an understanding of the area before they planned their students' activities. About a week later, the teachers had a "planning day" to plan in entirety all the activities of the Project that would be carried out by the students:

> We talked about on this planning day that they would actually do the whole thing from go to woe. Develop the permission notes for kids to take home to their parents, any advertising that needed to go into newsletters or, or into our [Community Newspaper]. That could be done on the one day. (Secondary Principal, CRC meeting; 18/4/02)

Following each of these meetings, the outcomes were reported at the next CRC meeting.

Student Activities

The Mt Capital Native Grasses Project involved Year 6 students from the local primary school and Year 9 students from the local secondary school, and both classes were represented by their teachers on the CRC. All of the science-related activities of the Project were centered on the students, and these were based on a "10 point plan for raising the awareness and interest in science" that the teachers composed during their planning day. Initially, students were introduced to Mt Capital in the classroom by discussing the past and current uses of the hill, including the historical agricultural practices. They also studied maps of the area and constructed topographical maps of the hill. The next step of the Project involved two student field trips to Mt Capital, the first on June 11th and the second on June 24th (see Figure 4). On the first field trip, students participated in "group cohesion work", acquired an overview of the area and collected grass samples. Later in the classroom these samples were identified, dried and labeled.

Figure 4. Students working on Mt Capital.

The second field trip involved both classes in quadrant studies; recording the species and abundance of vegetation in a one metre square area. Following this, the students analysed the results in the classroom and graphed the grass populations. Next the Year 6 students visited the Year 9s at the secondary school to construct "3 point action plans". The two year levels formed groups

to identify recommendations for what the students and community could do in the future to continue supporting the Mt Capital Native Grasses Project (see Figure 5). Over the duration of the Project, the students kept a record of the hill and their activities by taking photos, drawing and painting pictures of the area, and making journal entries. The final step of the "10 point plan for raising the awareness and interest in science" involved the students of both classes in a "celebratory" planting session on Mt Capital with a ranger from National Parks and members of Friends of Mt Capital. They were not able to plant native grasses as the winter weather is not conducive to their growth and instead planted other native species that Friends of Mt Capital had put aside to plant.

3 POINT ACTION PLAN

1. In future, there should be more scientific study on native grasses on [Mt Capital].

2. The community in [Mt Capital] could plant more native grasses there.

3. To help the environment on [Mt Capital] the community should try not to litter so much because of all the animals that live there.

Billy, Zed, Emily, Murial and Peta

Figure 5. Example of student "3 Point Action Plan".

"Tangible Outcome"

The tangible outcome from the Mt Capital Native Grasses Project was a display of the students' work at the local shopping centre. The display presented their work in chronological order, starting with a map of the area, followed with the quadrant study results, photographs and plant samples,

and ending with their "3 point action plans" (see Figure 6). The display remained at the shopping centre for a week (June 22-26) with students acting as explainers for the general public. The display was also shown at the primary and secondary schools' front offices, as well as the ACT Department of Education's main office.

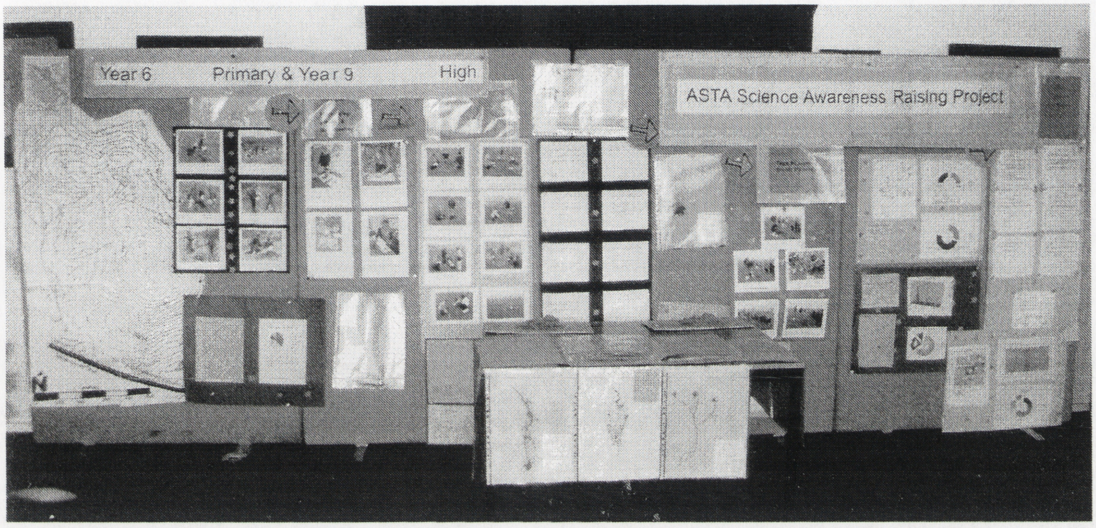


Figure 6. Display of students' work.

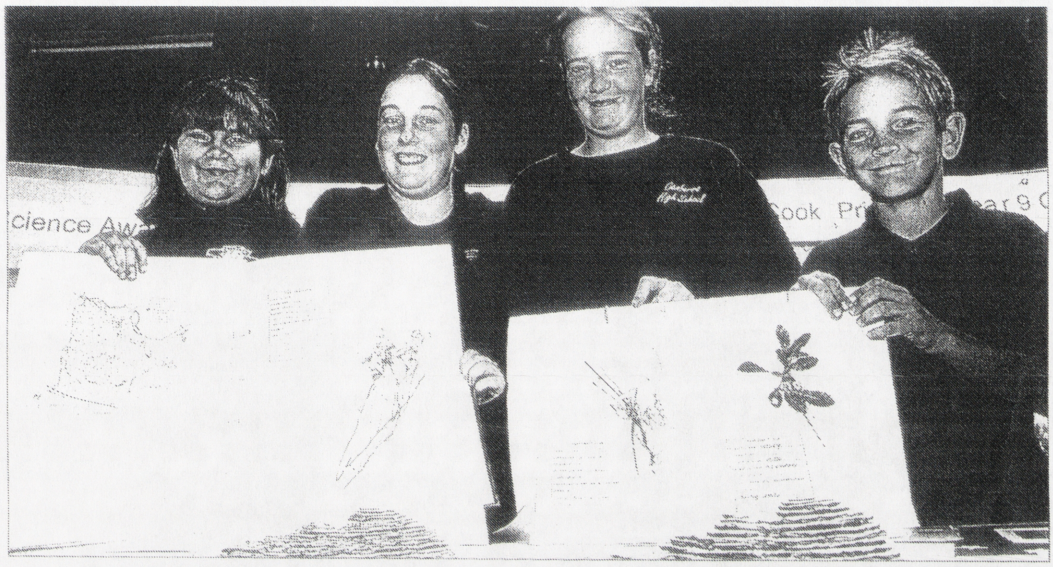
Communication Activities

The CRC considered the display at the local shopping centre as their main communication activity and way of involving the community in the Project:

> Having the exhibition over in [the local shopping centre] was to more and less really involve the community and having said that, I think we did that quite well. The kids were over there and they were talking to members of the community. These people have come across and asked this and we tell them what we have done. So that was great - the kids getting involved in talking to the community. (Secondary Teacher, Interview; 19/11/02)

The broader community also became aware of the Mt Capital Native Grasses Project and ASTA Science Awareness Raising Project through an article in the *Canberra Times* (see Figure 7). This article was initiated by the Local Leader who was interviewed for the story. Details of the Project were also published

in the local *Neighbourhood Watch* newsletter and the local real estate newsletter. Friends of Mt Capital also included an article about the Project in their newsletter. The school community was kept informed about the Project through reports at the school assemblies, and to the school board and parents and citizens group.



Primary's and , both of High, and , also of Primary, show some of their work on exhibition at the Centre.

Interest gently blossoms

By Cetriona Jackson, Education Reporter

AT FIRST students at Primary weren't too enthusiastic about the idea of a project on the native grasses growing on Mt , up behind their school. But their lack of interest didn't last long.

Once the project got going, students were so excited they were determined to continue intensive studies, despite increasingly frozen fingers during the winter study.

Principal said the project was driven by a $5000 grant from the Australian Science Teachers Association, and shared with the local high school. High.

A number of budding botanists had been uncovered during the intensive study of the grasses and weeds on the mountain. Students had worked closely with community groups, including friends of , and those connections would continue both formally and informally. said this was particularly pleasing because the students had been united with older community members by a common interest.

After carefully measuring out a one metre square area, the students collected specimens and returned to school for drying and pressing.

Then the often complex task of identification began. The lack of seeds in winter meant it wasn't possible to label some plants with certainty, and students had plans to go back once the season had changed.

Students were hoping to place a small sign at the foot of the mountain saying they were conducting studies there and would look for more funding to continue their work. said.

Figure 7. Article that appeared in the *Canberra Times*, Sunday, August 4, 2002 (p. 99).

Project Outcomes

In interview, and in both their mid-project and final reports, the CRC identified various outcomes of the Project, many of which related to the benefits to students who participated in the Mt Capital Native Grasses Project. These included the predicted scientific and educational outcomes, but also other outcomes which were more unexpected, such as the strong social bonds it created between the two schools, and the schools with the community.

Scientific Outcomes

As all of the science-related activities of the Project were centered on the students, the scientific outcomes of the Project were as well. As such, the CRC did not collect science-related information that underpinned the issue, but rather the students were involved in scientific studies of the area. The scientific data that the students collected, however, were already known by Friends of Mt Capital, who had previously commissioned a study of the vegetation by an independent environmental consultant. The students were involved in replicating scientific investigations on the hill and therefore the scientific outcomes existed only in terms of the educational outcomes of the Project. This was reflected in the comments of the CRC members, who when asked in interview what the scientific outcomes of the Project were, responded with a description of what the students had learnt during their studies:

> Okay scientific outcomes. Well I think the students...they learnt how to do things like quadrant studies, be able to investigate the landscape and see what flora is there and start to identify some of the grasses that they had. I think they looked at whether they were native or introduced. So I think those science outcomes were really important for those students to know because it s part of their own local community. (STA Coordinator; 10/12/02)

Educational Outcomes

In interview, all members of the CRC were very positive about the contribution of the Mt Capital Native Grasses Project to students' science learning. Many discussed that students "worked scientifically" and were involved in analysing, comparing, identifying and graphing. The development of scientific skills was also discussed, including those which students had learnt during their quadrant studies, plant identification, and the preparation of pressed plant specimens. The students had also learnt communication skills through report writing and the shopping centre display.

The Local Leader, as Principal of the primary school, discussed how teachers were also able to link the Project with "ICT competencies" (information and communication technologies), by having students create documents and graphs on the computer.

The Primary Teacher discussed that it was important for students to have "hands-on experience rather than just theory in the classroom" and that this encouraged students to be more aware and involved in their environment. Similarly, the President of Friends of Mt Capital discussed that the Project created awareness in the schools that the local environment can be used as a teaching resource, and provide an opportunity for students "to do some hands-on science". The Local Leader commented that it was beneficial to see "the dialogue and engagement at that level of the scientific outcomes for the kids to see they could be scientists" (Interview; 22/11/02). The sense of achievement, in that the students were willing to endure freezing cold weather and work alongside unfamiliar people to complete their studies, was mentioned by the Secondary Teacher:

> It could have been a shocker! The kids might not have gelled as well together. But they got up there, achieved things, the vegetation study. They might not have sat down properly in the freezing cold that was absolutely bitter, below zero. They still worked in those conditions that any adult wouldn't have. It was something that was taken in their stride and they were able to achieve it. And it was a credit to them. (Interview; 19/11/02)

Social Outcomes

The final reports of both the CRC and STA Coordinator keenly emphasised the "stronger links" formed between the two schools, and the schools with local community organisations, as a result of the Mt Capital Native Grasses Project. These sentiments were also echoed by all the CRC members in interview, particularly the links that were formed between the primary and secondary schools. The teachers partnered students from the Year 6 and Year

9 classes during their activities, and the students demonstrated both "patience and tolerance" in working together:

> The kids, the main thing is the Year 9 and 6 worked together extremely well. And it was great to see the Year 9 leading the Year 6s. Some Year 6s were leading Year 9s! The kids talked about it all the way up to the mountain and all the way back down. They had a good time...But I was really pleased just to watch the kids work and to get on like that. (Secondary Teacher, Interview; 19/11/02)

The Year 9 students were able to model skills to the younger Year 6 students, acting as peer tutors. As the secondary school has a program where Year 10 students act as "peer support leaders" for the incoming Year 7 students, this opportunity was particularly beneficial. The teachers explained that the Year 9 students, who will be Year 10 students the following year, were able to meet some of the future Year 7 students and practise this role. The Year 6 class visiting the Year 9 class at the secondary school to create their action plans gave them the opportunity to experience being on the secondary school campus. Usually an orientation day occurs as part of a "transition program", however, the Local Leader thought visiting to work on the Project was preferable:

> ...this year we thought that the science program was something that was more in depth and a bit more meaningful than one day at the high school having a taste test of various rooms and practicing going around the classrooms. We will do this as a transition project next year, or something like this, so they have a project. It was great fun. (Interview; 22/11/02)

Both principals expressed the desire for the link between the schools to continue.

The Secondary Principal thought that her students being able to work and interact with a "variety of different people in a focused way" was a good outcome of the Project. Not only did the students get an opportunity to work with other students of a different age, they were also able to interact with

members of Friends of Mt Capital and other people of the community at the local shopping centre (see Figure 8). An ongoing partnership has been formed between the schools and Friends of Mt Capital, with the two schools being placed on the Friends of Mt Capital mailing lists, and the Friends of Mt Capital meetings and planting sessions announced in the school newsletters, as a result of the Project. The President of Friends of Mt Capital thought that the social outcomes of the Mt Capital Native Grasses Project were "almost as important as the scientific part of it and that will help to create an awareness of the science part of it too" (Interview; 18/11/02). As a result of others hearing about the Project, Friends of Mt Capital received an expression of interest from another school to develop an environmental program.

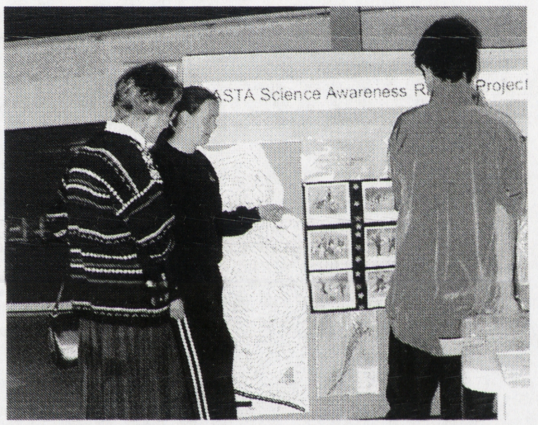


Figure 8. Students acting as explainers at shopping centre display.

The schools were also able to form links with other sectors of the community, such as local businesses and real estate agents. In her final report, the STA Coordinator commented:

> It was interesting to see the support that this project received from various levels of the broader community that would not necessarily be involved in 'science' activities, get involved in this activity, because it is related to an issue in the local area. (STAC Focus Questions)

The Local Leader also commented in interview about the support from the community of a "cross-school science project". The local shopping centre,

which hosted the student display, has requested that the schools provide "more displays of the same calibre". The Secondary Principal commented that "it is always good to have the name of the school in the face of, in front of the community" and brought to the attention of ASTA and other people who are working on the ASTA Science Awareness Raising Project (Interview; 13/12/02).

Success of the Project

In terms of the success of the Mt Capital Native Grasses Project the CRC expressed in their final report that "the project has been successful for those involved". They had achieved the aims of involving students in "working scientifically", and had established a working partnership between the two schools, and the schools with the community group Friends of Mt Capital. In her final report, the STA Coordinator identified some of the aims in the original project Nomination Form that were not achieved. This included a survey of the older members of the community and the planting of native grasses on the hill. When asked in interview if the Project had achieved what it set out to achieve, the majority of the CRC was very positive about its success. The Secondary Teacher commented that "it had worked a lot better that I expected" particularly with the limited time they had to complete the Project.

The Secondary Principal discussed that the Project had been successful because the different people involved had achieved their individual goals:

> Friends of [Mt Capital], they have a long term project to revegetate [Mt Capital] in terms of its natural vegetation and they have done a lot of work previously. Here's a little project that did some more and no doubt they will do some more work in the future. So I think their goal has been achieved. Certainly our goal, with that closer relationship with the primary [school], I think has been achieved. And I know that raising the community awareness of science in this particular project has been achieved because there was a big display at the [local shopping centre], for about a week, and there

> was also the same display down the foyer of our department in Tuggeranong. (Interview; 13/12/02)

Two CRC members were more reserved about the success of the Project, although they both recognised that the students "got huge amounts out of it" and there were limitations imposed due to timing and resources. The Friends of Mt Capital Representative expressed disappointment that the students did not become more aware of the work of Friends of Mt Capital and the type of people who volunteer for community groups involved in environmental action. The Community Representative thought that not enough community members were on the CRC and involved in the project "because it ended up being very school driven and not so much community driven" (Interview; 22/11/02). She thought that as a result the CRC were not able to get enough "information out to the community" about the Project.

4.3 ASTA Science Awareness Raising Package

Did the CRC Read the Package?

The Local Leader received the ASTA Science Awareness Raising Package mid-March, and it was distributed to the majority of the CRC members before the first CRC meeting. The STA Coordinator was very familiar with the Package as she had been involved in its development through ASTA. Both principals (one of whom was the Local Leader) reported having read the package in detail as well as the Community Representative, who was also employed within ASTA's head office. Both of the teachers and the Friends of Mt Capital representatives confessed that although they had scanned the document, they had not read it in detail. The Friends of Mt Capital President and Representative thought that the Package was a "really a good reference" and useful "framework", but that it was more directed at the schools who were actually involved in planning the Project. The Friends of Mt Capital Representative also commented that it reflected on the "level of

professionalism" of the ASTA Science Awareness Raising Project, which gave him more confidence in what could be achieved. The Secondary Teacher had not read the Package in detail because he became involved "late in the process" and so he had to focus more on "what are we going to do up there [on Mt Capital]". The Primary Teacher found the ASTA Science Awareness Raising Package overwhelming:

> To be totally honest the very first CRC meeting that I came to I felt that it went plung! straight over my head. I had no idea, and I looked at the booklet, and I was just going 'this is way too huge for me'. I just literally put the booklet aside and said to [the Local Leader] can you explain this? And she said this is what it is in simple terms and then that was all fine. So it was rather daunting at the start, I am not used to having that wad of information. It's just a different level that we work on in the school, project management is slightly different. (Interview; 22/11/02)

However, she also commented that when she looked back at it during preparation of the final report, in retrospect she could see how it would be useful for carrying out a project.

