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SCHOOL PARTICIPATION IN COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION SCIENCE EDUCATION PROGRAMS

An Interactive Qualifying Project Report

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Abstract

The objective of the project presented by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) was to evaluate the science education programs offered in the state of Victoria in order to provide recommendations to increase the participation levels of these programs. The project research was focused on determining factors hindering participation levels, such as the structure of the curriculum and program content, the marketing of the program, and logistical barriers preventing eligible schools from participating. The research included the collection of data that suggested reasons why Victorian teachers choose to participate or not in the science education programs offered by CSIRO. Data was collected through surveys and interviews of science teachers across Victoria, as well as through two focus groups of CSIRO educators. Successful completion of the project provided a report of the strengths and weaknesses of CSIRO's educational efforts, as well as recommendations of methods CSIRO could employ to increase participation.

Some pages are incorrectly numbered

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Executive Summary

The Commonwealth Science Industrial Research Organisation (CSIRO) education division seeks to promote science education among Australia's youth. The organisation offers educational programs for students in schools and the general community, as well as professional development sessions for teachers.

The goal of this study is to present recommendations to CSIRO that will contribute positively to the growth of the organisation. Specifically, the project aims to identify strategies to raise participations levels in CSIRO's science education programs, and to develop teacher profiles outlining teacher expectations of extension science education.

The background research investigated some of the academic and administrative details of CSIRO programs including logistics, curriculum, and program structure. Initial project work also included an investigation of the Victorian science curriculum requirements useful for comparison to the curricular aspects of CSIRO programs. In addition, background research included a general overview of the psychology and methodology of scientific learning in order to evaluate the teaching methods used by CSIRO Education's programs. For the purposes of comparison, we also investigated similar science-based educational programs in the U.S.

A comprehensive methodology was developed to formulate the most effective methods by which to collect information from a target population of administrators and teachers in Victorian schools. Utilising surveys, interviews, and focus groups, relevant information was collected. In addition, project members observed science education programs presented by CSIRO educators, in order to gain an understanding of what programs involve.

Surveys were developed both for teachers who participated and those who had not previously participated in CSIRO educational programs. The objective of the surveys was to gain statistical data about teachers' expectations of extension science education, while also gauging teacher's awareness of and satisfaction with CSIRO programs. Different surveys were administered to the two subgroups, participant and non-participant teachers, with questions catered to the different characteristics of the two subgroups. Primary and secondary teachers, from all types of schools, were surveyed from metropolitan as well as country regions.

Interviews were conducted both face to face and over the phone to add depth to the collected survey data. Questions for these interviews were also formatted and stratified according to teacher's participation in CSIRO educational programs. The subjects interviewed were a cross-section of teachers of different grade levels, from different types of schools and wide-ranging locations; this sample was representative of teachers throughout Victoria.

In order to gain internal perspectives of CSIRO's educational programs, two focus groups were conducted with CSIRO educators. Presenters and administrators gathered to brainstorm ideas for improvement.

Programs were observed first-hand; this gave insight into which aspects of program content, structure, and presentation were key to program success. Program success was measured by student engagement and interest, as well as teacher satisfaction.

The results compiled from these methods presented a clear picture of Victorian teachers' satisfaction with CSIRO programs and areas in which the organisation needs to improve. Participant teachers were generally satisfied with the educational programs in which they were involved and offered constructive criticism

for their improvement. Reoccurring comments and suggestions were centred on the integration of more hands-on components in programs and the restructuring of programs to include more activities and less introductory preparation. In addition, it became apparent that many teachers were unaware of CSIRO's general offerings. A large number of teachers were discouraged from booking programs because of distance (i.e. lack of transportation such as school buses and vans) and were unaware of any outreach opportunities. These findings prompted the conclusion that the current marketing strategies needed focus and refinement.

Recommendations were proposed to fulfil the objectives outlined in the problem statement. Additional recommendations for improvement, though outside the project focus, are also described, as they are still relevant to the progress of CSIRO Education.

Primarily, marketing strategies need to be modified to raise the awareness of CSIRO Education and more effectively convey the details of program offerings. Aesthetically, informative flyers and packets must be "eye catching" and elicit attention. Contextually, mail-outs must clearly relate important aspects of the programs to potential participants and be directed to the right audience. Without direct contact information identified for each teacher, often mailings are directed to curricular co-ordinators who fail to distribute the information. One suggested way to combat this would be to generate a CSIRO teacher profile database to utilise as a marketing tool to support direct contact with the teacher population. Each teacher profile would theoretically be a short synopsis of a teacher's basic information from the type of school they taught at, subjects of interest, to curricular needs, past program participation, email, address, etc. As a result, educators would receive the most

relevant information and thus would be more likely to examine the materials more closely.

Additionally, programs should be structured and developed to promote the highest degrees of flexibility to incorporate teacher preferences. Throughout surveys and interviews, educators commented on the importance of integrating educational extension programs with their existing curriculum. It might be advantageous for CSIRO to explore methods of modifying their current programs to be available in different variations, thereby catering to a wider audience.

This study identifies the possible areas for change and refinement that CSIRO should examine. Hopefully, implementation of carefully selected advancement strategies can help to build upon CSIRO Education's reputation and will help achieve increased attendance levels. Thus CSIRO will be better positioned to fulfill its overall goal of encouraging students to participate in scientific activities.

Authorship

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1.0 Introduction

This project investigated participation levels in educational programs conducted by the Commonwealth Scientific Industrial Research Organisation (CSIRO) Education, Victoria, based in Highett, Victoria. The program conducts science-related educational activities for primary and secondary school children at the CSIRO Science Education Centre (CSIROSEC) or at individual schools upon request.

The goals of CSIRO Education, as described on the division's website are to: "alert school students, their families and teachers of science to the contribution of scientific research to our community, encourage students to participate in scientific activities, especially those related to the applications of science, and encourage students to take up careers in science" (2000b).

The educational programs offered by CSIRO, Victoria are comprised of demonstrations and hands-on activities for students, generally lasting one to two hours. The session topics range across all four major branches of scientific study (physics, biology, chemistry, and earth sciences) and programs are available for students in all levels of their primary and secondary education.

In 1999, approximately 60,000 children from over 500 schools throughout Victoria participated in this program. This is a participation level of less than 10 percent of eligible children. CSIRO believes that they have the capability to increase participation as close to 100% as possible in the Melbourne metropolitan area. Reaching the entire regional area is not as feasible, but CSIRO would like to significantly increase the awareness of and interest about CSIRO's programs; with more demand, CSIRO Education may be able to expand to reach regional areas better (Krishna-Pillay, 2001). In order to improve the participation levels, our project

included a set of recommendations for the future in a report summarising the strengths, weaknesses, opportunities and threats of the existing program.

2.0 Background Research

The following section relates previously researched information with the objectives and goals of this project. In order to provide adequate information regarding science education programs, the project team reviewed many educational journals and web resources. The project team gathered information on the structure of the programs at CSIRO and several organisations in the United States. In addition, the team reviewed some of the psychology of conveying information to students. This review will discuss the structure of the CSIRO Education program and identify factors that could influence its ability to reach students.