Did the CRC Use the Package?

The ASTA Science Awareness Raising Package was referred to infrequently during the course of the CRC meetings, and references were always initiated by the STA Coordinator. Only during the first meeting did the CRC look at the Package as a group, which involved the STA Coordinator providing a brief overview of what was in the Package and pointing out particular documents that could be of use during certain stages of the Project. Documents in the Package were referred to five more times in the remaining four meetings by the STA Coordinator, however, at no time did the CRC work through one of the documents as a group. The STA Coordinator commented that as the Package was a resource, it did not need to be read in depth "unless that particular section is something that you really need to look at" (Interview; 10/12/02). Therefore, she "didn't really insist" that they look at

the Package because the Project was moving forward and she "didn't want to detract from the time". She also commented on a conflict of interest:

> ...sometimes I found it a bit difficult because I didn't want to be... especially the first couple of meetings where we have got to be looking at this Package to make sure that we are on track... I was pushing, maybe steering, saying this is what needs to be done. I didn't want to have to take that role as much. Not that I didn't want to personally, but I wanted to see how the group is going to work with the Package, as opposed to me saying this is what I think you should be doing, you have got to do that. (Interview; 10/12/02)

In interview, various members of the CRC had differing recollections on how the Package was used, which were not consistent with my observations of the CRC meetings. For example, one CRC member recalled working through the Package "page by page" during the first CRC meeting, which I did not observe happening. In addition, the CRC's final report recounted that they had utilised some resources within the Package at the CRC meetings, which is also not consistent with my observations. In their final report, the CRC recognised that the ASTA Science Awareness Raising Package "did not drive the project" and explained that was not necessary as "the CRC by nature of their collective skills were people who had been involved in strategic planning and action plans." Although the Package was not used extensively within the CRC meetings, those who had read it reported keeping the ideas in mind:

> Yeah I did. I read it pretty carefully before our first meeting. And I referred to parts of it throughout... I think I had this kind of stuff in mind. But after I had read through a couple of times, I didn't go back to it. I mean I didn't sit and go through it. (Community Representative, Interview; 22/11/02)

The CRC's final report also stated that although they had not used "the initial planning documents" of the Package, they were "kept in mind". They thought that it could be "less wordy but it was useful to have the structure

there if we needed to refer to it". This sentiment was also echoed in interview by the STA Coordinator and Secondary Principal who thought it was "really good guide" for people who haven't been involved in a project like this before to have "a framework or structure they can work through".

When asked in interview, individual members of the CRC reported that they had not used parts of the Package outside of the CRC meetings either, except for the documents concerned with budgeting and reporting back to ASTA, which were used extensively by the Local Leader, STA Coordinator and others involved in those processes. The conditions of the $5000 grant that ASTA provided each trial community was that at the completion of their project they provide ASTA with a case study report, feedback on the ASTA Science Awareness Raising Package and a project financial report. The STA Coordinator was also required to provide feedback to ASTA in the form of ten "STAC Focus Questions", which included comments on the effectiveness of the Project in addressing each of the tasks listed in the Process Guide of the Package and feedback on the ASTA Science Awareness Raising Package. These processes of reporting back to ASTA caused frustration for the Local Leader who took on the majority of the responsibility for doing so:

> I found it a bit frustrating because it was too wordy. You can see the rate I work here. And I need something I can pick up and go "badum dum dum". If I hadn't have had [the STA Coordinator] at the other end, I would have gone mad with the reporting mechanism. And I found that that was really limiting. If I was to do a science project again I would say 'no, just don't give me a grant with parameters on it because I am too busy'. I just want to get the science bit done and this I found very worrying and stressful 'cause I had to stick to the dots and cross ts. And I still haven't got it finished off because it is not exactly science. Somebody wants it. You know, to me, the great science has been done... (Interview; 22/11/02)

As the STA Coordinator expressed in interview, part of the difficulty for the Local Leader was that records of spending were not kept over the duration of the Project and neither were tax invoices. The STA Coordinator reflected that

reporting back to ASTA "was one of the hardest parts of the Project" and that expecting the CRC to complete "lots of paperwork... really takes away a lot from the celebratory of the program" (Interview; 10/12/02). She thought this could detract from the benefits of being involved in the ASTA Science Awareness Raising Project and deter schools from being involved in similar projects in the future

> That's always an issue you know, if they have had a bad experience when trying to carry through a grant or submission of some sort, they are less... just judging by some of the comments, they rethink 'well do we really need the funds to do this? Maybe I could just pull the funds out of the school budget. We are doing this because it is such a valued program'. If they have got those funds available. Rather than getting the grant and then having to do all the other extra bits associated with [it]. 'Yes we have done this wonderful fantastic program but now we have got to do the amount of paperwork that goes with it'. (Interview; 10/12/02)

The Local Leader and STA Coordinator suggested that it would have been beneficial if the ASTA Science Awareness Raising Package was on disc or online, so the proformas could be completed electronically, and the project reports emailed back to ASTA. It could also allow for hyperlinks between documents that could streamline the process. At the time of reporting, the Local Leader did request an electronic version of the "Project Record" for the final report and this was provided by ASTA.

4.4 People of the CRC

How Did People Get Involved?

It was through her position at ASTA's head office that the Community Representative became aware of the ASTA Science Awareness Raising Project. She "alerted" the principals of both the primary and secondary school to the Project through the advertisement in the *Australian Science Teachers Journal*. The principals, a teacher and the two community representatives met at the

secondary school to identify local issues in their area and respond to the request for expressions of interest. The STA Coordinator heard about the ASTA Science Awareness Raising Project through the ACT branch of the STA, and volunteered to be involved. She contacted the groups who had put in an expression of interest and offered to assist in their application to be considered to participate in the trial. The collective who were to become the Mt Capital Native Grasses Project, accepted her offer and together they completed the nomination form. The Local Leader contacted other possible partners to be involved in the Project and to support their application, including Friends of Mt Capital. The nomination form contained agreements from Friends of Mt Capital, three local plant nurseries, a local Landcare group and the Australian National Botanic Gardens.

Following the success of their application, the STA Coordinator sent a congratulatory letter to all of those listed "informing them that they had received the grant from ASTA to undertake this project, and invited them to come to the first meeting and consider becoming part of the CRC team" (STAC Focus Questions). Some declined, preferring to become "resource people" - people involved more peripherally in the Project. The teacher who was involved in writing the application was unable to continue due to other commitments. The two principals identified teachers from both schools that could become part of the CRC, the Primary Teacher came on board from the first meeting, but the Secondary Teacher became involved later, around the time of the third meeting. Meanwhile, the President of Friends of Mt Capital had sent an email to Friends of Mt Capital members which resulted in another Friends of Mt Capital representative joining the CRC.

Why Did People Get Involved?

The Community Representative expressed in interview that she had wanted the local community to become involved in the ASTA Science Awareness Raising Project because it is "a strong community and has a history of doing

things that are sort of community based" and because she thought "it would be a good thing for them [students] to do to see how you can apply science in the real world" (Interview; 22/11/02). The Secondary Principal also expressed similar reasons for becoming involved; for students "to see that science has a practical and community application". The Local Leader explained that she is interested in "anything to do with science" and that she would like her students to have a sense of their surroundings:

> What I would like to achieve out of this is the children to be aware of things in their environment. I just wonder how many of them have been up to [Mt Capital], and how many are aware of that park project. And to make strong links with our high school and the community by quality sort of living, rather than doing graffiti up there. To raise not only science awareness, but to make the contact with the wider community...through science awareness. (CRC meeting; 11/4/02)

The STA Coordinator's focus was more community based, she participated in the Project because she "wanted to see what we could do within the community in terms of raising some science awareness... not just within the school" (Interview; 10/12/02). The Friends of Mt Capital Representative also listed all the above reasons for becoming involved but also expressed a desire to "develop links" with the schools to achieve "greater community involvement" in Friends of Mt Capital. The President of Friends of Mt Capital agreed to be involved because she has a "personal interest in the schools", in that her children had attended them and now her grandchildren do, and she wanted to provide her assistance. Neither of the teachers were asked to comment on why they got involved, because as the Local Leader explained in interview "the direction comes from above, me, as the principal organised it ... I suppose in some ways the staff had it put upon them" (Interview; 22/11/02).

What Did Individuals and their Affiliations Gain From Being Involved?

When asked in interview what people gained personally from being involved in the Mt Capital Native Grasses Project, there were two main benefits cited. First, making the social links with other people in the community through the CRC was mentioned. Second, CRC members discussed gaining experience in working with other people, and in running a project, in terms of acquiring new skills in project management. For example, one CRC member commented:

> On the whole, probably more a different slant, the whole project management. In a school you have got different ways or just different projects. And having a look at how this project was run and all the different entities involved, and that sort of thing, for me that was really fascinating. And seeing how it progressed from when I got involved. (Primary Teacher, Interview; 22/11/02)

In terms of the benefits for the associations to which people were affiliated, these were related to the social links that were made during the Project. The Local Leader reported that the primary school students had gained "a strong sort of link with the high school rather than the artificial 'Come up on one day and see what high school's like'" (Interview; 22/11/02). And this was echoed in terms of experience in peer support for the secondary students, by the Secondary Teacher. The Friends of Mt Capital representatives commented on "renewed enthusiasm" of their members due to the display of support from the community, and an increase in membership. The STA Coordinator commented on the ACT branch of the STA gaining exposure within the schools that led to greater involvement in the organisation by teachers.

How Did People Work Together?

The Mt Capital Native Grasses Project involved diverse individuals coming together to work as a group on a science-related issue in their community. In addition to the project-related activities, there were various people-related

issues that had to be negotiated. This included determining the role of the CRC and those of the individual members of the CRC. The roles that people chose to undertake determined how the CRC worked together as a group.

Role of the CRC

The CRC members commented during meetings that it was important that the CRC include representation from the different sectors of the community (e.g. business, community groups and individuals) to ensure that the Project would involve the broader community, not just "the school in isolation". However, many recognised in interview that they were unable to achieve this. Rather than retaining the responsibility of coordinating the activities of the Project, from observation of the CRC meetings it became apparent that the CRC was referred to and used as a resource and support for the student-based activities. The group provided information, encouragement and practical assistance when required by the teachers who became responsible for driving the Project.

The Roles of Individual Members

The STA Coordinator commented in her final report "the CRC members had defined their roles early on" (STAC Focus Questions). However, these were not so much discussed and negotiated but rather they evolved as a result of people's background and their affiliation. She commented that if they had spent more time at the early CRC meetings really planning the Project, "nutting it out" by using the Package, then they would have been able to "assign those roles fairly clearly for each member of the CRC". The STA Coordinator often reminded the group that the roles of each member should be discussed with the project tasks shared around the CRC:

> This is why we have got the CRC. And that's why putting together that action plan, once you have got the ideas of what's going to happen. At the meeting we will go through it and then we are

> going to sign our names and things to various components to assist in various ways. (CRC meeting; 16/5/02)

The Local Leader took on the role of chair of the CRC meetings and the role of project manager including responsibility for the budget. This role of project manager was not negotiated during the CRC meetings, but rather it naturally progressed from her position as Principal of the primary school. As she commented herself; "principals always say this 'how much did the rip lines cost?' - I am budgeting" (CRC meeting; 16/5/02). This role also developed over the course of the Project. For instance, during the first meetings of the CRC the Local Leader sat at various places around the table in the staff room, whereas from the third meeting onwards she always sat at one end by herself. As chairperson of the CRC meetings, the Local Leader often opened and closed the meetings, as well as directed the flow of discussion. When issues concerned with project management were discussed within the CRC meetings, they were usually raised by the Local Leader and occasionally by the STA Coordinator. These included issues related to the timeline of the project, logistics of the activities and budgeting. The Secondary Principal took a less active role in the Project. She attended the first two meetings of the CRC and met with the Local Leader/Principal of the primary school to discuss possibilities for the Project, but visualised her role more as providing "executive" support:

> And there is a lot of research in education that says that any project must have the support of the Principal in order to be successful. If it doesn't have their support, it is unlikely to be successful. My role was really supporting the [secondary school] people who were doing it and sitting on the steering committee. It wasn't my job to actually go out and preach the gospel I suppose. (Interview; 13/12/02)

The Mt Capital Native Grasses Project was fortunate in that the STA Coordinator lived locally and could attend the CRC meetings, which was not the case for all the other trial projects. As such her role was more ambiguous,

however, in that she could become more involved in the Project as a member of the CRC, rather than just a support person. In this case, she may have ended up driving the Project and promoting the ideas in the Package, rather than allowing the community to interact with the Package according to their own inclination. The STA Coordinator commented that she tried to avoid taking on this role, and instead saw herself as providing "support, advice and encouragement" to the Local Leader throughout the Project. She assisted her with the "financial aspects of the Project" and administrative tasks such as the mid-project and final reports. The two were often in contact outside of the CRC meetings, as the Local Leader commented in interview "we used to email a lot".

With the teachers "driving" the Project, they became responsible for much of the planning of the Project activities. Their planning was guided by the ideas that the principals came up with during their meeting. For example, following their meeting, the principals reported back to the CRC that "we thought it would be good to have the groups come together for at least three occasions as an excursion [to Mt Capital] (Secondary Principal, CRC meeting 18/4/02). Later in the following meeting (16/5/02), when the Secondary Teacher joined the CRC for the first time, the Local Leader (Primary Principal) reported to him

Local Leader:	[The Secondary Principal] and I saw that there would at least be three occasions when the two groups would go to the mountain...
Secondary Teacher:	Umm
Local Leader:	That's where your planning will come in and you'll do preparation stuff with kids at school. And then three times between now and when we finish the project, do things on the mountain together. Either measure or predict or plant...
Secondary Teacher:	Okay.
Local Leader:	...to fit in with the pattern. Record all of that and make a display...

The student activities did end up involving three excursions, two to Mt Capital and one to the secondary school. Much of the actual planning of the Project therefore occurred outside of the CRC meetings, either at the principals' meeting or teacher's "planning day". The STA Coordinator's comment in her final report, "that the CRC spent a great deal of time and effectively planned the project in detail", is not consistent with these observations.

Not only did much of the planning of the Project occur outside the arena of the CRC, but also much of the decision making. Some of the decisions about how the Project would develop had obviously been made at the time of the Project nomination. Although ideas were often brainstormed during the CRC meetings, decisions made by members not involved with the schools were rare. In addition, there was reluctance to pass responsibility on to other members of the CRC:

STA Coordinator:	Could the advertising of the Project be done by say, not the teachers, but somebody else in this group. Take that role on, as sort of like a communications person or advertising person.
Secondary Principal:	I think the teachers would need to say what it is that they are going to do and then someone else could put it together.
STA Coordinator:	Put it together and then look at those (inaudible).
Local Leader:	We want to give them a lap top, and the timeline, and they can prepare the activities (inaudible). For a teacher, that takes up so much time, getting an excursion note ready to go out immediately. And that's why I thought, both [the Secondary Principal] and myself, so it's accurate and...
STA Coordinator:	That's why I thought... take the advertising away, because it is sort of an added extra for them. Somebody else can do it as long as the teachers can provide that information (inaudible).

Local Leader: We need to see the teacher's ideas first.

(CRC meeting; 18/4/02)

The issues associated with the Project such as the scope and activities, "tangible outcome", communication and budget were decided largely by the principals/Local Leader and teachers with student involvement in mind. As such, the teachers were left with the responsibility of "how we could make it work" and both expressed in interview some anxiety about this:

> ...my fear in the end, was the two teachers, and basically we have a project to do. And the fear was what are you going to do and what am I supposed to do? Where are we going? So I was a bit in the dark... (Secondary Teacher, Interview; 19/11/02)

Although they both commented that they were provided with sufficient support from the CRC, it was difficult for the teachers because neither was familiar with the ASTA Science Awareness Raising Package and they felt "a bit in the dark". However, both commented along the lines that they just "focused on what am I here for, what are the expectations on me, what do I have to do to achieve this program" (Secondary Teacher, interview; 19/11/02). Many of the CRC members, such as the Friends of Mt Capital President, were appreciative that teachers were able to do this.

The Friends of Mt Capital President saw her role on the CRC as providing "background knowledge" about Mt Capital "so the schools could run with it". However, as she "was a bit pressed for time at the time" she was reluctant to take on a more active role. She had been involved with Friends of Mt Capital since 1996, when Mt Capital was "declared a nature parkland". She reported not knowing "very much at all when she started" as President, but thought:

> I would just do it for a short while and if somebody like me who doesn't know much can do it, other people might be more inclined to do it. If they don't think they have to be an expert. (Interview; 18/11/02)

Over the six years she had been involved, she had "learnt an enormous amount along the way" and that is what she felt she brought to the Mt Capital Native Grasses Project. Indeed, the majority of her exchanges during the CRC meetings involved passing on knowledge about Mt Capital and its flora and fauna, as well as information about the people and organisations (e.g. Parks and Conservation) involved with its care. This local knowledge of the area was recognised as invaluable to the running of the Project by the Local Leader and other members of the CRC. The other Friends of Mt Capital Representative was only able to attend two of the five CRC meetings "due to the pressures of working fulltime". He expressed in interview his "regret that I missed seeing the school plans" but by attending a few meetings believed he was able to contribute with "a few ideas to put in there".