2.1 CSIRO Educational Programs

During the mid 1980's, CSIRO established an educational division in order to cultivate an interest in science among students. This learning facility currently operates with the purpose of informing students, their families and educators of the scientific contributions of CSIRO and other researchers to the community. CSIRO Education attempts to encourage students to participate in activities related to science and technology and to encourage the pursuit of careers in science (Krishna-Pillay, 2001).

In order to achieve this mission, CSIRO Education, Victoria offers, among other things, a variety of science programs for primary[1] and secondary[2] school students. These programs cover a variety of scientific topics for students of all ages.

[1] Primary school includes preparatory year through year six (CSIRO, 2000c).
[2] Secondary school is years seven through ten (CSIRO, 2000c). During years 11 and 12, students are involved in specialised study toward their Victorian Certificate of Education (VCE) (Board of Studies, 2000a).

The programs introduce younger students, from their preparatory year[3] though primary school, to a number of topics in the physical, chemical, and earth sciences. Program content increases in depth for secondary students, covering subjects such as electronics, forensics, and genetics (CSIRO, 2000c).

The CSIRO programs generally comprise an hour of demonstrations and hands-on activities, but some programs for younger students take only a half hour and some for older students are an hour and a half. The Electricity and Magnetism program, one of the most popular of 1999,[4] is a representative program. In a one-hour session, students in the preparatory year through year six view demonstrations and perform experiments that discuss electric circuits and the properties of magnets. Students learn about a variety of sources of electricity, how magnets can be used to create electricity and where electricity and magnets are applicable in everyday life. Another popular program, Forensic Frenzy,[5] is an hour and a half long criminal science workshop for students in years six through eight. Students have the opportunity to solve a crime using a variety of strategies such as chromatography techniques and the analysis of fingerprints, dental X-rays, or bloodstains. Generally, all programs are completed in one session, but this is not universal. The Super Sleuth program, for example, involves students pretending to be criminal scientists attempting to solve a mystery and requires two 2-hour sessions that can be done in a single day or over two weeks (CSIRO, 2000c).

Teachers can bring students to the CSIRO Science Education Centre (CSIROSEC) in Highett, Victoria to participate in any of the programs. In many of the activities, however, teachers can request to hold most of the programs at their

[3] Students entering the preparatory year are to have turned five years old by 30 April of the year they enroll (DEET, 2000).
[4] 11,451 students attended 265 sessions (CSIRO, 2001).
[5] 6703 students in 246 sessions (CSIRO, 2001).

schools instead of at the CSIROSEC. The programs are designed to be the same regardless of the location, in terms of content and style, but out-of-house programs can often accommodate more students (Krishna-Pillay, 2001). The "labs on legs," as the programs away from the CSIROSEC are called, are the more popular option. More than 86 percent of all programs held in 1999 were away from the CSIROSEC (CSIRO, 2001).

According to CSIRO, participation in the CSIRO Education programs has been lower than expected. In the most recent information available, CSIRO Education reported that in 1999, 58,290 students participated in 1706 sessions (CSIRO, 2001). CSIRO believes that they are capable of reaching a greater number of students because these totals represent a mere 10 percent of eligible students from 20 percent of eligible Victorian Schools (Krishna-Pillay, 2001).

2.1.1 Program Cost

The fees for CSIRO's programs range from $2.70 to $6.50 per student and are used to cover all the costs of the program (CSIRO, 2000c). Staff salaries, equipment maintenance, consumable materials used in experiments, administration costs, and taxes are expenses characteristic of all CSIRO educational programs. Programs that involve travel to the schools must also include vehicle leasing and petrol costs. The range of fees charged for the programs reflects the amount of time and supplies required to conduct the program (Krishna-Pillay, 2001).

2.1.2 Marketing Techniques

CSIRO Education, Victoria uses a variety of methods to inform schools about their science programs. Extensive information is available through the CSIRO Education website (2000c) and CSIRO maintains a list of schools deemed to be interested in the program. Marketing efforts are not limited to electronic communication. CSIRO sends out mass mailings three times per year to all Victorian schools. In addition, information about the programs is included twice a year in the Joint Council of Subject Associations of Victoria (JCSAV) mailing to individual and school members of the Science Teachers Association of Victoria (STAV). Information about the programs is also included in the Catholic Education Office (CEO) mailing to all Catholic schools in Victoria (Krishna-Pillay, 2001).

In addition to direct mailings, CSIRO uses more passive methods to advertise their programs. The organisation for example, publishes advertisements in educators' periodicals such as *Contact* published by STAV, the CEO newsletter published by the Catholic Education Office, and the *Victoria School News* supplement published by the Victorian Department of Education, Employment and Training. Officials from CSIRO Education, Victoria also frequent conferences and seminars held for science educators. Through this combination of marketing techniques, CSIRO Education seeks to inform teachers across the state of its program offerings (Krishna-Pillay, 2001).

2.1.3 Proximity versus participation

Approximately 79% of the students that attend the science programs are from schools in the greater Melbourne metropolitan area (Krishna-Pillay, 2001). This corresponds to census data showing a vast majority of the state's population in the

same area (ABS, 2000b). The CSIRO hopes to increase the participation levels in particular within the metropolitan area, since the incursion and excursion programs are quite accessible to these closely proximate schools. Several times each year, CSIROSEC educators embark on tours, lasting up to a week, to bring programs to schools further into the country (Krishna-Pillay, 2001).

2.1.4 Curriculum and program structure

The Victorian State Government, specifically the Victoria Curriculum Assessment Authority (previously the Board of Studies), is responsible for the development of curricular guidelines for Victorian schools. These guidelines, known as the Curriculum and Standards Framework (CSF) specify that science students must have an understanding of the four major sciences: physics, chemistry, biology and the earth and space sciences (Board of Studies, 2000). CSIRO Education, Victoria offers programs in all four of these subdivisions and attempts to make the "programs as closely linked as is reasonable to the CSF" (Krishna-Pillay, 2001). Cliff Wheeler, the director of the Wachusett Regional School District curriculum in Holden, Massachusetts says that a good curriculum is based on the requirements of the governing organisation, but incorporates the interests of teachers and students (Wheeler, 2001). A number of programs, at all levels, focus on electricity & magnetism and chemistry, but there are offerings in the biological and earth sciences as well (CSIRO, 2000c). A more thorough examination of CSIRO Education's coordination with the CSF follows in section 2.2.

2.1.5 Teaching strategies and presentation of information

CSIRO Education designs the programs offered to encourage student participation in learning. Consequently, the science programs consist of a combination of interactive demonstrations and hands-on activities for participants. In constructing programs, CSIRO Education administrators try to coordinate information with the state curriculum, but also consider logistical issues, such as the need for a demonstration to fit into a classroom setting, to be portable, and to be easy to set up and dismantle. CSIRO Education, Victoria does not employ a specific teaching philosophy other than that the scientific information be presented in a fun and engaging manner (Krishna-Pillay, 2001).

2.2 State of Victoria School Curriculum

The VCAA is the government entity responsible for developing a framework for material taught in all Victorian schools, from Preparatory to year 12. In addition, the framework provides suggested means for assessing student achievement (see section 2.3). The VCAA is comprised of eleven appointees and is responsible to the Minister for Education (Board of Studies, 2001).