Whilst one of the interested community representatives was only able to attend the first CRC meeting, the other attended the last three. The latter had been the member responsible for initiating the Project, by bringing the ASTA Science Awareness Raising Project to the attention of the principals. As such, she felt that she had been "more involved in the beginning of the Project and getting it started" but because the Project had been school-driven, didn't "really feel like I did very much...I just tried to help where I could and just supported [the Local Leader]" (Interview; 10/12/02). As she was employed in an administrative role in the ASTA head office, her support involved providing the Local Leader with "administrative energy". As a representative of the community, however, she did try:

> ...to keep the focus broad. I kept saying to various people you know we have got to keep thinking about the community as well, rather than just the school and the teachers. And even though we have to consider them, that they are not the whole project. We have to consider involving the community and letting the community know. But I did feel that, that was a bit of a 'voice in the wilderness' there. (Interview; 22/11/02).

4.5 Raising Science Awareness

Case Study Findings

There are two steps involved in the Model aimed at raising scientific literacy within the community: the first was to ensure that the community was aware of, if not involved in, the Mt Capital Native Grasses Project; and the second was to involve people in activities that would move them towards greater science awareness.

Involving the Community

The Mt Capital Native Grasses Project was to involve local schools, business and industry, representatives of local science and interest groups, as well as the "broader community" who live in the local area. The Mt Capital Native Grasses Project varied in success in engaging the different sectors of the community. With regard to involving schools, the Project was deemed successful by all members of the CRC. They were pleased with the participation of two classes of differing ages from the two schools, and commented it was "enough for management purposes". It was important to the teachers and principals that the students "feel that they are having some significant input or activity... not just planting plants" and that they developed skills (Secondary Principal, CRC meeting; 11/4/02). The STA Coordinator also commented that these skills may also "get communicated back to the community in some aspect" (CRC meeting;11/4/02).

Members of the CRC were asked in interview if they believed there was enough business involvement in the Project and nearly half declined to answer. There were no representatives of local business on the CRC, and there was general agreement amongst those that did respond that there could have been more business participation in the Project. Although the CRC had pledges of support from several local nursery businesses in their application,

they were not able to follow through at the time of the Project, and the display at the local shopping centre was the extent of business participation. As the STA Coordinator commented; "it takes time to try and find the right person from the business community that can join the CRC" (Interview; 10/12/02). The Local Leader explained that although on behalf of the CRC there "was interest to do it", they just didn't have time to follow-up and encourage that participation.

There was also general agreement from the CRC members that more could have been done to involve the broader community. There are two ways of looking at "involvement" of the community, as the STA Coordinator explained:

> I suppose the focus was on what the kids were doing, what the school was doing, and then that's communicated. As opposed to what I would have seen with the national project where 'what's the issue in our community? Let's get all the community together', and 'yes we are going to involve the school but we are also to involve everybody else in the community'. (Interview; 10/12/02)

The Mt Capital Native Grasses Project was more successful in the former method of involving the community communicating the students' activities via the media and the display at the local shopping centre. Unfortunately, as the STA Coordinator commented in her final report, this meant that much of the community "may not have heard about the Project until after it had been completed" (STAC Focus Questions). In relation to active involvement, there were representatives from the local interest group Friends of Mt Capital on the CRC, as well as the other interested community members who were also parents of children at the schools. In addition, they had assistance from a ranger and a couple of other community members during the students' visit to Mt Capital. Time was cited in the final report as the "crucial factor" for determining the amount of community involvement and, according to the Community Representative, this was the reason for some community

members not being as "involved in the project as they initially wanted to be" (Interview; 22/11/02).

Several members of the CRC discussed in interview their ideas for having more community participation in the Project. The Community Representative commented that it "requires a pretty strong push in the first place from the community", as well as the need to "target people in the community that you know are going to be aboard and be enthusiastic and follow the Project through and involve them in it from the start" (Interview; 22/11/02). Communicating about the Project through its duration, and not just at the end, was also mentioned by the Primary Teacher, even "having a launch". However, the Local Leader commented that the nature of the ASTA Science Awareness Raising Project and the evaluation placed limits on this:

> No, I think there could have been more. But given more time...we were constrained by the parameters of the research project. I am the sort of person that gets stuck into it straight away. I remember holding back saying I can't put it in the newsletter because you wanted to do some surveys and I couldn't say too much in case [it] influenced the surveys in the beginning. So I was very... I said we have got this grant and then I shut up for a while. Whereas normally I would be out there talking about it. (Interview; 22/11/02)

The Secondary Principal talked about the display being "a passive way of developing community awareness" and they should have been more "proactive" by surveying people in the community "about their opinions" and having larger community events such as clean-up days, and sausage sizzles on Mt Capital (Interview; 199/11/02).

Raising Awareness of the People Involved in Science in the Community

The Mt Capital Native Grasses Project helped to raise awareness of people involved in science in the community, at least within the CRC and for the school students. There was much discussion within the CRC meetings about

local people in the area who had been involved in studies of Mt Capital, or had skills or knowledge that could be useful for the Project. Although the Project did not involve "scientists" per se, it did involve people like the Friends of Mt Capital members and the ranger, who are involved in science-related activities. There was discussion within the CRC about people involved in community groups like Friends of Mt Capital, that although they are not "scientists in a formal sense", and may not see themselves as scientists, through their activities and "actively engaging in the discussion...about how the hill should look" they *are* "actively being scientists" (CRC meeting; 11/4/02). As the President of Friends of Mt Capital commented, when a person like her "who doesn't know much can do it", this presents science as accessible to the ordinary person. The CRC discussed that this was an important outcome for the students:

> We talked about that most of the people involved in [Friends of Mt Capital] [are] retirees. And I think it is good for the kids to learn that. The kids to recognise that what's happening there is science, the planting and the regenerating of the grasses and so forth. And that those older people who are doing that stuff are actively being scientists. (Community Representative, CRC meeting; 11/4/02)

Raising Awareness of Mt Capital and its Environmental Issues

In their final report, the CRC commented that "the whole project created a seed of interest within the community about the [Mt Capital] area". As the Friends of Mt Capital Representative commented, as far as awareness of Mt Capital, the Project has "definitely raised it amongst the CRC group". The Project also had students from both schools visiting the area and talking about the vegetation both in the classroom and within the community. As the Friends of Mt Capital President commented, the students "have become more aware of their local nature park" and that as a result it was more likely that "parents were aware of it" (Interview; 18/11/02). But although she could see how awareness had been raised within the schools, she was more reserved

about awareness within the broader community, as were all of the other CRC members in interview. As the STA Coordinator discussed, unless people were "linked with the school community", they may not have been aware of the Project or the issues of Mt Capital. Part of the difficulty in raising the awareness about regenerating native grasses, the Community Representative discussed, was that compared to other environmental issues such as "junk in the river... it's not quite so visible" (Interview; 22/11/02).

Raising Awareness of Science and why it is taught in Schools

Many CRC members were reluctant or found it difficult to respond in interview to whether they had thought the Project had raised awareness of why science is taught in schools. For many, this was because they were not aware that this was one of the stated aims of the ASTA Science Awareness Raising Project and therefore had not thought about it prior to the interview. Others believed that the students and other people in the community are well aware of the reasons that science is taught so that "it's a strange question" and a "very strange aim". Whilst others commented "I don't know".

Involving Participants in Using Science Processes

The Project did involve students in working scientifically. They collected data related to the vegetation of the hill, and used this to construct a "3 point action plan". However, as this information had already been collected by Friends of Mt Capital, and was not unknown scientific information that could help address the issue identified by the community, it did not translate into information that the CRC could use. The CRC, as a group, did not use science processes, in that they were not involved in identifying questions related to the issue and collect science-related information that underpinned their chosen issue which they could then use to make an informed decision. As the Friends of Mt Capital Representative identified at the first CRC meeting, there was potential for this to occur:

> In fact one of the things I would like to see drawn out of this, is the discussions about how should the hill look. What are the options for what the hill could look like? We have had many discussions at committee levels about do we reproduce an entirely native vegetation woodland? Do we go for a sort of a mixture? What are the options available to us? (CRC meeting; 11/4/02)

ASTA's Interviews with Community Members

In this section, the results from ASTA's pre- and post-project interviews with a representative sample of the Mt Capital community are presented as further evidence of the impact of the Project on the community. A total of 24 people were interviewed pre-project, of which 23 also participated in a post-project interview. As reported in Rennie & ASTA (2003), the results represent the interviewees only and cannot be considered to be representative of the local community or the ACT. It is for this reason, and because the sample sizes are small, that tests of statistical significance have not been conducted.

Raising Awareness of the Mt Capital Native Grasses Project

The pre-project interviews revealed that 75% had heard about the Mt Capital Native Grasses Project. Only one more interviewee (78%) had heard about it post-project. People who said they had heard about it were asked what they thought the Project was about. In the pre-project interviews, one third of the interviewees who had heard were unable to give any details about the Project. Another third had some understanding, commenting along the lines "getting kids involved in identifying flora with the view to regenerating the native species". The other third of interviewees who had heard pre-project, had a good understanding, for example:

> Doing some planting on the lower slopes of Mt Capital. Aim is as much about public awareness as it is about science. About communicating science and the importance of science.

In the post-project interviews, 44% of people had increased their knowledge about the Project. Of those who had heard post-project (78%), whilst 22% still could provide no details, the percentage of those who had a good understanding of what it was about increased to 61%. However, the effect of participating in the pre-project interviews on people's awareness of the Project should be taken into account.

Raising Awareness of the Science behind the Project

Community members were asked to rate their knowledge about science in the area of regeneration of native grasses in both the pre- and post-project interviews (see Figure 9). They were asked to respond on a five-point scale where 1 represented 'very limited' and 5 'very extensive'. The mean response pre-project was 2.39, with very little impact of the Project on interviewees' understanding of the science resulting in a self-rated post-project mean of 2.48. However, there was a small increase in interviewees self-rating of their confidence to find out more about the science behind the issue (see Figure 9). The interviewees pre-project mean response of 3.39 increased to 3.83 post-project, where 1 represented 'not very confident' and 5 'very confident'. Interviewees were very positive about how important it was for members of the community to know something about the issue, which was asked in the post-project interview only (see Figure 9). Again they were requested to respond along a five-point scale, where 1 represented 'not at all important' and 5 'very important', and the mean response was 4.22. People were also asked why they responded the way they did, and the most common reasons given for why people should know something was the importance of conserving our own backyard (61%), need support for the proper management of Mt Capital (44%), and the need to understand more about the science behind the issue (39%).

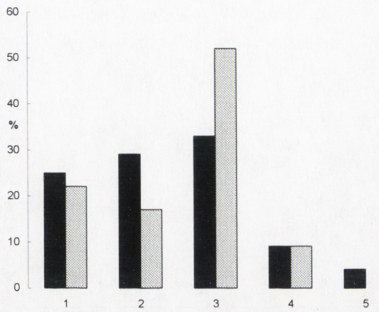
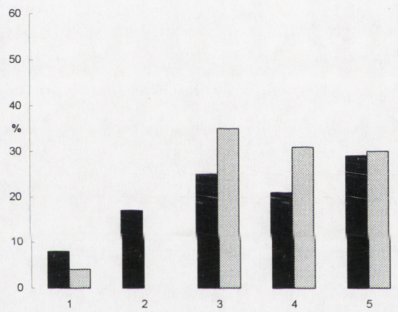
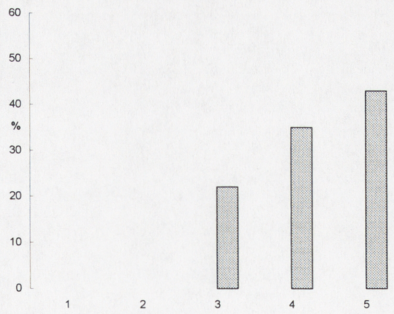
			Mean Scores	
			Pre	Post
Self-ratings of knowledge about science in the project area				
Very limited		Very extensive	2.39	2.48
Self-ratings of confidence in being able to find out more about science in the project area				
Not very confident		Very confident	3.39	3.83
Belief in importance for the community to know about the project issue				
Not at all important		Very important	-	4.22
	Pre-project Post-project			

Figure 9. Self-ratings for interviewees' ideas about the science behind the Project.

Raising Awareness of Science and why it is taught in Schools

The interviews with community members by ASTA asked for people's ideas about science because:

> It was important to establish how knowledgeable the interviewees were about science in general terms to provide some basis for judging the practical significance of any impact of the community projects. It would be easier for a project to impact upon a community with little idea about science than upon one that was very knowledgeable, for example. (Rennie & ASTA, 2003, p. 8/91)

The pre-project interview asked interviewees to rate their beliefs about the usefulness of science in finding answers to problems in different sectors of the community. They were asked to respond on a five-point scale where 1 represented 'not at all useful' and 5 'very useful'. Overall, the results were very positive with an average mean of 4.49, and for this reason the question was not repeated post-project (see Figure 10).

A question in the pre-project interview asked interviewees what they thought science is about. If people had difficulty answering, alternatively they were asked to nominate three words related to science and why they had chosen them. People gave a variety of ideas so a classification scheme used in Rennie & Williams (2002) was used to group the responses into five categories which form a hierarchy of understanding (Rennie & ASTA, 2003). One interviewee (4%) gave only an attitudinal response saying that science was interesting, exciting and educational. Eight interviewees (33%) gave a vague idea, such as "science is understanding the world" and another eight (33%) gave comments that indicated that they perceived science as a body of knowledge. Four (21%) made a reference to the processes of science and the nature of research, whereas two (8%) gave comprehensive descriptions of science including mention of science for decision-making or the nature of the relationship between science and society. In the post-project interviews, people were informed of their previous response and asked whether their ideas of the

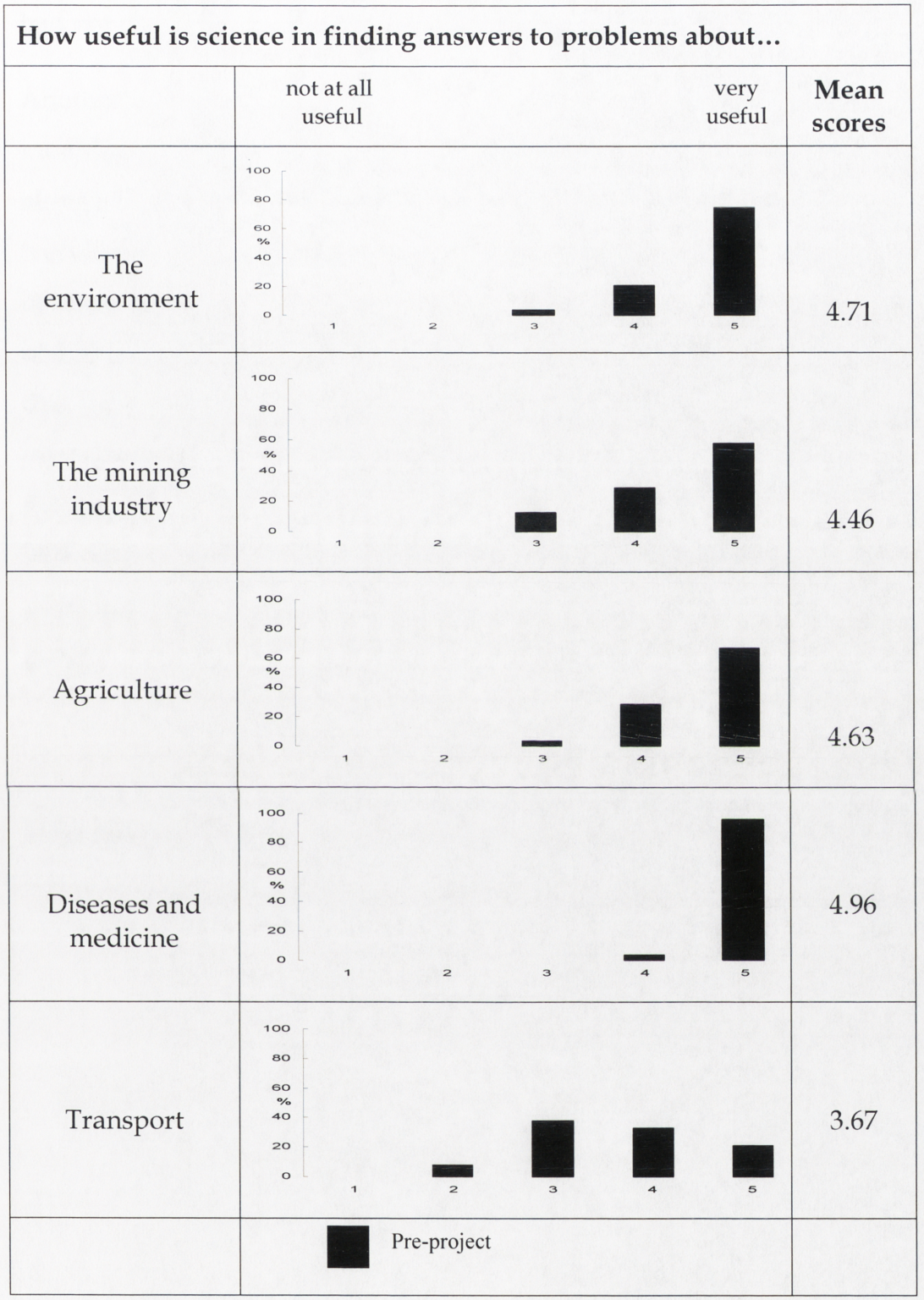


Figure 10. Responses for community beliefs about the usefulness of science (%).

nature of science had changed. All of the interviewees said that their ideas had not changed.

Another question in both the pre- and post-project interviews asked the interviewees to rate how important science is to the ordinary person, again along a five-point scale. A score of 1 represented 'not at all important' and 5 'very important'. There was a small decrease in their ideas of the importance of science, with a pre-project mean score of 3.48 and post-project mean score of 3.30 (see Figure 11). When asked in a follow-up question why they thought this, there was a variety of answers given in both the pre- and post-project interviews (see Table 2.). The most common responses were along the lines that people were generally unaware that they are using science (33% pre and 39% post), that science is more important than people think (33% pre and 26% post), and that science and research are behind many things (33% pre and 26% post).

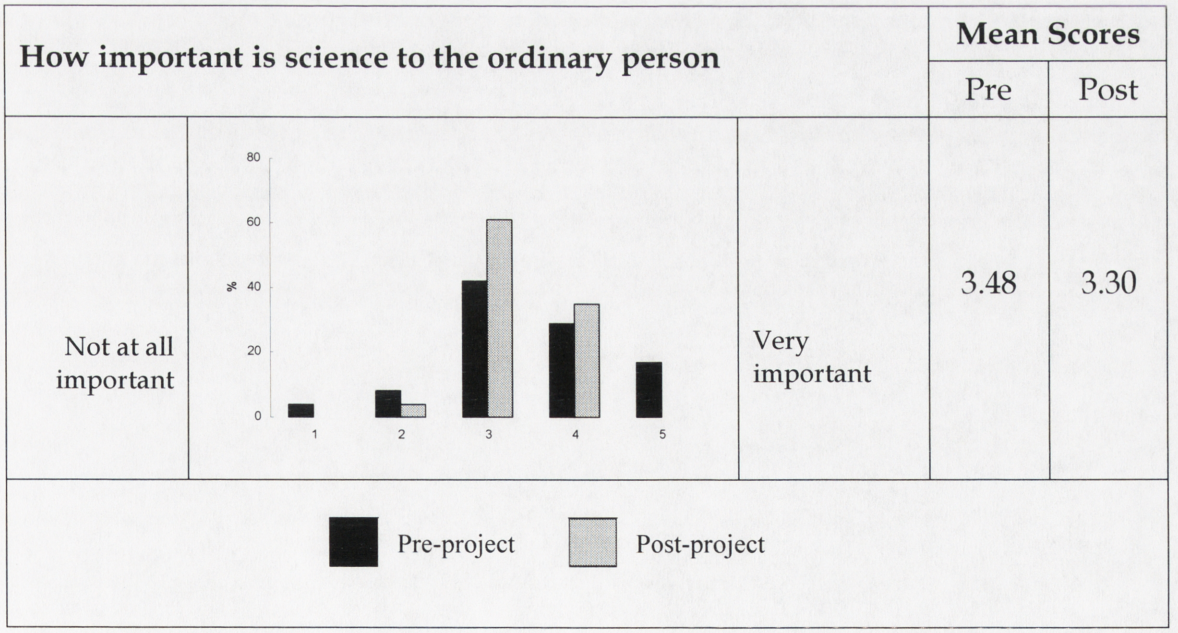


Figure 11. Responses for community beliefs about the importance of science (%).

Why science is important	Pre-project	Post-project
It's more important than people think	33	26
Science/research behind many things	33	26
People need science knowledge	17	22
Depends on people's interest	17	13
People unaware they are using science	33	39
People are not interested	8	17
Science is too hard	4	4
People don't use science	12	-

Table 2. Community ideas about why science is important to the ordinary person (%)

The interview of representative community members by ASTA also asked interviewees pre- and post-project why they thought science was taught in schools. People giving vague responses such as "its an essential part of their education" decreased from 13% pre-project to 4% post-project, and those giving a comprehensive response including reference to students understanding more about their world and the processes of science, increased from 83% to 92%. In addition, people were asked whether they thought that if students do not go on to have a career in science, the science they do at school would be of any use for them. In both the pre- and post-project interviews, a large majority (96%) thought it would, and when asked to explain, they discussed that it was necessary to understand the world around them and that everything involves science. The only interviewee (4%) who disagreed explained that she did "physics, chemistry and biology" and hasn't used them since she left school.

4.6 Success of the Mt Capital Native Grasses Project

Aims of the ASTA Science Awareness Raising Project

As the ASTA Science Awareness Raising Project was funded by DEST, the Commonwealth Government had several aims they wanted to achieve

> This project will seek ways of building effective partnerships between schools, their communities and local industries to promote understanding in the educational and broader community of why science is important, why time is spent on it at school and why scientific literacy is a desirable outcome of schooling for all students (*Australian Science Teachers Journal*, July, 2002)

Not only did they want to promote scientific literacy in the "broader community", but to also illustrate the importance of science education, and include strategies to involve the various stakeholders of science education - schools, community and business/industry. At the level of government the decision was made to "think outside the square" and fund the development of a model that would actively engage communities, and be adaptable to their local circumstances and consistent with local science curricula. The Model was based on the definition of scientific literacy set out in the Goodrum et al. (2001) report, and therefore was not about teaching science facts to the community, but rather to model science process and working scientifically (Rennie & ASTA, 2003).

Were these Aims Achieved by the Mt Capital Native Grasses Project?

In terms of forming effective partnerships between the various stakeholders, the Mt Capital Native Grasses Project had limited success. There is no doubt that the Project had great success in involving students in a science-related project and connecting them with "resource people" in the community as evidenced by the school staff's positive comments. The Project became school-focused, however, and there was general agreement amongst the CRC members that there was not enough involvement of the other stakeholders on

the CRC. The involvement that did occur was not "active", people were not involved in working scientifically and making decisions that would determine the outcomes of the Project. Not only was there not enough representation of the other stakeholders on the CRC, but there was also limited involvement of the broader community in the Project generally. With this in mind, there could only be limited opportunities for the Project to have an impact on the "broader community" in terms of raising science awareness. These findings were supported by the results from the interviews with community representatives carried out by ASTA, which reported very little change in interviewees' ideas about science post-project.

What had an Impact on the Achievement of Aims?

Time

Time was considered the largest constraint on what could be achieved by the Project. The CRC had five months to plan and execute the Project which they considered "a very tight timeframe" and this was recognised by ASTA. The "grand ideas" of many of the CRC had to be scaled down by the limited timeframe. The amount of time was also considered by the CRC to limit the involvement of the broader community on the CRC and in the Project, and also the communication about the Project back to the community. Some members of the community who had expressed a desire to be involved in the Project were not able to follow through due to other commitments. Others who became involved with the CRC had to take on more of a backseat role due to their other commitments.

As it was necessary to plan the Project after the school year had begun, the school staff commented that it became an "add-on" instead of part of the curriculum planned for the term. As the Local Leader commented, schools "plan so much further ahead" with the following year's activities usually planned at the end of the year. In its final report, the CRC commented that "it

was difficult to find time to fit the project in between the already established demands of the school program". If they had more preparation time "to plan and implement the activities better" the CRC believed the Project could have worked "more effectively as an integrated whole term's program".

> This was a worthwhile exciting and engaging project BUT it needs to be embedded as a valued part of the curriculum, not an added extra to be squeezed into an already overcrowded curriculum and that relies on the professional and personal generosity of the people involved - teachers, community members and students. (CRC Final Report)

Working within the school's schedule was seen as one of the challenges in carrying out the Project. The Local Leader commented that as Principal of the primary school, applying to take part in the trial the year before meant that she "didn't even know who my staff would be this year". Not only was finding "committed staff" a challenge for schools, but also as the Secondary Principal discussed "finding the right class, from our point of view, in terms of students" (Interview; 13/12/02). As the secondary school curriculum is organised on a semester basis, there were issues with having "the same students involved in July as we do have in June". She also discussed that "finding that mutually convenient time is always difficult" so the science-related project doesn't impact on the time reserved for other subjects. Staff also had "non-excursion periods" and other student commitments to negotiate. In addition, as the Project involved both the primary and secondary students working together, the two schools had to "co-ordinate our times".

The time of year, in terms of the season, also presented challenges for the Project. Winter was not a convenient time to carry out a project concerned with native grasses as identifying them was difficult due to the lack of flowers, and planting them considered a "waste" of time. Students also had to contend with inclement weather during their excursions to Mt Capital.

Support from ASTA

The support that the Mt Capital Native Grasses Project received from ASTA was generally recognised as adequate by the CRC. The members were pleased with the financial support provided by ASTA in terms of the $5000 grant, and the majority of this ($3000) was used for teacher release. Teacher release involved relieving the teachers from their class work and playground duty to plan and execute parts of the project. According to the CRC's final report, this included "time for contact with the community", the teachers "planning day", contact with the media and the display at the local shopping centre. In their final report, the CRC commented that the teacher release was "essential to the success of the Project". Support and guidance was also provided to the CRC in the form of the ASTA Science Awareness Raising Package, which was considered a "useful resource" by those who had read it. The other main support provided by ASTA was the STA Coordinator, and members of the CRC were very positive about the assistance she provided:

> [The STA Coordinator] was fantastic. She was there when she could be and got as much information out to people and was willing to help and all that kind of stuff... Yeah she was great. She was definitely part of the project. And having her onboard, you know, on site, was particularly helpful. (Community Representative, Interview; 22/11/02)

The Local Leader in particular said that it was essential to be able to have personal contact with someone who could answer your queries directly.

There were comments from various CRC members that conveyed that ASTA could have done several things better. It was thought that ASTA could have been more sensitive to how schools operate in terms of procedures and timelines. As previously mentioned, schools plan student activities the year before and therefore confirmation of the community's success to take part in the trial would have been useful at the end of 2001, as originally planned in the ASTA Science Awareness Raising Project timeline. Unfortunately this was

delayed and did not take place until the beginning of 2002. The communities who had been successful were contacted via email by ASTA. This was not sufficient for the Local Leader, who according to the STA Coordinator required a "more formal letter that she could take to the boards of both schools" (Interview; 10/12/02). The Local Leader waited for written confirmation but when this was not forthcoming, the STA Coordinator provided the required letter. This meant that "the CRC started fairly late" and essentially delayed the commencement of the Project.

Members of the CRC had varying knowledge of the ASTA Science Awareness Raising Project and Package depending on when they had become involved in the Mt Capital Native Grasses Project and whether they had read the Package. For example, the two teachers who planned the activities of the Project had not read the ASTA Science Awareness Raising Package in detail and were not very knowledgeable about the ASTA Science Awareness Raising Project

> One thing I wasn't aware was how significant it [ASTA Science Awareness Raising Project] was in terms of...It just seemed to get more and more involved that became quite clear. Well, when we had the exhibition over at [the local shopping centre), Professor Léonie Rennie and she was talking to me about a few things. And I thought this is really a significant program and it really didn't hit home until she talked to me about what she and ASTA were looking at, so... From that point of view it might have been in that document there. I had sort of scanned through it. I was just told before, I was informed we were going to do a study up there and I was just getting done. (Secondary Teacher, Interview; 19/11/02)

It was expressed by the STA Coordinator that it would have been useful to have a meeting between the community and ASTA, or "like a mini workshop of the package", prior to the Project. She thought it would have been useful for the CRC "just to hear where they [ASTA] were coming from" (Interview; 10/12/02). ASTA's original timeline had scheduled initial meetings with each community before the commencement of the trial. However, according to the STA Coordinator, the first meeting with ASTA was held just before the mid-

project report was due (end of June), and this only involved the school principals and the STA Coordinator. The Local Leader commented that the ASTA Science Awareness Raising Project and Package could have been introduced to teachers through a professional development day. She expressed in interview that this would have made the direction for the Mt Capital Native Grasses Project appear less "top-down" and teachers would have claimed more ownership.

4.7 Summary

The main aim of the Mt Capital Native Grasses Project was to raise awareness of science within the community through the study of native grasses on the hill. The Project involved the Year 6 and Year 9 students from the local primary and secondary school, respectively, in scientific studies of the vegetation of the hill. It culminated in a display of the students' work at the local shopping centre, the main communication activity of the Project. Although a CRC of nine individuals from the school and community was formed to coordinate the activities of the Project, the planning and execution became the sole responsibility of the teachers of the two year levels. As such, the Project was "school-driven" and it became based around the educational outcomes for students. The educational value for students was recognised as the most positive outcome of the Project, as well as the development of "strong social links" between the two schools. There was limited involvement of the community outside of the school, which constrained the potential of the Project to raise science awareness amongst the "broader community", and the aims of the ASTA Science Awareness Raising Project were not realised. Providing the Mt Capital CRC with more time to encourage involvement of the community may have provided more scope for this. There was very limited use of the ASTA Science Awareness Raising Package by the CRC, although it was generally recognised as a "useful resource".

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This case study documents the Mt Capital Native Grasses Project, a science-related project that involved a school-community partnership in investigating native grasses on a recreational reserve in Canberra. This Project was one of seven that participated in a national trial of a model developed as part of the ASTA Science Awareness Raising Project. The ASTA Science Awareness Raising Model endeavored to engage schools and their communities in science, with the aim of promoting scientific literacy in the community and the role of schools in its attainment. The purpose of this case study was to explore the success of the Model by investigating how one individual community adapted the Model and carried out their project. As such it had two main objectives: to describe the implementation of the Mt Capital Native Grasses Project and adaptation of the ASTA Science Awareness Raising Model; and to evaluate the Mt Capital Native Grasses Project in terms of the aims of the ASTA Science Awareness Raising Project. The Community Reference Committee (CRC), the group formed to drive and co-ordinate the activities of the Project, were the focus of this study in terms of data collection. Evidence was collected from a variety of sources including project documentation, direct observation of CRC meetings, and interviews with CRC members.

The findings are summarised around the research questions of the study:

<u>Research Question One</u>

What were the aims of the Mt Capital Native Grasses Project and were these achieved? What activities occurred during the Project? What were the scientific outcomes of the Project? Were there any unexpected outcomes of the Project?

The main aim of the Mt Capital Native Grasses Project was to form a school-community partnership to raise awareness of science within the community through the study of native grasses on Mt Capital. In terms of the success of

the Project, the CRC members were mostly positive, expressing that they had achieved most of the aims they had set out to achieve. Some were more reserved about the success of the Project; they thought that there was not enough community involvement in the project "because it ended up being very school driven and not so much community driven". All of the science-related activities of the Project were centered on the school students, who conducted studies of the vegetation on Mt Capital and constructed "3 point action plans". The Project activities were mainly communicated to the broader community through a week long display of the students' work at the local shopping centre. As the students were involved in replicating scientific investigations of the area, the scientific outcomes existed only in terms of the educational outcomes for the students. The main unexpected outcome of the Project related to the strong social bonds it created between the primary and secondary school, and the schools with the community.

Research Question Two

How did the community use the ASTA Science Awareness Raising Package to carry out their project?

The CRC members who had initiated the Mt Capital Native Grasses Project, including the two school principals, had read the ASTA Science Awareness Raising Package. However, the two teachers who became responsible for coordinating the activities of the Project had not read the Package in detail. The Package was referred to infrequently during the course of the CRC meetings, and the CRC did not work through any of the documents as a group. The CRC recognised that the Package "did not drive the project" and explained that was not necessary as "the CRC by nature of their collective skills were people who had been involved in strategic planning and action plans." The parts of the Package concerned with budgeting and reporting back to ASTA were used extensively by CRC members involved in those processes.

Research Question Three

How did people get involved? Why did people/associations become involved, and what did they gain from being involved? What skills/knowledge did people/associations bring to the project? How did they work together – share knowledge, make decisions?

The community representative who was employed within ASTA's head office "alerted" the principals of both the primary and secondary school to the ASTA Science Awareness Raising Project. The Local Leader contacted other possible partners to be involved in the Project and support their application, including Friends of Mt Capital. Following the success of their application, the two principals identified teachers from both schools that could become part of the CRC. The various members of the CRC had differing reasons for becoming involved in the Project, which generally related to the desire to engage students and/or the community in a project that involved science situated within a "real world" community context.

There were two main benefits of being involved that were cited by CRC members: making the social links with other people in the community through the CRC; and gaining experience in working with other people and running a project. In terms of the benefits for the associations that people were affiliated to, these were also related to the social links that were made during the Project and the exposure of their affiliation within the community. The roles that people adopted were not so much discussed and negotiated by the group, but rather they evolved as a result of people's background and their affiliation. With the teachers "driving" the Project, the majority of the planning and decision-making occurred outside of the CRC meetings, within the school environment. Rather than retaining the responsibility of coordinating the activities of the Project, the CRC was used as a resource to support the student-based activities.

Research Question Four

How did the Mt Capital Native Grasses Project help people to be more aware of science in ways that helped them to become more scientifically literate?

The Mt Capital Native Grasses Project varied in success in engaging the different sectors of the community. With regards to involving schools, the Project was deemed successful by all members of the CRC, however, there was general agreement that more could have been done to involve business and the broader community. The Project was more successful in communicating the students' activities to the community via the media and the display at the local shopping centre, rather than actively involving the community in the Project. Whilst the Project did involve students "working scientifically", neither the members of the CRC nor the broader community participated in the processes of science. The CRC thought that the Project helped to raise awareness within the CRC and the students, of both the vegetation issues of Mt Capital, and the people in the community involved in science. However, they were more reserved about the Project raising awareness of these within the broader community. This was supported by interviews with representative community members conducted by ASTA, which reported very little impact of the Project on interviewees' knowledge and ideas about science. In terms of the Project raising awareness of why science is taught in schools, many CRC members were reluctant or found it difficult to comment.

Research Question Five

What were the aims of the ASTA Science Awareness Raising Project? Were these achieved with respect to the Mt Capital Native Grasses Project? What had an impact upon this?

The ASTA Science Awareness Raising Project had several aims: promoting scientific literacy in the "broader community"; illustrating the importance of science education; and incorporating strategies to involve the various stakeholders of science education - schools, community and

business/industry. The Mt Capital Native Grasses Project had limited success in forming effective partnerships between the various stakeholders. The Project became school-focused, and there was little involvement of the other stakeholders on the CRC. Overall, in terms or raising science awareness within the community, the lack of community involvement in the Mt Capital Native Grasses Project limited its potential to have an impact. These findings were supported by the results from the interviews with community representatives carried out by ASTA. Time was considered the critical constraint on what could be achieved by the Project. The support that they received from ASTA was generally recognised as adequate by the CRC, although some improvements were suggested.

5.2 Conclusions

At a fundamental level, the ASTA Science Awareness Raising Project aimed to devise a means, or model, of moving people from being less to more scientifically aware (Rennie & ASTA, 2003). The ASTA Science Awareness Raising Package was developed to assist communities to adapt the ASTA Science Awareness Raising Model, the theoretical framework for engaging schools and their communities in science, to suit their local circumstances. As the Mt Capital Native Grasses Project was selected to trial the Model, ASTA envisaged that they would use the Package to help plan and execute their project. Consequently, the success of the Mt Capital Native Grasses Project reflects upon the success of the Model. Although the case study community of Mt Capital did not utilise the Package to a large extent, it is still possible to reflect on its success within the context of the Mt Capital Native Grasses Project.