According to the VCAA website, the Curriculum and Standards Framework (CSF) II is the result of a two-year revision of the original 1995 framework. This most recent version of the curriculum guidelines is the basis on which student success is measured and is available to all Victorian teachers in print or via the web (Board of Studies, 2000).

The curriculum in Victoria is divided into eight key learning areas: The Arts, English, Health and Physical Education, Languages Other Than English, Mathematics, Science, Studies of Society and Environment, and Technology. Each of

these learning areas is subdivided into several strands, or important topics. Science has four strands: Biological Science, Chemical Science, Earth and Space Sciences, and Physical Science. The CSF outlines six levels of achievement for students between the Preparatory Year and Year 10. These levels each identify material that students must understand by the completion of that level. For example, level four of the Physical Science strand says that students are expected, by the end of year six, to be able to "design, build and describe the operation of simple devices that transfer or transform energy" and to "describe the motion of objects in terms of simple combinations of forces" (Board of Studies, 2000).

CSIRO structures its educational programs in a manner that attempts to address many of the skills and subjects in the CSF (Krishna-Pillay, 2001). Some CSIRO Education programs correlate to the CSF better than others. Appendix A offers a comparison between the program descriptions and the CSF requirements. The Electronics program, for example, is suited for students in years 9 or 10 and correlates directly with learning outcome 6.2 of the physical science strand of the CSF. This outcome states that students should be able to "describe the effect of electronic and electrical components in the operation of electronic and electromagnetic devices" (Board of Studies, 2000). The Electronics program addresses these topics directly by having students build a number of practical electronic devices, such as alarms, timers, or even a radio, stressing the use of particular electronic components (CSIRO, 2000b).

Other programs have a less obvious correlation to the CSF. Cool Chemistry introduces students to a variety of technologically advanced materials and their uses. The hands-on activities or demonstrations include introductions into liquid crystals, thermo chromatic pigments, and electroplating (CSIRO, 2000b). According to the

CSF, students in year six are to be able to "relate properties of common substances to their suitability for particular use." Students in year eight are supposed to be able to "relate the safe use and disposal of common substances to their physical and chemical properties" (Board of Studies, 2000). There is clearly some correlation between the content of the Cool Chemistry program and the CSF, but not all of the outcomes are addressed. Not much emphasis, for example, is placed on the molecular structure of materials and the relationship between that and use and disposal.

The Curriculum and Standards Framework does not divide the first two levels of science education into individual strands. Students in years P-2 are taught some basic scientific observational skills and are exposed to basic inquiries into chemistry, physics, and earth sciences (Board of Studies, 2000). CSIRO Education offers younger students an introduction to a variety of subjects, including weather, and chemistry, as well as electricity & magnetism (CSIRO, 2000c).

Beginning in year three, a distinction is made between the four major branches of science and details about scientific concepts and the application of science to everyday life are made (Board of Studies, 2000). CSIRO addresses topics in all four strands at levels three and above, but not exhaustively (CSIRO, 2000c).

2.2.1 Biological Science

The biology strand of the CSF is designed to expose students to how living things function and interact with each other and their environment. More specifically, primary school biological science seeks to develop an understanding of the similarities and differences between life forms. Students learn about the relationship between the function and structure of creatures and are taught methods of classification. Secondary school biology incorporates studies of factors affecting the

survival of organisms as well as genetics and inheritance. In addition, students study certain environmental topics, such as the impact of humans on other living things and the functioning of ecosystems (Board of Studies, 2000).

CSIRO Education offers some programs that provide introductions into the various levels of the biological sciences. The Life and Living program, for example, provides students in years five and six with some hands-on activities covering functions of the human body, and topics relating to other life forms. Students in years nine and ten can participate in the Gene Technology program where they learn about genetics in the context of forensic science and have the opportunity to extract plant DNA (CSIRO, 2000c).

2.2.2 Earth and Space Sciences

During the course of their education, Victorian students learn about the planet Earth, its place in the cosmos, and its dynamic systems. Students learn about the origin of major physical features through processes such as erosion and plate tectonics. The practical use of various rocks and minerals is discussed. Students also examine the effects of the movement of the bodies in the solar system (Board of Studies, 2000).

CSIRO Education offers programs that introduce students to this strand as well. Various weather phenomena are demonstrated in the Weather program for primary school students. In addition, the Air and Atmosphere program shows students in years P-4 some of the properties of air and how it can influence weather.

2.2.3 Chemical Science

The study of chemistry in Victoria is based on knowledge of the properties, uses and creation of matter. Younger students are expected to be able to discern between liquids, solids, and gasses and to be able to identify chemical change. Secondary chemistry focuses on the structure of the atom and, particularly, the effect of atomic structure on the characteristics of groups of elements in the periodic table. This knowledge of atomic structure aids students in developing models and formulas to represent chemical change (Board of Studies, 2000).

Teachers may turn to CSIRO Education for programs that cover a large portion of the chemical science strand. The Reaction and Change program, for example, seeks to demonstrate how to create chemical reactions and how they can yield useful results. The Cool Chemistry program allows students the opportunity to perform a variety of chemical experiments. Topics covered in this hands-on program include electroplating and liquid crystals (CSIRO, 2000c).

2.2.4 Physical Science

The study of physics in Victoria is centred on the concepts of force and energy. Students learn how light, sound, heat, electricity, and bodies in motion all contain energy and that this energy can transform from one form to another. The motion of objects is explored in terms of forces and combinations of forces of various types (Board of Studies, 2000).

CSIRO Education provides programs that cover a majority of the physical science topics outlined by the CSF. The programs: Force and Movement, Electricity and Magnetism, and Light and Sound introduce primary school students to these

fundamental aspects of physics. More advanced programs, such as Physical Science and Electronics are available for secondary school students (CSIRO, 2000c).

2.2.5 Other CSIRO Programs

The strand-oriented courses are not the extent of CSIRO Education's program offerings. In additional programs, such as Science in Action, Science and Technology, and Science Procedures and Processes, participants learn how scientific principles apply to a variety of unusual or technologically advanced scenarios. These programs can be tailored to cover a specific strand or they can serve simply to reinforce general scientific thought. In the Super Sleuth and Forensic Frenzy programs, secondary school students use their knowledge of science to solve mysteries. While such in-depth activity is not expressly a part of the CSF, it does imply that students are to leave school with a strong appreciation for how science can contribute to society (CSIRO, 2000c).

The CSIRO Education, Victoria programs address many of the topics outlined in the Victoria Board of Studies' Curriculum and Standards Framework. More extensive offerings exist for the physical and chemical sciences than do for the biological and earth sciences, but educational programs are available for all four strands. All programs offer an interactive or hands-on learning experience that gives students the opportunity to participate in scientific activities not available in a typical classroom setting (CSIRO, 2000c).

2.3 Student Assessment

The VCAA is also responsible for providing a means by which schools can measure student achievement. Concurrent with this objective, the Curriculum and

Standards Framework II provides educators with a number of learning outcomes, or skills, for students in each learning area. There is no standardised testing to determine whether students adequately acquire knowledge of the material in the CSF. Instead, the VCAA suggests a number of possible means by which students can demonstrate their mastery of concepts. Common suggestions are for students to explain material through written or oral presentation or to demonstrate understanding in examinations. The VCAA makes it clear on their website, however, that acceptable methods of demonstrating comprehension are by no means limited to these suggested evaluations (Board of Studies, 2000).