The ASTA Science Awareness Raising Model

The ASTA Science Awareness Raising Model was based upon a set of guiding principles, which were identified by the authors as essential to the Model

achieving the aims of the ASTA Science Awareness Raising Project (Rennie & ASTA, 2003). These guiding principles were distilled from several sources including the stated aims of the ASTA Science Awareness Raising Project, the definition of scientific literacy that was set out in the Goodrum et al. (2001) report, a comprehensive review of the literature, and a review of current science-awareness-raising activities. The following discussion of the success of the ASTA Science Awareness Raising Model is based around these guiding principles.

Be interactive and engage people

The notion of a two-way dialogue in the relationship between the public and science is important to the ASTA Science Awareness Raising Project (Rennie & ASTA, 2003). It was for this reason that the Model was to actively engage the school and community in a science-related project. There was evidence that the "engaging" nature of the Project attracted some participants to be involved, and they cited gaining experience in working on a project and with other people as the main benefits of participating. The opportunity for students to be "hands-on" and to communicate their work to the community was appreciated by school staff. In addition, participants expressed the desire to have had more opportunities to actively involve the community in the Project. The interactive design can be considered a successful element to the Model, and preferential to a more passive method of promoting science awareness within the community.

Address an issue which comes from the community, is important to the community, and is not imposed

Providing the opportunity for people to engage in science within a local context has benefits. For students it bridges the gap between school learning and life within the community, which is often seen as disconnected in science education. It also encourages participants' relationship with and awareness

of their local environment, which Evans et al. (2002) termed people's "sense of place". Encouraging an awareness of Mt Capital and its vegetation issues was considered an important outcome for the students who participated in the Project. It is probable that the members of the CRC, and the community members who saw the display at the local shopping centre, also experienced an increase in their awareness of their local landscape. Participants who are engaged in a project within their local context also have the opportunity to develop social links with others in their community, an outcome which was identified as important to those involved in the Mt Capital Native Grasses Project.

Bouillion & Gomez (2001) believe that in situations where participants are engaged in addressing a local issue, the choice of problem and partnership needs to emerge from and reflect the values, goals and resources of the local context. The authors also discuss that they must be "real world problems", real in the sense that they are current, unsolved and are of consequence. Similarly, Evans et al. (2002) concluded in their study of a school-community partnership, that one of the most important factors that influenced the potential of the project to develop scientific literacy was the initial motivation and interest of the participants. In the case of the Mt Capital Native Grasses Project, the science-related issue was identified by the principals of the school in conjunction with a community member. They were motivated by a desire to be involved in the ASTA Science Awareness Raising Project, and identified the issue because they believed there was a "wide range of discussion about the vegetation" of Mt Capital in the community, with a local interest group, Friends of Mt Capital, already formed. However, as the problem did not evolve from the students, or teachers that planned the project activities, it was somewhat imposed in a "top-down" approach rather than from "grassroot" interest.

The issue of native grasses, as discussed by one of the CRC members, was also not a highly visible "problem" within the community. It could be argued that

the issue was not a "real world problem" as identified by Bouillion & Gomez (2001) in that it was not of great consequence for the community. If genuine interest in an issue leads to greater motivation and engagement, as authors such as Hodson (2003), and Flanagan and Draper (2006) argue, then the difficulty of getting the larger community involved in the Mt Capital Native Grasses Project could have been partly due to a lack of community interest in the issue. Similarly, if the issue was of shared community interest, there may have been more desire to develop a mutually beneficial solution, which was not achieved through the Mt Capital Native Grasses Project (Bouillion & Gomez, 2001).

Tytler, Symington, Smith and Rodrigues (2008) studied 16 exemplary cases (of a total of 300 projects which occurred over 3 years) of the Australian School Innovation in Science, Technology and Mathematics (ASISTM) Project which was funded by the Department of Education, Employment and Workplace Relation to encourage curriculum innovations and practices. They concluded that engagement with science was largely achieved through involvement of students in authentic practices in local settings. Students got satisfaction from knowing they contributed to the knowledge needed to address a specific issue in the community, rather than repeating the work already done by others. This opportunity of contributing to community knowledge was not afforded to the students participating in the Mt Capital Native Grasses Project, who were involved in repeating the work of others.

In contrast to the Mt Capital Native Grasses Project, the Tasmanian project which took part in the trial of the ASTA Science Awareness Raising Model addressed the issue of air quality in their community, which was being adversely affected by the presence of wood smoke in the winter. The issue of air quality which was identified by the students involved in the project, was highly visible during the winter months, and the results of the survey of representative community members illustrated that the community believed it was an important issue. The aims of the project, which were raising

awareness of air quality and changing attitudes and behaviours, were believed to be achieved by the participants. This project was considered to be one of the most successful of the trial, as it had a comparatively high involvement of the community, and was determined to have had a large impact on the broader community in terms of raising science awareness (Rennie & ASTA, 2003). This illustrates the benefits of identifying a "real world problem" that encourages greater motivation to be involved, and to find a solution to that problem.

In summary, the guiding principle of "addressing an issue which is important to the community, comes from the community, and is not imposed" was not entirely followed by the Mt Capital community. Evidence suggests that it would have beneficial for the community to do so and that this element is significant to the success of the ASTA Science Awareness Raising Model.

Use local knowledge to ensure input of community members

The purpose of seeking input of local knowledge is not only to encourage the involvement of community members but also to recognise the importance of local knowledge in making decisions with regard to local issues. As Bouillion and Gomez (2001) discuss, it also serves to both highlight the diverse range of people who can participate in science, and brings together distributed sources of knowledge. The Mt Capital CRC expressed that it was important for students to see that people like the Friends of Mt Capital members, who are not "scientists in a formal sense", can participate in science-related activities. The input of community members, and the partnering of schools and communities, again makes explicit the link between learning in schools and life in the community.

The CRC was included in the ASTA Science Awareness Raising Model to facilitate the interaction between the schools and community (Rennie & ASTA, 2003). The *ASTA Science Awareness Raising Model: An Evaluation Report*

concluded that the trial projects that had properly established and functioning CRCs had the greatest impact on their community (Rennie & ASTA, 2003). The Mt Capital CRC included two members from the local interest group Friends of Mt Capital, who contributed useful practical knowledge about Mt Capital. In particular, this assisted teachers in planning their activities with students on the hill. However, the Mt Capital CRC recognised that there was not enough representation of the community, business or otherwise, on the CRC, and not much involvement of the broader community in the Project. The Project was school-driven with a student focus, and this naturally limited the potential impact of the Project on the broader community. The purpose of the ASTA Science Awareness Raising Project was to increase the community's awareness of science and this was undermined by the CRC not maximising this critical principle of the Model.

Involve the community in negotiation and decision-making based on different perspectives and the information collected (both local and science-related)

The decision-making within the Mt Capital Native Grasses Project occurred almost entirely within the school environment. In this regard, the opposite to what was envisaged in the Package occurred; the project issue of native grasses on Mt Capital was tackled around what the schools wanted to do with students, rather than the student activities being planned around what the community/CRC wanted to do about the issue. Consequently, the Mt Capital Native Grasses Project did not actively involve the community in science-related activities such as collecting information and making decisions based on that information.

Tal (2004), in her case study of school-community collaboration for environmental education, makes a distinction between "real involvement" and "artificial involvement". Real involvement was perceived by participants as community participation in setting priorities and decision-making. This was compared to artificial involvement which was perceived as the

traditional type of involvement of assisting with social activities such as carnivals and cake stalls. There was potential within the Mt Capital Native Grasses Project to involve the community in making decisions with regard to how the Project should proceed and more broadly, how the hill should look. It is only through such active or "real involvement" that it is possible to encourage the type of scientific literacy defined by Goodrum et al. (2001).

Include an educative element: to focus on science as a way of knowing, thinking and acting; to model the science process (working scientifically); and to use scientific evidence.

It was considered that to make it "worthwhile" to develop the model and carry out the ASTA Science Awareness Raising Project there had to be an educative element (Rennie & ASTA, 2003). That is, there was potential for participants to learn something about science from utilising the ASTA Science Awareness Raising Model and taking part in a science-related project. In keeping with contemporary concepts of scientific literacy, the ASTA Science Awareness Raising Model was to focus on "ways of thinking and acting", to model the processes of science, rather than teach science facts to the community (Rennie & ASTA, 2003). The students involved in the Mt Capital Native Grasses were involved in "working scientifically", they collected a variety of information about the hill, including its background and current vegetation, and used this information to construct action plans. However, these activities were not extended to the CRC or the broader community, again limiting the Project's ability to raise an awareness of science.

Link into science at schools

For it to be worthwhile for schools to participate in the ASTA Science Awareness Raising Project and all the additional work that it required, the ASTA Science Awareness Raising Model emphasised the importance that each trial project should "have links to science at school" and at least

contribute to students achievement in the working scientifically strand of the curriculum. As Rennie and ASTA (2003) explain, this ensures that participation "counts" for teachers and students. Not only were the teachers involved in the Mt Capital Native Grasses Project able to link the project to their science program, they were also able to link it to other areas of their curriculum including communication skills and "ICT competencies". Although teachers were put at a disadvantage by a lack of lead time, they were able to capitalise on this guiding principle, and students' learning was considered one of the most positive outcomes of the Project.

Have a tangible outcome

According to the ASTA Science Awareness Raising Model, the Mt Capital Native Grasses Project was to have a "tangible outcome" to show when the Project is complete and has achieved something worthwhile (Rennie & ASTA (2003). The tangible outcome from the Mt Capital Native Grasses Project was a display of the students' work which featured at the local shopping centre as well as the schools' front offices, and the ACT Department of Education's main office. This guiding principle worked well for the Mt Capital Native Grasses Project providing the participants with not only a conclusion to the Project, but also a means to communicate with the broader community, link with local business, and to demonstrate and celebrate their achievements.

Include some general organisational principles involved with working with the community

As the ASTA Science Awareness Raising Package was a resource for schools and their communities to work together on a science-related project, it was recognised that there was a need to provide some general organisational principles in working with the community and managing a project (Rennie & ASTA, 2003). The Package promoted the concept of a CRC, and ASTA considered this essential for their communication with the community, as

well as providing accountability to how funds were spent during the trial. The Mt Capital community established a CRC which met several times during the course of the Project. Although it did not have the co-coordinating role as envisaged in the Package, its supportive role did work well for the Mt Capital Native Grasses Project as it transpired. However, it did mean that the teachers and Local Leader assumed the majority of the responsibility for the Project and its tasks. In an attempt to provide some guidance in relation to project management, the Package provided resources on how to determine the scope of the project, develop plans, negotiate roles and allocate tasks, and make decisions, all within a group context. If the Mt Capital CRC had utilsed these resources and followed the ideas more closely, they could possibly have avoided the difficulties and angst that was experienced by the teachers and Local Leader, as well as have ensured more community involvement. In particular, if they had utilised the resources on keeping records and activity logs, the difficulties that were experienced in reporting and budgeting may have been alleviated.

Supporting the ASTA Science Awareness Raising Package

I believe that this case study provides evidence that suggests that the ASTA Science Awareness Raising Model does provide a useful format to engage schools and their communities in a science-related project with the aim of increasing science awareness. As with all field-tests, there are improvements to be made with regards to the structure and fine-tuning of the Package. However, I have argued that if the Mt Capital CRC had followed the "guiding principles" embodied within the Model more closely, their project would have been more successful in terms of increasing science awareness within the community. If the CRC had utilised the Package more, this would have ensured that they were aware of and therefore more likely to apply these principles. There are several elements of project management, on behalf of ASTA, that could have been improved to support the use of the Package.

To begin with, part of the reason that the CRC voiced for not utilising the Package was the restrictions of time. The time restraints imposed by government funding of the ASTA Science Awareness Raising Project were in turn imposed upon the communities. As Rennie and ASTA (2003) recognised, "longer lead times" within the ASTA Science Awareness Raising Project would have been beneficial and in this regard would have given the Mt Capital community more time to plan, as well as read and utilise the Package.

Another element that may have supported the use of the Package was to hold workshops prior to the commencement of the Mt Capital Native Grasses Project. As it was, the STA Coordinator was responsible for introducing the Package to the community during the CRC's meeting time. This ended up in direct conflict with the CRC's desire to get moving with the Project and the STA Coordinator's perception of her role as supporting, and not directing the Project. As a result, the Package was not looked at in detail during the CRC meetings. The concept of "professional development workshops" was discussed by the Local Leader and STA Coordinator. These workshops could not only introduce and work through the ASTA Science Awareness Raising Package, but also provide information with regard to the motives, expectations and significance of the larger ASTA Science Awareness Raising Project. As illustrated in this case study of the Mt Capital Native Grasses Project, there was potential for a breakdown in communication within the CRC, where some members were not aware of the national significance of the trial, and generally the CRC lost focus that they were actually participating in a trial of the Package.

The request of a workshop by the Mt Capital CRC also points to the significance of having personal contact between ASTA and the communities, rather than providing the Package as a stand alone resource. As Rennie and ASTA (2003) recognised

> The ASTA Science Awareness Raising Model is also about developing relationships within and between all groups and levels

> involved. A visit to the CRC from a member of the ASTA Project Management Team at crucial times such as strategic planning or report of budget preparation may have been of great assistance (p. xii)

The ASTA Science Awareness Raising Model could have also included a national coordinator, to assist the communities to interact with the Package and to act as a liaison between ASTA and the communities. Although STA Coordinators were appointed to take on this role, having eight different individuals would result in much inconsistency between the projects. In addition, as illustrated in the Mt Capital Native Grasses, there may be perceived conflicts of interest. Although ASTA had a project management team, with a project assistant who came on board from April 2002, it would have been beneficial to have a dedicated coordinator from the beginning of the ASTA Science Awareness Raising Project, with this sole responsibility made explicit.

The case of the Mt Capital Native Grasses Project illustrates that people do not always read all the resources with which they are provided. In addition, the community's ideas about the ASTA Science Awareness Raising Model were not only sourced from the Package, but also from the other written forms of communication such as the project nomination proforma and even the original advertisement calling for nominations. Therefore, it is important to ensure that there is both consistency and clarity in the messages that are communicated through these media. The guiding principles that frame the Model should have been emphasised in all forms of written communication, including the Package. In this respect I agree with Rennie and ASTA (2003), that it was not very clear in the Package of what constituted "the model". Similarly, these guiding principles of the Model were not communicated clearly through the other forms of written communication sent out to the communities.

ASTA had a preference for Local Leaders to be school-based as they already had a working relationship with them. For this reason, the national trial of the ASTA Science Awareness Raising Model was advertised through educational avenues. I would argue that to avoid the Project becoming school-driven, it would be useful to have a Local Leader that is community-based rather than a teacher or principal from a school. In *The ASTA Science Awareness Raising Model: An Evaluation Report,* Rennie and ASTA (2003) concluded that

> The under utilisation of the CRC was often a function of Local Leader style. Where the Local Leader dominated or tried to take on all the tasks of the project there was less impact on the community than from those projects that had Local Leaders that led a team of people and had interactions between students, community members and organisations (p. xii).

Although Rennie and ASTA (2003) argue that teachers "need to embrace these [community] projects as an integral part of their teaching practice", I believe, as illustrated with the Mt Capital Native Grasses Project, that often in the reality of a busy schedule it becomes necessary for teachers to take "a school or inward looking focus". A community-based Local Leader, along with CRC meetings held outside of school grounds, would encourage a more even power distribution and community members to take a more active role. For ASTA, this would have presented issues with responsibility for project completion, reporting and use of funds. However, there are many instances of community-based interest groups that successfully apply for grants where these processes are required.

In summary, there were several steps ASTA could have taken to improve the likelihood that the ASTA Science Awareness Raising Package was used by communities and the Model implemented more effectively. These include providing the community with more time to plan their Project, running a workshop on the Package, providing a National Coordinator to assist with communication, providing clear and consistent communication of

expectations though written communication, and encouraging the CRC to adopt a community-based Local Leader.

Limitations of the Study

This case study focused on the CRC for data collection. As the CRC did not take on the coordinating role as envisaged in the Package, with much of the decision-making and planning of the Mt Capital Native Grasses Project occurring within the school environment, it was difficult to gain access to this information. Likewise, it was difficult to capture the communication that occurred between individuals, for example, between the STA Coordinator and Local Leader during the processes of budgeting and reporting. I had to rely on the information that was reported back to the CRC. I attempted to follow-up on any leads from the CRC meetings by collecting documentation and obtaining people's recollections and perceptions during interviews.

The constraints of time, and ethical considerations determined that evidence could not be collected from the students who participated in the Project, or the broader community to determine the impact of the Project. I did not observe the student activities, which was limiting as this constituted the majority of the project activities, particularly the science-related activities of the Project. Instead, I had to rely on other people's accounts of what transpired. In addition, this meant that students' experiences and perceptions of the Project were not sought. With regard to the impact of the Project on the broader community, I had to rely on the data provided by ASTA.

Relying on other people's accounts of events, means that additional bias (as well as that of the researcher) is introduced to the evidence, as naturally their accounts are filtered through their own perspective (Merriam, 1988). As I was unable to observe all the activities of the Project, including the decision-making, planning and student activities, this may have meant that this case study is a less than full description of the Project. In terms of the data collected by ASTA, I had no influence on the design, but I did have some

input in that I was employed to undertake the phone interviews of community representatives. ASTA requested that the CRC select the community members who were to be interviewed. I noted during my observations of the CRC meetings, that often they were selected because they had some previous experience with science. This would have biased the sample to one that possibly had more positive attitudes and was more informed than a more representative sample of the local community. This is supported by the comments of Rennie & ASTA (2003) that "the ACT project's very small effect may well be due to the fact that the interviewees were already informed at the time of the pre-project interview" (p. 8/107). As a result, this may have lessened the perceived impact of the Project on the broader community.

5.3 Recommendations

For Practice

This case study analysis was used to develop a set of recommendations both for the future of the ASTA Science Awareness Raising Model known as the School Community Industry partnerships in science (SCIps) Project, and for any similar projects which seek to engage schools and their communities in a science-related project with the aim of increasing science awareness.

Recommendation 1: It is recommended that the school-community project address an issue of real concern to the community and that the mechanisms to identify an "issue of real concern" be explored.

It is important that the issue chosen as the basis of the science-related project is of genuine interest to the community. If the issue is of great consequence to the community there will be greater motivation to get involved and to find a mutually beneficial solution. Before engaging in a project it is important to assess that there is some existing activity with regard to the issue, the issue

remains unsolved and that possible partnerships can be identified. This will assist in determining whether the project addresses an "issue of real concern" to the community.

Recommendation 2: It is recommended that the Local leader or coordinator of the school-community project be community-based rather than school-based.

This would ensure that the project does not become school focused and supports greater community involvement. It would also encourage community members to take more ownership and an active role rather than relying on school teachers to carry out the project activities.

Recommendation 3: It is recommended that the funding body provide a National Coordinator to work with the individual school-community partnerships.

Providing a stand-alone written resource is not sufficient, more personal contact is required between the community and funding body. A National Coordinator could act as a liaison to provide better communication, greater utilisation of the Package and consistency across projects. The role is substantial and needs to be properly recognised and funded.

Recommendations 4: It is recommended that the funding body run workshops to introduce the project and written resource to the school-community partnership.

Workshops with the local community would provide the opportunity to introduce and work though the written resource to ensure that all participants are familiar with it and therefore more likely to utilise it. It would also provide an opportunity to provide participants with information on the motives, expectations and significance of the larger project from which the written resource originated.

Recommendation 5: It is recommended that the various forms of written communication are prepared in entirety prior to the commencement of the project and before they are provided to participants. This would assist to ensure that they are mutually supportive in that they re-emphasise the same message in their different formats and at different levels of detail.

Participants construct their ideas about a project through various forms of written communication. It is important that these complement each other so that the concepts are reiterated and unambiguous.

Recommendation 6: It is recommended that the timelines of projects which involve school-community partnerships are sympathetic to the requirements of each organisation, and the involvement of multiple partners.

Each organisation involved in a project would have has its own constraints with regards to time. Schools, for example, need to be made aware of their involvement in the previous year, so that they can integrate their activities into their curriculum. Projects that involve multiple partners require additional time to be able to plan, make decisions and implement activities as a group.

For Further Research

The schools involved in the Mt Capital Native Grasses Project appreciated the provision of funds for teacher release. Encouraging the involvement of community members, including business, is challenging as we have no means of "releasing" them from their other commitments. Further research is required into how such Projects can be made to "count" for community members and business, where generally their only motivation to be involved is derived from their interest in the issue. This motivation should not be underestimated, however, as there are many examples of projects occurring in all countries around the world confronting science-related issues often associated with the environment. Documenting these projects and their

outcomes is important if their potential to increase science awareness in the community can be exploited.

Students' experiences and perceptions of the Mt Capital Native Grasses Project were not sought in this study as is often the case with similar projects in the literature which tend to focus on teachers' perceptions. However, I believe these are necessary variables for study if this approach to increasing science awareness is to be developed. Measuring the impact of a project on the community's awareness of science remains a challenge. The findings of this case study suggest there was little impact, as the involvement of the broader community in the Project was minimal and this was supported by the results of ASTA's interviews with community members. However, this type of measurement is limited and only looks at short term impact. Rennie and ASTA (2003) cite the work of Falk and Dierking, who reported that the literature strongly endorses the view that the impact of activities of activities engaged in by the community frequently is not evident for some time. Developing approaches to measuring the impact of school-community projects, particularly the long-term impact, requires further research.

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APPENDIX A

EXTRACT OF THE ASTA SCIENCE AWARENESS RAISING PACKAGE

ASTA Science Awareness Raising Project

Science Awareness Raising Package for Participants in the Trial Project

Léonie Rennie and Gina Williams-Pearse

January, 2002

APPENDIX A (Continued)

Table of Contents

Process Guide: Suggestions for Carrying Out Your Project

Who	Phase	Tasks	Resources
STAC, Local Leader	1. Pre-Planning	(a) Assess for potential to raise science awareness	1.A1 Guidelines for Assessing for Potential to Raise Science Awareness
		(b) Assess whether your project is likely to work	1.B1 Workability Checklist
		(c) Get the CRC started	1.C1 Establishing the Community Reference Committee (CRC)
CRC, Local Leader	2. Planning	(a) People Issues • Recruit participants • Identify common interests and concerns • Negotiate roles	2.A1 Recruiting Resource People
		(b) Project Issues • Determine scope of the project • Deciding on the aims and the desired outcomes/end product • Identifying the science issues	2.B1 Refining Your Project 2.B2 Sources of Information 2.B3 Expanding the Science behind the Project
		(c) Make sure the community knows about the project	2.C1 Informing the Community About the Project 2.C2 Choosing the Format of Your Communication
		(d) Organise resources and support	2.D1 Money Matters 2.D2 ASTA Funding 2.D3 Seeking Additional Support

Who	Phase	Tasks	Resources
CRC, Local Leader	2. Planning (cont.)	(e) Document and Reflect • Document aims, outcomes, strategies • Record tasks, roles and timeframe • Check: Is this the best way to go?	2.E1 Developing A Strategic Plan 2.E2 Developing An Action Plan 2.E3 Reality Check!
Local Leader CRC Participants	3. Doing the Project	(a) Meet regularly	3.A1 A Process for Making Decisions
		(b) Collect and use information	3.B1 Collecting Information 3.B2 Assessing the Value of Information 3.B3 Where Do Data Fit in the Process of Science?
		(c) Tell the broader community what you are doing and invite feedback	3.C1 Reminder to Communicate!
		(d) Document as you go	3.D1 Keeping Records 3.D2 Activity Log
Local Leader CRC	4. Finishing Up	(a) Prepare report for ASTA	4.A1 Writing the ASTA Report
		(b) Share what has been achieved and acknowledge all participants (including sponsors).	
		(c) Celebrate!!!	

APPENDIX B

COMMUNITY PROJECTS SELECTED TO TRIAL THE ASTA SCIENCE AWARENESS RAISING MODEL

Location	*Project*	*People/Partnerships*	*Predicted Outcome*
Australian Capital Territory *Metropolitan*	Regeneration of native grasses on Mt Capital	Primary & secondary school, business, Landcare, botanical gardens & Friends of Mt Capital	Display in school & local shopping centre, & media involvement
New South Wales *Metropolitan*	Community awareness of the biodiversity of local blue gum forest	Secondary schools, university departments, trust, Rotary Club & local council	Brochure, & photographic display at local shopping centre & environmental expo
Queensland *Coastal*	Waste problems associated with local creek	Secondary school, Surfrider Foundation, Friends of Creek & Environmental Council	Increased awareness
South Australia *Metropolitan*	Biodiversity of local hill & management strategies	Primary & secondary schools, Friends of Hill, & Parks & Wildlife	Informative brochure & website
Tasmania *Semi-rural*	Monitor air-quality & raise community awareness to changing burning practices	Secondary school, local mill & city council	Display of daily air-quality reading in main street, informative website & council display
Victoria *Large rural*	Community awareness of the biodiversity of local grasslands	Primary & secondary schools, Parks Victoria, local residents & industry	Baseline data and advise on new recreational facilities
Western Australia *Regional city*	Use, location & future of an intractable waste facility	Secondary schools, business, council & government	Community education program & brochure, curriculum resources & assessment tools

APPENDIX C

LETTER TO CRC REQUESTING PERMISSION TO CONDUCT RESEARCH

18/4/02

Dear Community Reference Committee,

As I mentioned at the meeting on the 11th April 2002, as part of Master's course I would like to conduct a case study of the ACT Mt Capital Revegetation Project.

With your permission, this would involve observing your regular meetings and tape-recording them. It would also be useful for me to have access to documents that are produced as part of the activity of the CRC, such as your strategic plan and the report that you prepare for ASTA. I would also like to interview individual members, with their permission, towards the end of the project. Please be assured that all the information I collect will be kept confidential at all times and in reporting the findings, all individuals will be anonymous.

As well as providing data for my thesis, this information will be useful for ASTA to refine the "draft package" that you have been given.

As part of gaining ethics approval from the Australian National University committee, I would appreciate it if you could indicate below whether you give your consent.

Yours Sincerely,

Gina Williams-Pearse

Name	Affiliation	Consent Yes/No	Signature	Date

APPENDIX D

APPLICATION TO ANU HUMAN RESEARCH ETHICS COMMITTEE

ALL APPLICATIONS TO BE TYPED

THE AUSTRALIAN NATIONAL UNIVERSITY

HUMAN RESEARCH ETHICS COMMITTEE

APPLICATION FORM

Name of Researcher (including title): Ms Gina Williams-Pearse

Position Held (staff, postgraduate, undergraduate, etc.): Postgraduate student

Student ID no. (if applicable): u3941782

Dept/Group/Centre: CPAS

Mailing address: GPO Box 1104 Canberra ACT 2601

Telephone: 6125 0739
Fax: 6125 8991
Email: gina.williams-pearse@anu.edu.au

Date: 16 April 2002

Project Title: Raising science awareness through community-based projects

1. (a) Briefly describe the basic purposes of the research proposed:

In my previous employment, I was involved in a project with the Australian Science Teachers Association (ASTA). The aim of the project is to develop a science awareness-raising model that can be used by a diverse range of schools and their communities.

APPENDIX D (Continued)

The "draft model" that we developed is a process guide for a community to work on a science project that is relevant and appropriate to their local circumstances. Eight communities (and their associated schools), one from each state and territory around Australia, have been selected to participate in a trial of the draft model.

The purpose of this research is to investigate the success of the draft model in increasing science awareness by focusing on one of the trial communities - the ACT Mt Capital revegetation project. I have attached a copy of their project nomination form.

(b) Outline the design of the project:

I would like to conduct a case study of the ACT Mt Capital revegetation project. A Community Reference Committee (CRC) has been formed to steer the project. This, at the moment, consists of representative members from community interest groups (Friends of Mt Capital), local business (Capital Business Centre) and teachers from local schools (Primary School and High School)

I will observe and tape-record the regular meetings of the CRC. Towards the end of the project I will conduct individual interviews with the members of the CRC. The interviews will be open-ended and will also be tape-recorded. Documents that the CRC prepare as part of the project will also be sourced. This includes their strategic plan, action plan, activity report and their final report back to ASTA.

On an individual level, I wish to ascertain why each member became involved, what skills/knowledge they bring to the group and what they gained from being involved.

On a group level, I wish to ascertain whether the "model" was useful, how the group work together to conduct a science project including the sharing of knowledge/skills and decision making, and also the outcomes of the project in relation to their stated strategic plan.

ASTA are collecting data from the general public and school students, so I will not need to do this, but may use the information they collect to complement my own.

(c) Describe the research procedures as they affect the research subjects and any other parties involved:

I will not take an active role in the CRC meetings as this may seriously affect the outcomes of the project. Instead, I will seek to be a non-threatening observer.
The individual interviews will occur at a time and place convenient to the interviewee. They will be informal and participants will be encouraged to express their views, whatever they are.

[(a),(b) and (c) should be intelligible to a non-specialist.]

2. What in your opinion are the ethical considerations involved in this proposal?
(You may wish to comment, for example, on issue to do with consent, confidentiality, risk to subjects, etc.).

I have met all the members on the CRC and they have given their written consent for me to observe their meetings, which I have attached. ASTA have also given verbal consent for me to do the research. Interview participation will be solicited on a purely voluntary basis towards the end of the project. At this stage, however, all of the participants have indicated that they are not opposed to this occurring.

All information collected via observation and interview will be kept confidential at all times. The data will also be kept secure (see question 12). The identity of the individual will be protected in the analysis, and in the final thesis. All qualitative comments will be cited anonymously.

In interviewing, participants should not feel that any particular response is required or not be made to feel uncomfortable during questioning.

3. Outline the reasons which lead you to be satisfied that the possible benefit to be gained from the research proposed justifies the discomforts and risks involved (if any).

The Commonwealth Department of Education, Science and Training, who entered into a contract with ASTA, is funding the larger project of developing, evaluating and disseminating a science awareness-raising model. The purpose of the trial is to evaluate the effectiveness of the draft model in raising science awareness. The model will then be refined with the view to distributing the "refined model" to communities throughout Australia.The results from this research would give ASTA useful feedback on the model and its effectiveness in raising science awareness, and assist with refining the model.

As all concerned are willing to take part in the research, there should be minimal discomfort and risk.

4. Who are the investigators (including assistants) who will conduct the research and what are their qualifications and experience?

I, Gina Williams-Pearse, am the only investigator. I am currently studying a Masters in Science Communication at the Centre for the Public Awareness of Science.

I have a Bachelor of Science with honours. I have worked as a social science researcher, interviewing people in public places about their ideas and opinions about science, and analysing and reporting the results.

My supervisor is Dr Sue Stocklmayer, Director of the Centre for the Public Awareness of Science.

5. Can the proposer certify that the persons listed in answer to 4 above has been fully briefed on appropriate procedures and in particular that they have read and are familiar with the guidelines issued by the NH & MRC and relevant professional body (please specify)?

I have been briefed and read the guidelines.

6. Are arrangements to handle emergencies or difficulties necessary? If so, briefly describe the arrangements made.

Such arrangements are not necessary for this research project. I will have regular face-to-face contact with the respondents who will be able to discuss any concerns they have with me.

7. Please specify all sources of information:

The source of all information gathered will be members of the CRC.

8. In cases where subjects are identified from information held by another party (e.g., doctor, hospital association) describe the arrangement whereby you gain access to this information. (You may wish to attach relevant correspondence.)

As part of my previous employment, I was involved in selecting the communities that will take part in the trial. This gave me access to the ACT

Mt Capital* revegetation project nomination form, which is the only information I will receive that does not come directly from the participants. I have attached this nomination form.

9. Specify whether subjects will include students, children, the mentally ill or others in a dependent relationship, and specifically if payment will be made to any subjects. Please give details of these arrangements.

No subjects of this kind will be involved in this study.

10. Describe the procedures to be followed in obtaining the informed consent of subjects and/or of others responsible. If information for the purpose of obtaining consent is provided in writing, attach any relevant documents; otherwise specify the information provided.

As I mentioned previously, all CRC members have already given written consent for me to observe their meetings and to tape-record them. Individual consent will be sought towards the end of the project to gain volunteer participants for interviews.

11. Comment on any cultural or social attitudes of subjects which have affected the design of the research or which may affect its conduct.

There are no matters of this kind.

12. Give details of the measures which will be adopted to protect confidential information about subjects.

All materials concerning the study will be locked in a filing cabinet and only I will have a key. This includes all of the audio-cassettes, transcripts of the interviews and my hand written notes from the meetings. The cabinet is in the CPAS Masters students' office which is kept locked at all times and Building 42 is secure. I will not leave the filing cabinet unlocked unless I am in the area.

All qualitative comments will be cited anonymously in the final thesis.

1. **Date on which project will begin:**

I informally attended the first CRC "meet and greet" which occurred on the 11th April to introduce myself and talk about this research. The ACT revegetation project officially begins May 2002 and I would like to attend the meetings as soon as possible.

and end:

February 2003

14. I agree to notify the Committee in writing of any significant departures from this protocol.

Name and title (please print): ...Gina Williams-Pearse
(Proposer of Research)

Signed: G WPearse Date: 18/4/02

Where the proposal is from a student, the Supervisor is asked to certify the accuracy of the above account.

Name and title (please print): DR SM STOCKLMAYER
(Supervisor)

Signed: SM Stockleyer Date: 17.4.02

APPENDIX D (Continued)

COMMENT ON PROJECT FROM HEAD OF DEPARTMENT/GROUP/CENTRE:

Name and title (please print): DR SM STOCKLMAYER
(Head of Department/Group/Centre)

Signed: SM Stockl... Date: 17.4.02

Applications should be submitted as follows:
EITHER
(a) 12 hard copies (one master copy with original signatures + 11 photocopies)
OR
(b) 5 hard copies (one master copy with original signatures and 4 photocopies)
PLUS an identical email version emailed to Human.Ethics.Officer@anu.edu.au.

Hard copies of the completed protocol form, together with all supporting documents, should be sent to:

The Secretary
Human Research Ethics Committee
Research Services Office
Chancelry 10B
The Australian National University ACT 0200
Tel: 02-6125-2900
Fax: 02 6125-4807

APPENDIX E

APPROVAL FROM ANU HUMAN RESEARCH ETHICS COMMITTEE

THE AUSTRALIAN NATIONAL UNIVERSITY

RESEARCH SERVICES OFFICE

Human Ethics Officer
Sylvia Deutsch

CANBERRA ACT 0200 AUSTRALIA
TELEPHONE: +61 2 6125 2900
FACSIMILE: +61 2 6125 4807
EMAIL: Sylvia.Deutsch@anu.edu.au

23 May 2002

Ms Gina Williams-Pearse
GPO Box 1104
Canberra
ACT 2601

Dear Ms Williams-Pearse,

Protocol 2002/66
Raising science awareness through community-based projects

On behalf of the Human Research Ethics Committee I am pleased to advise that the above protocol has been approved as per the attached *Outcome of Consideration of Protocol.* Please note that as a formality this approval is subject to formal ratification by the Committee at its next meeting on 7 June 2002.

For your information:

1. Under the NHMRC/AVCC *National Statement on Ethical Conduct in Research Involving Humans* we are required to follow up research that we have approved. Once a year (or sooner for short projects) we shall request a brief report on any ethical issues which may have arisen during your research and whether it proceeded according to the plan outlined in the above protocol.
2. Please notify the Committee of any changes to your protocol in the course of your research, and when you complete or cease working on this project.
3. The validity of this current approval is five years' maximum from the date shown on the attached *Outcome of Consideration of Protocol* form. For longer projects you are required to seek renewed approval from the Committee.