The CSIRO Education programs are designed to stimulate students' interest in particular areas of scientific study. Many of these programs address issues concurrent with the goals and outcomes of the CSF and will, consequently, aid students' understanding of concepts and improve the results of assessment.

2.4 School Distribution

CSIRO Education, Victoria services schools and students in all of the State of Victoria. Key to understanding their ability to reach all of these students is a realisation of what types of schools are in Victoria and where these schools are located.

The Association of Independent Schools of Victoria reports that, in 1999, there were a total of 794,554 students in 2319 schools in the state of Victoria. Among these, there were 1631 government-run schools, 492 Catholic schools, and 196 independent schools (1999).

Schools are concentrated, of course, in areas with higher populations. The Australian Bureau of Statistics (ABS), in the 1996 Census, studied the distribution of

families in Victoria. The ABS divided the state into twelve regions, as shown in Figure 2.1, for the examination of distribution (ABS, 2000b). According to census data, 71 percent of all Victorian families live in the Melbourne subdivision. The Highett location of the CSIRO Education, Victoria headquarters, is also located within this region. An additional 19 percent of the 1.15 million families live in the regions bordering the Melbourne subdivision. Similarly, 90 percent of Victoria's 480,456 couples with dependent children are in these same regions (ABS, 2000b).

Figure 2.1 – Victoria Statistical Subdivisions (ABS, 2000a)

In general, a vast majority of the population of Victoria lives in the regions surrounding Melbourne. As a result, most of the schools within Victoria are located in these same areas. Since CSIRO Education intends to expand the base of the schools it services, an understanding of the distribution of the schools is important.

2.5 Other Science Education Programs

CSIRO's web page declares the educational mission of the organisation in three parts, to: "(1) alert school students, their families and teachers of science to the contribution of scientific research to our community, (2) encourage students to participate in scientific activities, especially those related to the applications of

science, (3) encourage students to take up careers in science" (CSIRO, 2001b). By focusing on this mission, we were able to find means of comparison between CSIRO Education and similar programs. In order to offer CSIRO well-thought recommendations, we studied organisations that offer educational programs in the United States that seemed uniquely able to offer insight into what determines their success.

2.5.1 Massachusetts Academy of Mathematics and Science

The Massachusetts Academy of Mathematics and Science is a public high school that provides education for skilled maths and science students in grades eleven and twelve. According to Principal and Assistant Director, Pauline Lamarche, the Academy's purpose is to nurture kids with exceptional maths and science ability and prepare them for the future (2001). The Academy, though a full-fledged public school for grades eleven and twelve[6], is considered an extension of the students' previous high school, a gateway to fulfilling learning potential. Academy students explore in depth concepts of maths and science, using the best technology available to aid in learning. While CSIRO's education programs are enriched by the research actually taking place within the organisation, the Academy's students have resources from Worcester Polytechnic Institute (WPI), literally at their doorstep. Located on the WPI campus, Academy students take college courses at WPI during their senior year in high school. Throughout the two years the Academy provides guidance for the students, encouraging them to develop the independent and analytical thinking skills conducive to successful futures in math and science.

[6] Grades eleven and twelve are the final two, junior and senior, years of secondary school education (ages are 16-18 years old).

The teaching at the Academy is based on discovery of concepts, the students learn and remember by experience. Hands-on group work, Lamarche feels, is the key to preparation for the "real world"; cooperation and collaboration are emphasised in order to give students a sense of the intense interaction involved in the process of reaching goals (2001). Unlike normal public high schools, there is little grading involved in evaluating student learning, so the program likens to a large compilation of relevant projects that are completed with plenty of feedback and interaction among and between student groups and faculty.

Considered a research and development centre of pedagogy in Massachusetts, the Academy's ever-evolving system is used as a model for determining the best methods of teaching. Through summer outreach programs the Academy provides workshops for teachers anxious to learn the latest in successful teaching (Lamarche, 2001). It seems that the Academy's flexibility in its curriculum and genuine interest in student well-being yield the program great success in education, as well as the ability to contribute nurtured, developed minds to the fields of math, science, and technology. The Massachusetts Academy of Math and Science can provide a great resource for up-to-date information on how to fulfill the missions that both CSIRO and the Academy hold dear.

2.5.2 Ecotarium

The Ecotarium, known as the Center for Environmental Exploration, is a museum that offers programs "to promote appreciation, increase knowledge and foster stewardship of the New England environment by stimulating learning about the world in which we live" (Ecotarium, 2001c). The Ecotarium is a private, not-for-profit institution that is supported by its admissions, memberships, gifts and grants.

Classrooms and families visit the museum primarily from Massachusetts, but some visitors travel from New Hampshire, New York and Rhode Island in order to experience what the Ecotarium has to offer.

Like CSIRO, which offers programs that coincide with much of the state curriculum of Victoria, the Ecotarium offers collaboratives with schools to advocate the reform of preschool, primary, and secondary education as suggested by the Massachusetts Education Reform Act of 1993[7]. Specifically, the Ecotarium partners with schools and teachers to offer support and training on topics including "environmental sciences; urban ecology; inquiry-based learning; integration of computer technologies; and implementation of National, State, and Local Curriculum Frameworks and Standards." (Ecotarium, 2001a) The Ecotarium provides educational programs that correspond to the aspects of the Educational Frameworks that echo the Ecotarium's mission. In this way, the education offered is relevant for students and true to the Ecotarium's purpose.

The Ecotarium also offers Family Preschool Days for young children and their families. These nature exploration programs include hands-on activities, crafts, and 'story time'. Programs are limited to small groups, so individual attention is given to each child and family (Ecotarium, 2001d). Workshops for home-schooled children[8] and their families are also available. According to Education Administrator Janet Seston, home school families are more demanding and require more time flexibility, so the Ecotarium has tailored programs to the needs of these families (2001). Seston explains, "We are trying to figure out how to work with them and make them happy when they're here and give them really rich content" (2001). The extra efforts to

[7] Changes were suggested for the seven-year period following the Massachusetts Education Reform Act (Massachusetts Department of Education, 1997).
[8] Home-schooled children are educated at home, usually by their parents. Parents follow certain guidelines for teaching children appropriate subject material.

reach out to these groups have paid off at the Ecotarium; overall visitor numbers are rising. Besides the acknowledgement of participation numbers, the Ecotarium also measures its success through surveys given to participating teachers requesting feedback on the program (Seston, 2001).

2.5.3 Museum of Science, Boston

The Museum of Science, Boston is a not-for-profit educational facility whose mission "is to stimulate interest in and further understanding of science and technology and their importance for individuals and for society." (Museum of Science, Boston, 2001) The Museum relies upon grants and donations from its visitors, members, and annual supporters for funding.