Yours sincerely,

Sylvia Deutsch

Sylvia Deutsch
Secretary, Human Research Ethics Committee

APPENDIX E (Continued)

THE AUSTRALIAN NATIONAL UNIVERSITY

HUMAN RESEARCH ETHICS COMMITTEE

Outcome of Consideration of Protocol

Researcher: Ms Gina Williams-Pearse
Contact details: Centre for the Public Awareness of Science, Faculty of Science
Protocol No. 2002/66
Title: Raising science awareness through community-based projects
Date on application: 16 April 2002 **Date received in Research Services Office:** 19 April 2002

On behalf of the Human Research Ethics Committee,

I approve/~~do not approve~~ the above protocol.

Approval is subject to the following conditions:

.....

.....

.....

Reasons for non-approval: .....

.....

.....

.....

Review due: .....

Chairperson: ..... **Date:** 23/5/02

(Professor Hilary Charlesworth)

APPENDIX F

RESEARCH CONSENT FORM FOR CRC

"A Model for Raising Science Awareness in the Community"

As part of my Masters of Science Communication course, I would like to conduct a case study of the ACT Mt Capital revegetation project. I would like to evaluate ASTA's "project model" and the materials that you were given for how useful they were for conducting a science project and raising science awareness within the community. I am also interested in why people became involved and what they gained from being involved.

With your permission, this would involve observing the CRC's meetings and tape-recording them. It would also be useful for me to have access to documents that are produced as part of the activity of the CRC, such as your strategic plan and the report that you prepare for ASTA. I would also like to interview individual members, with their permission, towards the end of the project.

I will be the only person to have access to the data that is collected as hardcopies will be locked in a cabinet and any computer files will be kept secure. In reporting the findings, I will seek not to reveal individual identities. If I feel that a particular comment identifies a person, I will approach the individual for their permission to include the comment.

Participation in the research is entirely voluntary and you can choose to withdraw from participating at any time. If you would like to find out more about my research or have any concerns that you would like to talk to me about, please do not hesitate to contact me. My details are as follows:

Gina Williams-Pearse, Masters student,
Centre for the Public Awareness of Science, ANU, ACT 0200
Day ph: 6125 0739
Home ph: 6255 4380
Email: gina.williams-pearse@anu.edu.au

Alternatively, if you have any concerns you would like to discuss with a representative from the University's Human Research Ethics Committee, contact:

Sylvia Deutsch, Human Ethics Officer,
Research Services Office, ANU, ACT 0200
Day ph: 6125 2900
Email: Human.Ethics.Officer@anu.edu.au

If you agree to participate in the research, please sign below.

Name ..... Affiliation .....

Signature ..... Date .....

APPENDIX G

RESEARCH INFORMATION SHEET FOR CRC

"A Model for Raising Science Awareness in the Community"

As part of my Masters of Science Communication course, I would like to conduct a case study of the ACT Mt Capital revegetation project. I would like to evaluate ASTA's "project model" and the materials that you were given for how useful they were for conducting a science project and raising science awareness within the community. I am also interested in why people became involved and what they gained from being involved.

With your permission, this would involve observing your regular meetings and tape-recording them. It would also be useful for me to have access to documents that are produced as part of the activity of the CRC, such as your strategic plan and the report that you prepare for ASTA. I would also like to interview individual members, with their permission, towards the end of the project.

Please be assured that all the information I collect will be kept confidential. I will be the only person to have access to the data that is collected as hardcopies will be locked in a cabinet and any computer files will be kept secure. In reporting the findings, I will seek not to reveal individual identities. If I feel that a particular comment identifies a person, I will approach the individual for their permission to include the comment.

Participation in the research is entirely voluntary and you can choose to withdraw from participating at any time.

If you would like to find out more about my research or have any concerns that you would like to talk to me about, please do not hesitate to contact me. My details are as follows:

Gina Williams-Pearse, Masters student,
Centre for the Public Awareness of Science, ANU, ACT 0200
Day ph: 6125 0739
Home ph: 6255 4380
Email: gina.williams-pearse@anu.edu.au

Alternatively, if you have any concerns you would like to discuss with a representative from the University's Human Research Ethics Committee, contact:

Sylvia Deutsch, Human Ethics Officer,
Research Services Office, ANU, ACT 0200
Day ph: 6125 2900
Email: Human.Ethics.Officer@anu.edu.au

APPENDIX H

LETTER REQUESTING WRITTEN PERMISSION FROM ASTA

13 Cabramatta St
Bayswater WA 6053

ASTA
PO Box 334
Deakin ACT 2600

17th July, 2009

Dear Mr Russo,

In 2002, as part of my Master of Science Communication course at ANU, I chose to conduct a case study of the ACT Mt Capital Native Grasses Project which was one of the trial projects for the ASTA Science Awareness Raising Model. I am now nearing completion of my thesis (many years later!), and am approaching you for written permission on behalf of ASTA.

In 2001, I was involved in the development of the Model during my employment at Curtin University of Technology as Léonie Rennie's research associate. I met you at the Science Teachers Association Coordinator meeting in Melbourne. As I was completing my Masters in Canberra the following year, it seemed logical to undertake the case study for the sub-thesis requirement of my course. At the time I was given verbal permission to conduct the study by Jan Althorp, but now require written permission to include in my thesis. My research involved attending and recording the meetings of the Community Reference Committee and interviewing the individual members. I also accessed documents produced by the Community Reference Committee, such as their project reports, and documents produced by ASTA in correspondence with the Community Reference Committee. Each member of the Community Reference Committee gave written permission and my research was approved by the University's Human Research Ethics Committee.

If you are satisfied to provide written permission, for your convenience I have enclosed a form for you to sign and a self-addressed envelope. If you require further information about my research or have any concerns that you would like to discuss, please do not hesitate to contact me. My phone number is 0402 915 478 or my email address is gina_williamspearse@yahoo.com.au.

Yours Sincerely

Gina Pearse

APPENDIX I

WRITTEN PERMISSION FROM ASTA

I .....Peter Russo....., as Chief Executive Officer of the Australian Science Teacher Association (ASTA), give permission for Gina Pearse to conduct a case study of the ACT Mt Native Grasses Project which was run as part of the trial of the ASTA Science Awareness Raising Model in 2002. I give permission for her to include information related to the activities of the Community Reference Committee in her thesis, including correspondence with ASTA.

Signature .....Russo..... Date .....23/07/09.....

APPENDIX J

INTERVIEW QUESTIONS FOR CRC MEMBERS

1. How did you hear about the project?
2. Why did you get involved with the project?
3. Were you involved in putting together the original proposal?
4. Do you think the project is novel/unique?
5. Before the project began, what did you think it was about? Was this different to what actually happened with the project?
6. What do you think the project set out to achieve? Did it achieve [discuss each aspect]?
7. Was there anything you had hoped the project would achieve that it did not?
8. Do you think there were any unexpected outcomes from the project?
9. What activities were you involved with as part of the project?
10. What future activities are planned as a result of the project?
11. What do you think were the scientific outcomes of the project?
12. What do you think you brought to the project – in terms of knowledge, skills, labour etc?
13. What did you think that you personally gained from being involved in the project?
14. What do you think [the group they represent] gained from you being involved in the project?
15. Do you think there was enough community involvement in the project? Please explain.
16. Do you think there was enough school involvement in the project? Please explain.
17. Do you think there was enough business involvement in the project? Please explain.
18. Do you think the project fostered relationships between these different groups? Why or why not?

APPENDIX J (Continued)

19. Do you think the project helped to raise awareness of [issues identified within the project] - within the CRC? People associated with the CRC? The community? Why?

20. Do you think the [members of the CRC/people associated with the CRC/ the community] are more interested in [issues identified within the project]?

21. Do you think the project helped to raise awareness about why science is taught at schools? Why or why not?

22. Did you use the package that ASTA provided you with? Was it useful for carrying out the project? Why or why not? Did you find it useful? What parts worked, what did not?

23. Do you think there was enough support from ASTA to carry out the project? Why or why not? What further support would you have liked?

24. Were there any difficulties/challenges in carrying out the project? What were these?

25. What advice would you have for any future groups carrying out similar projects?

APPENDIX K

SAMPLE INTERVIEW

Interview with STA Coordinator

3 p.m. Tuesday 10th December 2002

Researcher	First, to start off with, I would like to go back to... I guess some time ago when you first heard about the project?
STA Coordinator	I was involved in the initial report, the studies of the quality of teaching and learning in science. So having been involved in that project, and this one was raised in one of our science teacher association meetings. I thought this is nice because it is a follow-up from that report. So um that's why I put my hand up.
	Interview suspended for phone call.
STA Coordinator	So basically I heard about it through the science teachers... through the SEA*ACT council meetings and we were talking about the project and it was pretty much suggested that I might like to take on this role. (inaudible) great idea. So that's when I first heard about the project.
Researcher	Why did you think you it was a 'great idea'? I am trying to ask why did you want to get involved?
STA Coordinator	Basically I really wanted to see what we could do within the community in terms of raising some science awareness. Raising the profile of science around the community not just within the school. And the other reason was that I thought it would be good to see that some of the recommendations that came out of the first report were being implemented.
Researcher	So were you involved in putting together the original proposal?
STA Coordinator	With the school? I sat in on a meeting. What happened when I got back from the meeting with all the focus group leaders we had in Melbourne from the states. I came back and they had already put in an expression of interest. So when I got back I contacted them. Sent out a whole lot of others to other schools to see who else we could get to put in a submission. And each time I offered that if they would

like me to sit in on their original initial discussions as to what they wanted to do, then I was available. Um they took that up, so I just went along. I pretty much just sat there while they discussed issues. And I said 'whatever you do just keep the project simple so we can make the main criteria'. Cause they had some big ideas which is good, but they had to focus. Yes, so of course I was involved.

Researcher — Did you think this kind of project, looking on a national scale, does it seem unique to you, with your science teacher background and your involvement in [program]?

STA Coordinator — That's a difficult question to answer. I don't think there is such a structured program which gets the schools to try and make... hang on let me think what I was going to say. Um it depends on the school, some schools are very active in the community and go out and seek information and work with the community and do things locally. Having a formal structure, such as the package, I think is really useful because if they haven't been involved in something like this before they have got a framework or structure they can work through. Um I don't know how often schools do do this. I think the intention is there but time factor, which is always killers of most programs, they might not be able to. So being given some time, some funding, to cover that. Time to actually get something off the ground, yes.

Researcher — What do you think the project set out to achieve? What do you think were the main aims?

STA Coordinator — Oh the project itself? Or the [Mt Capital] project? Or the science awareness project?

Researcher — Um (inaudible) I suppose as we talked about a little before and how it gets the (inaudible) out I guess on the local level.

STA Coordinator — Okay. The reason I ask that was because um I think there was sort of two different aims. The science awareness, the model is to, the aim I saw there was to actually link in and get community to see the science and what's happening. Whereas I think the schools aim, and I say schools because I think that is where the driving force was, was to link the two schools, gets some science happening, get the students to see but also to take it out to the community and it was just slightly different to the package. But that is my

personal perception. I think it worked well and um I suppose the focus was on what the kids were doing, what the school was doing and then that's communicated. As opposed to the, what I would have seen with the national project where what's the issue in our community let's get all the community together, and yes we are going to involve the school but we are also involve everybody else in the community.

Researcher — You have probably had a bit of time to reflect, why do you think these aims separated?

STA Coordinator — Okay because one is time, the time factor for driving. I think we had a really strong community group as part of the CRC and there were people from the schools and yes some were parents, but there was people like [the Friends of Mt Capital representative], was there who wasn't. She was still linked with the schools, she wasn't really (inaudible) which she was coming from a different perspective. So the links were there with the Friends of [Mt Capital] group, so that was the outside community people. But I think we could have involved possibly the business people a lot more right from the start and got them involved. And we could have had um like a weekly update on 'this is what the kids are doing at the moment' so the community could see what was happening throughout the duration of the project rather than just at the end. But it is a time thing, it takes a lot of time to get us all together, to get things happening like that. One of the key problems were that I think we didn't actually meet together until April, and then we had about two months to get the program done before we could start reporting on it. So the time factor was just very, very short.

Researcher — (inaudible).

STA Coordinator — And the reason for that was...I can't remember when I got confirmation of which schools had received the grants. And then I said 'well I'll let them settle and get their ideas together and then I will contact them in about two three weeks'. By the time I contacted them, [the Local Leader] hadn't heard. She had heard via an email but she wanted something more official that she could to the school board, to get the board saying yes we go through with that. So seeing that hadn't been done, when I spoke with [the Local

	Leader] we, I wrote up a letter of congratulations to all the members that had been in the original writing. We sent that out and we called a meeting of the CRC representatives. And that is why time got really late there. Should have been something done (inaudible).
Researcher	So it was sort of held up by ASTA's...
STA Coordinator	I think ASTA and maybe and as I said I can't remember when I found out. And then I called them a week or two weeks after I found out. I don't know where the hold up was. Then once I had called [the Local Leader] it was 'well we can't do anything until we have this and this and this' and um (inaudible)
Researcher	(inaudible)
STA Coordinator	(inaudible)
Researcher	(inaudible)
STA Coordinator	There was a bit of a lag lead up to so that everything had to be done very, very quickly. That's how things go sometimes (inaudible).
Researcher	We have talked about the different aims. So what aims do you think, I guess from ASTA's point of view that the project achieved?
STA Coordinator	Well I think it did. I do believe that it did achieve some of the aims of alerting the community to one of the, not maybe alerting but involving the community on a community issue. [Mt Capital] is used by the local community and everybody over there seems to have an interest. Living outside the area I don't really know what the... So they know the area, they have used it. So hearing about what the students have been doing, or the community and the students have been doing, in terms of taking the quadrant studies and that sort of thing. I think there is an active community interest there and as I said it happened at the end point as opposed to right through. Other than unless they were linked somehow to the school, or through Friends of [Mt Capital], or the students themselves. But somebody saying living in the suburb two streets away from the mountain sort of may not have realised that this is happening as such.
Researcher	Was there anything you hoped the project would achieve that it did not?

STA Coordinator I suppose not really. Just that more community involvement, and more people living nearby. As I said it was all due to not, I think the ideas were that, 'yes we all want to do this, and yes we loved to get the community involved'. We have to be realistic you only have such a timeframe you could work within and that was all that could possibly be done.

Researcher Do you think there were any unexpected outcomes from the project?

STA Coordinator I think the link between the two schools. I didn't expect that would have happened. I expected that they would work together but it would be on this project and then perhaps on something else. But um seeing that the outcome that they would use this as part of their peer support group. The activities between the school is a really lovely outcome for the students themselves as well. And also that it will be ongoing that wasn't as unexpected, because as I said initially when we, the ideas were coming through it was so big that I said lets focus on this and we might be able to do the rest later. So the ongoing nature is good.

Researcher I probably know your answers to the next few questions, about the activities that you were involved in? I guess you were more from my perception part of the CRC (inaudible). Did you actually go to the [local shopping centre]?

STA Coordinator No I wasn't here. I missed the two, the two three weeks that the students were really doing a lot of the stuff. Especially the display. I just wasn't in town. So I missed that bit, which I was really disappointed with. But as I said, we had fit it within a certain timeframe. I found out about it through the photos and the media and the (inaudible). So my role was pretty much on the CRC. I saw myself as a support to the team leader, especially to [the Local Leader]. Just supporting her through the program as much as I could and also being sort of a liaison between ASTA and the schools and the community group. So those things that needed to be passed through...sometimes I found it a bit difficult because I didn't want to be, especially the first couple of meetings where we have got to be looking at this package to make sure that we are on track. I was pushing maybe steering saying this is what needs to be done. I didn't want to have to take the role as much. Not that I

didn't want to personally, but I wanted to see how the group is going to work with the packages at opposed to me saying this is what I think you should be doing, you have got to do that.

Researcher — Cause I guess you did have a kind of a unique role. Maybe it was a difficult one to try and know how much to...In particular you, compared to other states where the ASTA representative is somewhat further from the actual CRC meetings...

STA Coordinator — I guess. I saw myself as one more member of the team, is how they viewed... and I mean I was happy to do that but at the same time my role was supposed to be as a support person, whereas if you needed something (inaudible). So I think that there was one, possibly two, CRC meetings that I didn't get to.

Researcher — As far... say the project goes on and I guess I am just exploring the idea of your role and whether what you think about if they were do again whether you had any suggestions or...

STA Coordinator — I think if I wasn't involved you don't... it is very difficult to be able to put all this stuff together all the reports without really knowing all the background (inaudible) like if you were a bit further away. This was hard enough by me missing just a few weeks of the program and trying to work out how am I going to write my perception of what's happened. I think if I wasn't as involved this would have been a lot harder to know and also it would have been a lot harder to support [the Local Leader] and who ever else needed that support through the project, whether for the budget, or report writing. So I think you need to be active (inaudible). I mean I know as I said the mid the mid-report um [the Local Leader] was quite, quite busy with that so and so I just said (inaudible) guidelines that we have to so she passed it through me and I sent it all to ASTA. Um the final report was just her ideas, everything was there and I just edited it for her. Just to try and get it into, I won't say the language of ASTA because it would probably be the same, but to a language that um... I tried to remove myself a little bit from the project so that somebody reading that could understand it without having been involved. Whereas, I mean, she was quite close to it. Friends of [Mt Capital] did this without...introduced just little things.

Budgets, I know when I was talking to [the Local Leader] before I didn't realise, because I haven't been in touch with her for the last two three weeks, that she is still working on budgets and that's really causing quite a lot of chaos and angst. So I need to find out why it's causing her so much angst. (inaudible) original receipts for everything back to ASTA and because things like paper and whatever we had to factor in. The school gets them in great big bulk quantities so trying to get a simple receipt for four reams of paper was just ridiculous. So she is really stressing about that so...

STA Coordinator and Researcher talk about the report.

Researcher What do you think were the scientific outcomes of the project?

STA Coordinator Okay scientific outcomes. Well I think the students themselves, I think the students got... its going to be hard, cause my background in that area is very limited. Um okay, they learnt how to do things like quadrant studies. Be able to investigate the landscape and see what flora is there and start to identify some of the grasses that they had. Um I think they looked at why they were there, how they, and whether they should be there or not whether they were native or introduced. So I think those science outcomes were really important for those students to know because it's part of their own local community (inaudible). Um some of the other scientific outcomes would have been things like the impact that people have on that environment as well so probably came through the discussions and um studies they were doing on the mountain, with not just the students and the teachers themselves but with the links through Friends of [Mt Capital] and the rangers and the... You were there at that?