The Museum offers educational programs that encourage children to answer their own questions about the natural world by giving them tools to do so. Active participation in the process of science that nurtures children's curiosity accompanied by a good collection of materials to aid sensory perception provides an environment for learning. The friendly attitude toward learning that characterises the Museum of Science, Boston seems to have contributed to its success; 240,000 students and chaperones visited the Museum in the year 2000 (Dunne, 2001). By providing such an enthusiastic atmosphere for learning and attractions such as an Omnitheater and Planetarium, the Museum of Science, Boston has attracted students from all over the world. Locally, the Museum distributes science kits to school groups and sends educators to public libraries, classrooms, and school assembly halls for hands-on demonstrations; 40,000 students take part in these outreach programs annually (Dunne, 2001). The Museum of Science, Boston has also had tremendous success distributing science kits through its rental program. The kits demonstrate concepts in

an exciting manner, and are big timesavers for educators. Kit distribution has expanded beyond the normal classroom, to home educators, after-school programs, scout groups, and summer camps. By offering a diverse array of opportunities for further learning, the Museum of Science, Boston has programs that fit every educator and student need and desire.

2.5.4 National Institute of Standards and Technology

The National Institute of Standards and Technology (NIST) is an organisation in the United States known for excellence in science and technology; "NIST strengthens the U.S. economy and improves the quality of life by working with industry to develop and apply technology, measurements, and standards." (NIST, 2001) Comparable to CSIRO, NIST also takes an active role in promoting science and technology education in geographic areas proximate to the organisation's locations in Gaithersburg, Maryland and Boulder, Colorado. The Gaithersburg location does not actually have an educational division; instead employee volunteers run programs for children. Guest lecturers participating in the 4-H[9] Adventures in Science Program at NIST cover many different scientific topics, and every lecture also involves some sort of demonstration and/or hands-on project. Logistical factors, such as limited facilities, lack of equipment and low staff involvement, have been obstacles for NIST educators (Steiner, 2001). Fortunately, according to Research Physicist and volunteer teacher, Dick Steiner, the federal government may soon be encouraging more volunteer efforts by requiring such in government work agreements (2001). NIST has no plans to expand its education programs beyond the volunteer level (Steiner, 2001).

[9] 4-H is a youth education program sponsored by the United States Department of Agriculture.

Educational programs have also been established at NIST's location in Boulder, Colorado. The Career Awareness and Resource Education (CARE) Program is a community outreach program that offers many science presentations and educational materials such as videos and science kits for schools. Videos are available for free by mail and science kits can be picked up and returned by teachers for classroom use. All services are free of charge, as NIST provides funding in its budget. Presentations are limited to a 65 km (40 mile) radius of Boulder and are given by NIST staff members in the classroom or NIST laboratory. The presentations usually involve the use of the same kits that are given out to teachers; presenters demonstrate the use of the kits. Though the presentations are in more of a lecture-style, the students are quite engaged and often help with the demonstration (Wright, 2001). According to Education Administrator Phyllis Wright, the CARE program reaches 20,000 students per year (2001). The program is marketed through brochures sent to teachers, but primarily by word of mouth. Established in 1979, the CARE program is well known in the community. Though the administration does not provide evaluations for assessing the program, a steady amount of positive feedback demonstrates the program's success. Phyllis Wright suggests that the CARE program could be improved by offering more kits that are specific to the needs of teachers (2001).

2.5.5 Cost

A logistical issue involved in student or school participation in educational programs is cost. Many schools do not have the funds to offer educational opportunities to their children outside of the regular curriculum. All educational programs researched offer assistance to schools or students in need. NIST, Boulder,

encourages participation by offering all loans of educational materials (videos and kits) for free. The Museum of Science, Boston determines the eligibility of schools for reduced admissions by requiring the school to list the number of Title 1 students[10], the number of students on free lunch plans, as well as a written statement of goals for the field trip (Dunne, 2001). This way, the Museum is able to evaluate the need of the schools, and award the schools whose goals best fit the objectives of the Museum's programs. Teachers are also allowed free admission anytime. By offering assistance to students and schools, educational programs encourage involvement and extend their range to a greater expanse of possible participants.

2.5.6 Marketing

The marketing techniques used by each institution can provide insight into program success. The Massachusetts Academy of Mathematics and Science has tried to reach students/schools through advertisements run on cable television, radio, and in local and statewide newspapers. Marketing techniques should target the audience toward which the program has the greatest relevance. The Academy has used mailing lists of all children born in a certain year within the area, but has found obtaining the names of all sophomores (year 8 in Australia) in high school within a certain radius to be more successful (Lamarche, 2001). According to Pauline Lamarche, the best way of communicating the program's purpose and reputation has been through word of mouth (2001). Academy also sends out information to maths and science teachers and guidance counselors across the state of Massachusetts (Lamarche, 2001). NIST forwards information about its educational programs through youth organisations as well as the Air and Space Museum at the Smithsonian (Steiner, 2001). All

[10] Title 1 students are from low-income households.

educational programs researched also provide updated information through organisation homepages on the World Wide Web. By using a broad range of marketing techniques, educational programs can increase awareness of their offerings.

2.6 Student Motivational Habits

Often an analysis of the building blocks of learning is necessary to understand different approaches to education. This section aims to provide insight into the psychology of learning, as well as the factors that motivate students to learn. The development of this perspective is critical to our research in that it gives us the leverage needed to critique the presentation of educational information. Furthermore, this section offers additional insight into the importance of recognising and nurturing different learning styles and motivation levels.

2.6.1 Student Motivation in Classroom Settings

Aside from presenting information in a favorable manner and trying to formulate an equation that stimulates learning, often a student's motivation to learn will become the deciding variable in the student's success or failure in the classroom. Harmin discusses his perspective of a student's view of the classroom, and the challenges experienced in that setting. He describes how many students fear making mistakes and being seen as un-intelligent by classmates. Thus, these students choose not to participate in activities and miss the key portions that facilitate the learning process (Harmin, 1994).

Lee & Brophy present theories that delve into the aspects of student motivation as it pertains to science education in their article on the motivational patterns observed in a sixth grade classroom. The researchers outline five patterns of

student motivation observed during their study: "(1) intrinsically motivated to learn science, (2) motivated to learn science, (3) intrinsically motivated but not consistent, (4) unmotivated and task avoidant, and (5) negatively motivated and task resistant" (Lee & Brophy, 1996). These five patterns aim to address the different motivational factors inherent in students. Moreover, these theories on motivational patterns account for the personal interests in science some students hold before they are exposed to classroom materials.

Lee & Brophy state that students from patterns one and two seem interested in learning science, even though their internal motivations varied at times. Students from pattern three appeared to settle and be satisfied with a limited understanding of the information. Pattern four students avoided engagement in classroom activities, and pattern five students actively resisted engagement all together. In considering the wide spectrum of learning patterns associated with students as described by the study, Lee & Brophy hypothesise that classroom motivation is a function of many variables. Some of these factors include curricular content and materials, instructional programs, academic tasks given, the teachers selected, and the students themselves (Lee & Brophy, 1996).

These five patterns exist only to categorise basic motivational traits in students, and are detailed enough to encompass all students. Furthermore, motivational strategies should be geared to address the characteristics of individual students on a case-by-case basis, rather than making general assumptions (Lee & Brophy, 1996).

2.7 Student Learning Patterns

Grasped hand-in-hand with the ability to motivate students to learn, must be an understanding of student learning patterns.

> One is learning when he increases the probability of making a correct response to a given stimulus. This is an operational definition. One has learned only when he is capable of giving an appropriate response. Moreover, the definition points out that in learning there is no certainty. Nothing is sure. There is only a probability that the response will be correct (Lancaster, 1974).

As described in Lancaster's work, the probability of recalling items from memory changes and is a function of time, repetition, and other variables (1974). It is clear that just because an individual is capable of recalling information in one instance, does not mean that he or she will be able to in another. A conclusion can be drawn that only when the probability of giving a correct response is raised to surpass the levels presented by mere chance, has learning taken place.

"Perhaps all learning could be attained from experience (in infinite time), yet the time required for development of responses to stimuli or for change in behavior may be materially reduced by guidance based upon vicarious experiences" (Lancaster, 1974). Lancaster's use of the phrase "vicarious experiences" infers that learning is stratified in various levels. Consequently, these levels of learning are broken down into "discrimination, identification, motor sequences, concepts, and concept sequences" (Lancaster, 1974). These five patterns combine to underline the fact that learning is gained through various types of experiences. If examined further, an understanding of these levels of learning could provide information useful in trying to outline the optimal conditions conducive to learning.

Understanding learning patterns in their most basic forms, if applied to the development of programs provided by CSIRO, could have a high impact on the retention levels of students after programs have concluded. From another perspective,

knowledge of these learning patterns in the development of CSIRO programs may allow them to be utilised as a complete instrument for learning or as an enrichment tool for current studies.

Lancaster concludes from his discussion of learning patterns, "the ultimate in human learning is to be able to build sequences of concepts and to use them in arriving at decisions" (1974). Ultimately, recognition of these concepts and patterns will set the stage for further understanding the methods of teaching explored in the following section.

2.8 Teaching Methods

Refined teaching methodologies are essential, and provide the foundation and backing needed for students to be successful in the classroom. Moreover, the absence of time, energy, and resources put into developing these methods can be directly analogous to students' struggles in absorbing and retaining information.

Of the many techniques put forth by modern educators, inquiry teaching is one of the most effective ways to educate youth about the maths and sciences. "According to the National Science Education Standards, inquiry is central to science learning and rests on the premise that science is an active process" (Dailey, 1999). Dailey also provides us with a conceptual definition of inquiry teaching by the following quote from her teachers guide on inquiry adapted from the PBS *Scienceline* video series on K-5 (kindergarten through fifth grade) professional development.

> Inquiry is a dynamic teaching method that engages students in 'minds-on' as well as 'hands-on' activities. Functioning as scientists, students actively generate questions…collect, evaluate and synthesise data…draw conclusions…rely on evidence to support ideas… and contemplate next steps. You facilitate the process by posing questions, managing the learning environment, assessing progress, helping students make sense of what they've

learned and providing opportunities for them to investigate, collaborate and explore (Dailey, 1999).

Breivick, in his task of presenting the importance of resource based learning, states "academicians must stop assuming that students know how to research information, or that students can easily learn research skills without any intervention" (1998). As an aside, research skills seemingly hold little relevance with respect to promoting science education; Breivick's mention of this was to denote their integral presence in science in general. As the fundamentals of science point to the quest for information, surely the acquisition and formulation of sound research skills would hold relevance in this respect. Conceptually, inquiry teaching speaks precisely to the problems Breivick aims to illuminate (1998).

These problems stem from a non-existent fundamental background of how information is acquired through drawing concise and clear conclusions as to make inquiries, as commented by Lorie Roth, director of academic services and professional development at California State University. A summary of Ms. Roth's remarks were given in the context of her concerns with the lack of skills necessary to find information inherent in her students at California State University. The absence of such skills at the collegiate level leads one to believe that these tools should be developed early in a student's academic career, and if possible at its inception (1999).

Teaching methods that incorporate inquiry techniques including interactive exercises and logical thinking activities attempt to avoid the limitations of lecture-based teaching. A study conducted at Norwich University (England) on the poor level of retention held by students after lecture-based teaching found that "they remembered on average only 20 percent of the lecture content, having forgotten in one week an additional 50 percent of what they had remembered earlier from the lecture" (Breivick, 1998).

In Lancaster's book entitled Effective Teaching and Learning, he explores the lecture method of teaching and describes lecture as one-way conversations that lack the dynamic needed to clarify and reiterate the material presented. However, Lancaster, in his thoughts on lecture, meant to merely set up his counter argument, that lectures have a proper place in the realm of education. Furthermore, in the same breath, he makes it clear that:

> Lecturing is a desirable method where the objectives are largely inspirational, motivational, and slanted toward the development of certain attitudes and values. A professor can convey far more through a lecture than through a written text. By the intensity of his voice, his gestures, and his facial expression, he conveys feeling. He makes the subject alive (or dead). He connotes things through the atmosphere as well as through the words. His intrigue with a subject is instilled to the student. His enthusiasm (or lack of it) is contagious. There is no doubt that a good lecturer can stimulate his students to action. He can stir their emotions and evoke involvement. He can provoke thoughts. In a lecture, one relays his attitudes and his sense of values (Lancaster, 1974).

While there is no doubt that the ideal lecture or lecturer could be conducive to learning, and or stimulating students to pursue information, Lancaster's argument has not led this researcher to have faith in a lecture, or lecturer's ability, to stimulate minds in the art of problem solving, questioning, and probing to discover answers (1974). Furthermore, the very idea of teaching through inquiry, as Breivick (1998) indirectly supports, implies that there are more effective ways to present information than by lecture.

In the context of CSIRO's philosophy and educational approaches to learning, their utilisation of a hands-on methodology would seem to provide a teaching advantage. While it is challenging to design programs to "fit" or address the points of an externally mandated curriculum, it is more challenging still to design programs that will be enjoyed and absorbed by students.

2.9 Science Outside the Classroom

One could argue that it is more challenging to spark interest in students in the topics of science and mathematics. One approach taken by science educators is to make science fun and entertaining for students. Advanced Exhibits, a designer of *Grossology*, a popular science exhibit, utilised this strategy. The exhibit attempts to educate students about the human body's inner workings through an aesthetically rich and interactive environment. As a travelling exhibit, *Grossology* was well received by the public regardless of site location. The exhibit was able to boost attendance levels in some places by as much as 50% above normal, and at every location, it generated large amounts in revenue. One curator recognised the need for creating and sustaining stimulating environments, and remarked, "If you have dry exhibits, nobody's going to come. That's where the entertainment part comes in" (Sorensen, 2001).

Clearly, the founders of *Grossology* found ways outside of the normally prescribed methods of praise and coaxing to motivate students to embark on a path towards learning. On the contrary, Hooley McLaughlin a senior advisor at the Ontario Science Center (who recently moderated a panel on the marketing-versus-education issue at a conference of the Association of Science-Technology Centers) speaks her position that much is lost in the shuffle of the "comic-book approach" to learning. Furthermore, she adds, therefore "the thrill of intellectual discovery that comes from a challenging presentation may be lost" (Sorensen, 2001). Scientific displays similar to *Grossology*, such as *Marvelous Molecules* presented at the New York Hall of Science in New York City, proved less than successful as inferred from the hall's stagnant attendance figures. The only prominent difference prevalent between the programs, *Grossology* and *Marvelous Molecules*, is the latter program's

failure to "consult marketing experts about the exhibit's design" before its introduction to the public (Sorensen, 2001).