Researcher No actually (inaudible).

STA Coordinator So I missed, I haven't got them here but the some of the material that I sent... the materials that I saw that the kids had written about. They seemed to be the things that were getting (inaudible) as to 'this is what we found, this is what we saw and this is what we did'. And then the action plans

that had been put together as to this is what we need to do, I think that was a buzz. There is quite a lot of science involved coming up to it coming up and link forward those action plans (inaudible).

Researcher — I think we have actually covered this next one but I will ask it anyway if there is anything additional you want to add. What you brought to the project in terms of skills and... You have pretty much made it clear to me that, we talked about you being a support to [the Local Leader].

STA Coordinator — That's yeah I say that was... just as a back-up person who they can bounce ideas off. And so I have enjoyed that, so it's been good.

Researcher — What do you think you personally gained from being involved in the project?

STA Coordinator — Well I hadn't worked with [the Local Leader] or any of the other teachers before. I mean even for a personal gain finding out who or what Friends of [Mt Capital] were because I had heard about them. I already knew about them. And just on a personal level, making those links with the various people on the CRC and the other teachers that were involved. And um I was just actually quite delighted to be part of it actually.

Researcher — So do you think um, I would guess that ASTA have gained a lot from you being involved in the project, what about SEA*ACT ?

STA Coordinator — SEA*ACT. I suppose I am really SEA*ACT representative from ASTA if that makes any sort of sense. Um SEA*ACT have been informed throughout the process. The council have been discussing what is happening and I think there has been two articles in the science teachers association newsletter that have gone out to all science teachers in ACT. So they have been sort of alerted that this is happening and the background. On another level it has also shown that SEA*ACT is involved in trying to raise the profile of science in the ACT. And this is done through... because we have got the affiliation with ASTA, so I think it has been quite positive for SEA*ACT as well. It has also been positive in that, I have just remembered, through this that we had two or three teachers come along to our main conference...

STA Coordinator talks about the conference and how the project helped to raise awareness of SEA*ACT.

Researcher	Just looking at the different groups we have talked about community, you thought there could have been more community involvement. What about school and business wise. Do you think there was enough school...?
STA Coordinator	I think it was quite a lot of school involvement because it is very difficult to... I mean it would have been lovely to have the whole school, both schools involved, but then again becomes quite a major project with a lot of time needed and a lot of lead up time to think about how we are going to implement it. So usually, I think, in the school environment when you are taking on a project of that size, you want to be able to plan everything before, rather than that year within a month or two months to be done in a month or two months. It contracts everything right down. And that's why things like the community and everyone else's involvement becomes lessened. So in terms of school, and in terms of the timeframe that we had, yes I think there was enough school involvement. Business, like the community maybe, um having someone on the panel on the CRC right at the start who could sort of be jumping into things would be... But again that takes time to try and find the right person from the business community that can (inaudible) the CRC. I think [the community representative] did look at it (inaudible) but anyway that was one of things that she was going to try and do.
Researcher	So do you think the project has fostered relationships between the various groups?
STA Coordinator	Oh definitely, because there has been the local business community wants more displays from the schools to put up in the shopping center, which is good. So it doesn't have to be just along the lines of science. It means that they get to see what the kids can do. Um relationships, between the schools and Friends of [Mt Capital]. Schools and the real estate agent, (inaudible) in their real estate times, about the project, so that is nice. And also the relationships between the two schools as well.
Researcher	Hopefully they will all continue.

STA Coordinator	Yeah it would be good to see that. Yeah it would be good to see I think they will be so.
Researcher	(inaudible) do more long term follow-up.
STA Coordinator	Just don't give them lots of paper work to do and filling in forms and doing this. That really takes away a lot of the celebratory of the program. I know they are important final reports and I know getting all the budgetary stuff right and everything, but the more paperwork that teachers have to do, the harder it is for them. They just don't have time to do it.
Researcher	(inaudible).
STA Coordinator	That's always an issue, you know. If they have had a bad experience when trying to carry through a grant or submission of some sort they are less just judging by some of the comments. They rethink 'well do we really need the funds to do this maybe I could just pull the funds out of the school budget'. We are doing this because it is such a valued program. If they have got those funds available rather than getting the grant and then having to do all the other extra bits associated with. 'Yes we have done this wonderful fantastic program but now we have got to do the amount of paperwork that goes with it'.
Researcher	Obviously ASTA needs that and the government...
STA Coordinator	Yeah...
Researcher	Do you have any suggestions or any ideas of how that could have been done better?
STA Coordinator	I liked that we ended up getting this electronically rather than having to type it in. So that was really useful. Um I can't remember was it [the Local Leader] who requested it electronically.
Researcher	Yes.
STA Coordinator	Getting that in electronic form was easier because she didn't have to worry about setting it up, it was just writing down things. If the same could have been done with the budget... the only reason I keep saying that is I know that the thing behind, that she is really stressing, and its only been today that I realised that it hasn't been done. I just assumed it had been done because we had a preliminary budget put together a while back and had allocated sort of the funds that we would require. When I said to her, was to

just go back and actually see what we didn't spend on the actual project and then put in that tax invoice to ASTA to have the remaining $2500, which is what I am assuming. But it sounds like it has been slightly changed (inaudible). I can't remember if it said we have to give all the original receipts and things...

STA Coordinator looks through the package.

STA Coordinator We are trying to back track and do all that...I know that receipts should have been kept but its all those bits of paper its very difficult you know we have got to factor it in and the teacher release time we have got to we knew that we gave them three days, I don't know if it was documented exactly which day they took to do that, the day they went up to the mountain, the day that they worked. So it would have been probably been something that [the Secondary Teacher] and [the Primary Teacher] organised as opposed to something that [the Local Leader] and [the Principal - High School] organised so as I said that is causing a bit of angst at the moment.

STA Coordinator talks about the project report.

Researcher Do you think the project helped to raise awareness of the issues with [Mt Capital]? I guess looking at the different, I imagine amongst the CRC. Do you think...?

STA Coordinator I think it did amongst the school community. As well just having the kids involved in going home and talking to the parents about what they were doing, going through the newsletters, um and also raising it through the real estate people and possibly a few through the local business community display as well. So I think mostly, if they were linked with the school community in some sort... and then focus through the Friends of [Mt Capital]. The only reason I keep saying the real estate people is that (inaudible). But beyond that if they didn't have a direct link with that or hadn't heard it. I am just thinking of one or two people that I know who live

	in the area, who I'd said oh this is happening but unless they'd heard about it through me or through [the Local Leader] or Friends of [Mt Capital] (inaudible). So in terms of the wider general community no, but the immediate community associated with the schools and Friends of [Mt Capital] yes.
Researcher	On the other hand do you think it has encouraged interest, I guess amongst the community?
STA Coordinator	I think so I think Friends of [Mt Capital] has had increased membership which is apparently coming through the schools. I can't really answer what else it has done.
	STA Coordinator looks through her report to remind herself.
STA Coordinator	All the Friends of [Mt Capital] meetings, that's right, are being announced in the school newsletters now, which is nice. And the two schools are now on the Friends of [Mt Capital] mailing lists. So there has been some really nice links between the community groups. And as I said the local shopping centers have requested more displays of the same calibre.
Researcher	Do you think the project has helped to raise awareness of why science is taught at schools, because as you know that was one of the key aims?
STA Coordinator	Oh I don't know if really it has raised major awareness. I think, the only reason I am saying that because I didn't see it, I didn't see how the community reacted to the displays. I haven't seen comments that the community has sent into the schools, so I am finding it difficult to answer that.
Researcher	I would like to turn our attention to the package. Of course ASTA are looking to improve it. I know that you're aware of it and have worked through all of it after our workshop. So what parts do you think were useful for this project?
STA Coordinator	The best part, the part that I liked the best, were pages 7 & 8. Cause it was a nice short brief um, 14 yeah it was the checklist, the process guide, where you could see what you needed to do um. What else do I have here...

STA Coordinator discusses her final report and giving me a copy.

Researcher: So do you think there was enough support from ASTA for the group, the CRC to carry out this project? And is there any additional support that you think would have been useful?

STA Coordinator: It is really difficult to say because um... I suppose ASTA can't really put in more to the group um cause I suppose I am sort of their representative. So if I needed something, I could call ASTA. Or if ASTA needed something, they would call me or [the Local Leader]. So from that point of view, and because all the projects right around the state were different. I suppose the only thing that would have been useful may have been to have had a first meeting. We had to rush because of the timeframe. Would have been really good to have had like a mini workshop of the package. This is what the package is, not just with me, with what I do with my group, but um giving all of the CRC to see it go through it without discussing what the issues were that we were going to be looking at. We couldn't do that because of the timeframe. We had to go straight into working out what we were going to do in this project. Um that would have been useful. Now whether it was ASTA or myself having done that. I think probably my role would have been to have done that with the group. What ASTA could have done more is...now they came here just before the mid-report time and what... because we met up with, [the Local Leader] and myself met up with [ASTA]. (inaudible) Just got a chance to touch base that was really good because also that was the first time [the Local Leader] had met the ASTA people.

Researcher: That would have been useful at the beginning you think or?

STA Coordinator: Possibly, just to hear where they were coming from. Because as I said, I think that was part of my role as well. So, but it could have been useful the thing that would have been really useful was... As I said [the Local Leader] received an email saying 'congratulations you have won this grant'. It didn't really go into more details, it wasn't something, she could take...she felt. I never saw the email. It wasn't something that she thought she could take to the

	school board or to the chairman of the school board and say 'we have been given this money and to do this project we need your approval as well'. And so what I did do was the letter that I wrote, the congratulatory letter, I pulled out the aims from the package (inaudible), what the schools involvement would be, and pulled that into it so the board or whoever else knew what this was about. (inaudible) The other part that ASTA probably could have been involved in, was setting down with us with budget stuff. We sort of did that in the middle of the year that's why I need to find out a bit more about it.
Researcher	You have mentioned quite a few (inaudible) [difficulties and challenges]...
STA Coordinator	I had a few others. I mean, a lot of this doesn't (inaudible) with teachers. And I am not saying teachers, it is also the community they give up their time to come to the meetings so...
Researcher	Talked a bit about that in here...
STA Coordinator	I think so I am just trying to...And I said something about it is difficult to do without an active CRC group that can take on the tasks. That the teachers don't have time to do so. That's why I said, you need to make sure that there were numerous community members that were available and could assist in the admin. So it wasn't really just [the Local Leader] and [the Primary Teacher] and [the Secondary Teacher] trying to drive this thing, you know, in between all their other work.
Researcher	Cause it I guess from my point of view [the Local Leader] did take everything on and...
STA Coordinator	I think she felt responsible for the project to work. I think she felt that 'well I got the schools into this so I had better make it work'. (inaudible) But then again, I mean, that as a Local Leader you need that person to take the initiative and follow it through. There was a lot of stuff that perhaps could have been delegated to some of the other people on the CRC to take that responsibility on. (inaudible) budget maybe she didn't have to look at it maybe it could have been [the Primary Teacher] or [the Secondary Teacher] or somebody else. But she was quite conscious of what their workload was like as well.

APPENDIX K (Continued)

Researcher — What advice would you have for any future groups carrying out similar projects?

STA Coordinator — I would say spend quite a lot of time in the planning stages really nutting it out having a look at ...There is some really good stuff in that package in terms of what needs to be planned. And just keep quite a bit of time, into that planning, making sure that you know what you need to keep track of um and then also assign those roles fairly clearly for each member of the CRC. Not just a group meeting together and throwing ideas around. I think it gives people, it breaks down some of the jobs (inaudible) teachers did lots. And then they could maybe work through what they are going to do with the students that was the, their role. So that worked pretty well. But there were other things, like publicity for example. If we had nominated a person on the team that was in charge of getting publicity done, rather than the teachers and [the Local Leader], and everybody trying to do that. So that's where...well read because that identifies do this do that.

Researcher — From the comments I have had, it is quite an overwhelming package.

STA Coordinator — But you use it as a resource set. That's why I said the two most important pages are those pages 7 & 8, which is that process guide. And I think before, especially the planning, going through those two pages...'This is the process that we have to take, lets have a quick look. Oh yes, okay, finding extra resources, well we don't need to read this section because we know which extra resources we need, and we know who to contact'. Which is what happened here, they really didn't need to refer to that section at all. I think in terms of clearly defining the roles, yes we sort of we knew who we wanted on the CRC... But I don't think we, we sort of had people in for certain things, but we could have done that a little bit better. Turned over the page and said maybe we need to look at this. And it's not, I mean the package is easy to skip through. So you don't really need to read it in great depth unless that particular section is something that you really need to look at. So I think it is a good resource. I am just trying to think what else was there. (inaudible) I mean the teachers organised, and I am saying teachers because it really was the teachers doing this in some respects, and also some of the

community people, have organised projects before. They know the general procedures that they need to be doing and so things like the strategic plan developing your strategic plan. I thought that was quite late in the program. And really you do a plan, you might not call it a strategic plan, but you have done some sort of plan right at the beginning. And your actions and tasks come out of that and then from that you might then start looking at your CRC and resource people. (inaudible) So that's why I didn't really start to insist that they look at this cause, I can see things had been done and you also don't want to detract from the time.

Researcher And the last question whether you had any general comments anything else you would like to say?

STA Coordinator I think it was a really worthwhile experience for everyone involved. And I think the kids got a lot out of it the teachers certainly did just the comments that they had. And I know [the Local Leader] um straight after the project was just buzzing how wonderful it was and now she is more angst, as I said with all the paperwork and the admin and things. So it has been a really a really positive for the people involved. And it's not just the schools and the students but also Friends of [Mt Capital] and the local community did get involved. I'd love to see what happens later whether they do follow it through. They said they were going to put the plaque up on the mountain and do some regeneration of the plants. It would be nice to see what happens.

END OF INTERVIEW

APPENDIX L

CASE STUDY EVIDENCE

Type	Author/Source	Evidence (date originated)

Project Documentation	ASTA/ Curtin University of Technology	1. Original project brief from DEST (01)
		2. Timeline for project (Aug 01)
		3. Advert for *ASTJ* & *Investigating* (July 01)
		4. Nomination Proforma (Oct/Nov 01)
		5. Mid-project Report proforma (June 02)
		6. The package
		• Rennie, L & Williams-Pearse, G. (2002) *ASTA Science Awareness Raising Project: Science awareness raising package for participants in the trial project.* Consultation draft
		• Rennie, L & Williams-Pearse, G. (2003) *ASTA Science Awareness Raising Project: A support package for science awareness raising projects in schools and their communities.* Revised package
		7. Rennie, L. J., & Williams-Pearse, G. F. (2002, July). *Changing the Way Communities Think About Science: An Ambitious Project.* Paper presented at the Annual Conference of the Australasian Science Education Research Association, Townsville, QLD.
		8. Community interviews
		• Pre-project (June 02)
		  • Pre-project Interview Proforma
		  • Instructions for Community Interviews
		• Post-project (Sept 02)
		  • Post-project Interview Proforma
		  • Instructions for Post-project Community Interviews
		• Survey letters sent to parents and non-parents (Sept 02)
		  • Instructions for letters to people in the community as part of the evaluation
		  • Cover sheet
		  • Survey letters

APPENDIX L (Continued)

Type	Author/Source	Evidence (date originated)
Project Documentation (continued)	ASTA/ Curtin University of Technology (continued)	9. Rennie, L. J., & Australian Science Teachers Association. (2003, June). *The ASTA Science Awareness Raising Model: An Evaluation Report.* Report prepared for the Department of Education, Science and Training. Includes "Australian Capital Territory Case Study: Native Grasses of Mount Capital"
	CRC	1. Nomination Form (Dec 01) 2. Timeline for project - written against ASTA proforma (Jan 02) 3. ACT Community Reference Committee contact details (Apr 02) 4. 10 point plan for ACT Mt Capital Native Grasses Project (May 02) 5. Budget/Resources for Mt Capital Native Grasses Project (May 02) 6. Meeting minutes • First 11/4/02 • Second 18/4/02 • Third 16/5/02 • Fourth 30/5/02 7. Permission slip for Year 6 primary school students (May 02) 8. Project reports • Mid-project Report (June 02) • Final report including feedback on ASTA package (Aug/Sept 02) • STAC focus questions/report including feedback on ASTA package (Aug/Sept 02) 9. Correspondence email with Friends of Mt Capital (Nov 02)
	Various - other projects	1. All nominations and their ranking (Dec 01) 2. Nomination forms from selected communities (Dec 01) 3. Mid-project reports (June 02)

APPENDIX L (Continued)

Type	Author/Source	Evidence (date originated)
Direct Observation	Researcher	Meetings held by CRC 1. (11/4/02) • Field notes • After-meeting memos • Transcripts 2. (18/4/02) • Field notes • After-meeting memos • Transcripts 3. (16/5/02) • Field notes • After-meeting memos • Transcripts 4. (30/5/02) • Field notes • After-meeting memos • Transcripts 5. (8/8/02) • Field notes • After-meeting memos • Transcripts Field-trip 1. (22/5/02) • Field notes • After-trip memos
Interviews	Researcher	Interviews with individual CRC members 1. Friends of Mt Capital President (18/11/02) 2. Secondary Teacher (19/11/02) 3. Friends of Mt Capital Representative (20/11/02) 4. Community Representative (22/11/02) 5. Primary Teacher (22/11/02) 6. Local Leader/Primary Principal (22/11/02) 7. STA Coordinator (10/12/02) 8. Secondary Principal (13/12/02)
	ASTA	1. Community interviews pre-project and post-project - 23 Coding and statistical results supplied to researcher

APPENDIX L (Continued)

Type	Author/Source	Evidence (date originated)
Physical Artifacts	Various	1. Photos of students working (June 02) 2. Students work • Year 6 primary school worksheets (May 02) • Results & 3 point action plans (July 02) 3. Photos of display presented in local shopping centre (July 02) 4. Newspaper article from *Canberra Times* (August 4, 2002)