In settings outside of the classroom, motivating students to learn takes on many different dynamics. Students generally are attracted to the most exciting and engaging activities. In contrast, when in a classroom, students will most times give their attention to the educator, and more passive teaching methods might be utilised.

As educational demonstrations are integral in CSIRO Education's approach to stimulating learning in its centre, as well as in outreach classrooms, it might be advantageous for these units to be examined and evaluated from a marketing standpoint both internally and externally. If student motivation can be boosted through a refined presentation of information, clearly this would be a small price to pay for a situation by which both CSIRO and the students it services will benefit.

3.0 Methodology

The objective of this project was to provide CSIRO with a report summarising the strengths and weaknesses of the existing educational programs. In order to do this properly, several key aspects of the programs were investigated. Among these were the program content and presentation, the marketing of the program, and logistical barriers preventing eligible schools from participating, as well as teacher impressions of all of these aspects. In order to collect the data needed to fulfill the objective given by CSIRO, a careful methodology was followed. To determine the appropriate methodology, the benefits and limitations of available methods of data collection were evaluated; these are surveys, interviews, and focus groups. By strategically employing all three of these methods, the chances of biased results were lessened. The evaluation and implementation of each method are outlined below.

3.1 Quantitative Analysis of Teacher Impressions

We used surveys to gain an extensive amount of information about and impressions of involvement or non-involvement in CSIRO Education programs. Surveys were sent to science teachers at participant (current and former) and non-participant schools. The surveys asked for data profiling the responding teachers and contained questions regarding factors involved in participation in CSIRO Education programs. In addition, the surveys contained questions that measured teacher awareness of CSIRO Education's program offerings, as well as the overall impressions of program participants (past and present). The participant surveys consisted of 16 questions, and the non-participant survey consisted of 11 questions. Question format included multiple choice, multiple answer, and numerical grading of aspects of CSIRO Education; additionally, a limited number of questions at the end of

each survey requested qualitative data in a short answer response. Surveys can be viewed in Appendices D and E. Confidentiality was assured in writing in the cover page that introduced the survey. The surveys were catalogued by tracking numbers located in the upper right hand corner of the first page of questions; these numbers did not affect the confidentiality offered. The tracking numbers were used to determine which surveys had been returned and what relevant statistical information was available regarding the schools, such as region, grade level of school, and participation standing. The surveys were sent out through the postal service and included an envelope with return postage. Follow up phone calls were made beginning one week later, in order to encourage participation. The follow up phone call protocol can be viewed in Appendix F. Surveys were resent and faxed to teachers on an individual basis upon request per phone conversation.

3.1.1 Survey Sample Determination

Because Victoria is so large and over 2500 schools are located throughout the state, it was deemed best to sample equally from two regions, labeled metropolitan and country. Surveys were sent to 289 science teachers from schools within these two regions. In order to obtain an accurate representation of the population, our choice of region, schools, and individual science teachers reflected consideration of many factors. The metropolitan region represented close proximity to CSIROSEC and covered the surrounding area within a driving hour of the centre of Melbourne. The country region represented all Victorian schools outside the metropolitan region; schools in this region would likely consider travel a definite obstacle, in this case outreach offerings would be put to best use. Because it was important represent both rural and metropolitan regions accurately, population distribution was an important

factor in sampling. In order to determine whether cost is a hindrance to participation, schools varied in economic distribution were sampled. One hundred fifty surveys were sent to country schools and 141 surveys to metropolitan schools of different size and economic status. Additionally, surveys were sent to government, Catholic, and independent schools in a proportion similar to the actual ratio of school types. Information categorising the different schools was obtained from Australian Bureau of Statistics (ABS) and CSIRO. An approximately equal number of surveys was sent to schools of different categories of participation in CSIRO Education, those being participant (both current and former) and non-participant. Because we were unable to obtain specific names of teachers from each school, surveys were sent to the "Teacher in Charge of Science" in primary schools and the "Science Coordinator" in secondary schools. Mailing information was obtained from CSIRO's database of Victorian schools. An approximately equal number of surveys was sent to primary and secondary schools, in order to gain information about participation in relevance to these levels.

Two surveys were structured in a manner appropriate for participant (both current and former) and non-participant teachers. Each type of participant had a unique perspective to offer our investigation into the strengths and weaknesses of CSIRO Education programs. Schools that frequently participate were able to give the best insight into the strengths of the programs and schools that are non- or past participants offered some of the most important weaknesses of the programs to consider. It was important to adequately sample each participation type. Survey size was limited to 289 teachers, and distributed the surveys to an approximately equal number of teachers in each of the two participant categories: participant (both current and former) and non-participant.

3.1.2 Survey Analysis and Presentation of Results

Perhaps the most important part of the survey process was the analysis of the data in order to collect results. Survey questions formatted as multiple choice, multiple answer and numerical grading were analysed and compiled for statistical use by counting the different responses. Content analysis methods learned from Berg (2001) were used to interpret the data gained in short answer responses qualitatively. Content analysis counts the following elements in recorded social communication: words, themes, characters, paragraphs, items, concepts, and/or semantics. Keywords, phrases, and concepts were counted in the analysis of short answer responses.

For each of the two types of surveys, participant and non-participant, a detailed Microsoft Access worksheet was developed to record the data gathered from responses. The worksheets covered a wide spectrum of instructions for data entry as to minimise basic human error and bias, in particular for the interpretation of the short answer data. This component was especially important since more than one person entered the data and word connotation can be understood differently by different people. These worksheets, entitled the Survey Content Analysis Form and Entry Protocols, can be viewed in Appendices G and H. In the Access database, each short answer portion of the survey has detailed instructions for content analysis. Through identifying keywords, phrases and concepts in the short answer responses of the survey, the responses were classified by strata that are representative of the overall sentiment and ideas expressed in the different answers. The responses were grouped under various classifications including: monetary, communication, presentation of information, etc., and were systemically recorded and entered in the database. Each database, participant and non-participant, was developed using completed surveys in order to ensure that a full range of responses could be entered into the related fields.

The survey data were presented descriptively. The variables: mean and standard deviation were used to show average response, percentage response, et cetera. The classifications outlined allowed the extrapolation of recurring opinions of the survey population. The Microsoft Access database information was easily exported to Microsoft Excel where graphic and tabular representations of the data outcomes were created.

3.1.3 Eliminating Survey Error

Surveys have the ability to gain large quantities of data from a large group of people with minimal effort per capita. Though time has to be taken to develop well-thought-out survey questions and a waiting period follows distribution; surveys can reach a great number of people. Unfortunately, the immensity of information gathered can be a weakness. Thirty percent of a population must be surveyed, according to Wes Jamison (personal communication, 2001), in order to be statistically accurate. In addition to population considerations, a minimum of 50% of the surveys must be returned for the study to be considered acceptable, due to possibly biased responses (Jamison, personal communication, 2001). To counteract a potentially low turnout, the surveys for this project were clear and concise and a series of follow up phone calls were made to all of the respondents of surveys that we had not received, to encourage them to reply. It was also important to prevent bias through insufficient sampling and coverage. Sampling size and coverage were determined based on participation type, as well as many demographic considerations including distance from CSIROSEC, population distribution, and economics.

A problem that will contribute to an increase in measurement error is the need for a deadline for the receipt of surveys. This was required due to the time constraints

of the project, but it placed a limit on the amount of surveys that would be accepted. The date that was selected was three working days past the end of the fall school term. Teachers that received surveys at school would likely have reviewed the survey by this point, if they were going to do so, and would have returned them. A few surveys were received after the deadline and are not included in the Results section of this report.

Another bias involved with surveying is measurement, as it is difficult to determine differences between latent and manifest meanings on paper. Inter-subjectivity was prevented by using questions of a quantitative or objective format, with the exception of a few qualitative short answer questions at the end of each survey. Responses to these short answer questions were studied using content analysis in a way that allowed quantification of the answers given (Jamison, personal communication, 2001).

Even with the largely quantitative format of surveys, care must be taken in choosing question order; the most interesting and simple questions should be placed first followed by the more difficult questions and concluding with the most sensitive questions. Additionally, as questions with given response options were used, it is important that these given choices do not affect responses. This was taken into consideration, as these options can lead a respondent to think and respond differently than if an open-ended question was used. In order to prevent problems with influential questions and other mentioned biases, our surveys were pre-tested with the following subjects: social science professor Wes Jamison, project advisors Holly Ault and Jonathan Barnett, and four Australian Victorian residents (three of which are educators who work for CSIROSEC). With the help of these pre-tests, surveys were

carefully designed to maximise the quality of data gathered (Jamison, personal communication, 2001).

3.2 Qualitative Analysis of Teacher Impressions

In addition to written surveys, interviews were conducted with both participating (past and present) and non-participating educators in Victoria. A number of interviews were scheduled with teachers across the metropolitan and country areas, from all different types of schools, in order to gain qualitative data to enhance and reinforce the results of the surveys. The insight of these teachers has given CSIRO Education an in-depth perspective of those it seeks to serve. Such insight was invaluable toward determining the strengths and weaknesses of the existing programs.

Before individual interviews were conducted, two comprehensive interview schedules were formulated, one for participants (past and present) and one for non-participants. Interview schedules can be viewed in Appendices J and K. The interviews were structured primarily as attitudinal and behavioral interviews (in a funnel form), asking broad to specific questions. Additionally, some basic profile questions were included at the beginning of the interviews for introductory purposes. The interview schedules were designed in a semi-standardised structure, with a set questions and follow up probes to be used when appropriate. This structure allows for formalised content analysis, as all interviewees were given the same questions, but also gives flexibility in the questioning since probes can be used to gain more in-depth information pertinent to the responses offered (Berg, 2001).

A respondent population of 24 interviewees was used to collect qualitative opinions and suggestions to augment information gathered in the surveys. Interviews

were requested by phone, using contact information from CSIRO's database of Victorian schools. The interview request phone script can be viewed in Appendix I. The interview sample covered participant (current and former) and non-participant science teachers of a variety of grade levels from government, Catholic, and independent schools in the metropolitan region. Metropolitan schools were selected for interviews based primarily on their proximity to public transportation. A detailed map of greater Melbourne was used to locate schools along tram routes or near train stations further away from the city, up to 40km from CSIROSEC. A concerted effort was made by the project team to select schools both near and far from CSIROSEC in Highett. Once a school was selected from the map, it was located in the CSIRO database of all Victorian schools to obtain contact information. In addition, three country school interviews were conducted by phone, in order to get information from teachers distant from CSIROSEC. Although this was not a large sample size, sufficient data regarding country schools was obtained from the surveys, therefore these interviews were used to confirm and enhance survey findings.

After each interview, detailed transcriptions were completed and field notes were typed in a standard agreed-upon structure to aid in the analysis of the collected data. The collected data were analysed using the technique of content analysis, in which recurring ideas or themes addressed during interview were listed and quantified. Results of this analysis were compared with the results of the surveys with the intention of the two methods substantiating one another (Berg, 2001).

The general opinions of teachers were best presented in summary form, and included which fraction of responses incorporated which concepts and ideas. Specific comments or suggestions for the improvement of CSIRO Education were explained as well.

The interview data served as qualitative evidence from which conclusions were drawn on the level of effectiveness of CSIRO Education, Victoria's programs. These points served as springboards into areas that our research had overlooked. In addition, as the response rate to the surveys was not guaranteed to be sufficient, additional interviews were used to provide data to complete the sampling of the science teacher population.

Interviews are a good method for obtaining qualitative information about a topic or subject. Specifically, an interview allows researchers to probe details that would be unavailable from a survey. There are some major disadvantages, however, to interview-based data collection. The collection and analysis of interview data is painstaking and slow. An amateur social scientist requires up to eight hours for transcription and analysis for every hour of interview time (Jamison, 2001). In addition, the interviewer must be careful to interpret the nonverbal messages being conveyed by the respondent. If an interviewer probes a sensitive subject, the respondent may not be willing to divulge information and responses may be untruthful. A skilled interviewer will observe cues from the respondent that might indicate whether their responses are entirely honest (Berg, 2001). Interview questions must be clear and worded as to not invoke a negative response. In addition, the interviewer should play a sympathetic role and assure strict confidentiality in order to encourage truthful responses (Jamison, personal communication, 2001). To avoid problems with misinterpretation, interviews were pre-tested with social science professor Wes Jamison, project advisor Holly Ault, and CSIROSEC Director David Trotter. Interview questions and probes were modified and redesigned extensively before use in the field. Interviews helped to collect specific and well-developed impressions in a context that surveys cannot provide. This information was

invaluable, as it gave CSIRO a greater depth of awareness of the attitudes towards its programs.

3.3 Observation of CSIRO Education Programs

Integral to the objective of providing recommendations to CSIRO is an understanding of the structure and content of the offered programs. To gain a better understanding of these elements, the project team attended six education programs in the subjects of: Electricity & Magnetism, Light & Sound, Gene Technology, Forensics, and Air & Weather presented to groups of children from primary and secondary grade levels from all types of schools. Through observation, programs were evaluated; in particular the teaching methods employed by the presenters were assessed. Field notes were taken on student motivation and excitement, as well as the amount of actual hands-on work included. From this information, conclusions were formed to augment information gathered from surveys and interviews. Knowledge gained from previous studies of what makes science education programs successful, as well as what methods motivate students and provide the most productive learning experience, was used to determine whether CSIRO is employing the best techniques for its education programs.

Additionally, two focus groups were used to gather data from CSIROSEC educators, allowing them to provide some suggestions for improvement of the programs they are involved in. Using this method, ideas were brainstormed among a total of 13 educators in focus groups held at CSIROSEC. Focus groups provide an interesting opportunity to observe not only given responses, but also the interactions within the group interviewed. This type of concealed exchange does cause hindrances within the group's communication, and precautions must be taken to prevent

interference in response. Opportunely, these interactions can also give insight into the latent meanings behind the manifest, obvious responses offered. These observations have their interpretive limitations, but are important in determining the actual sentiments involved in the focus group. In the focus groups with CSIROSEC educators, paying attention to such aspects of communication was helpful in collecting true opinions from the respondents.

A focus group protocol was created with the funnel format necessary for maximising the potential of obtaining attitudinal and behavioral data, and was designed for no longer than 45-minute sessions. The protocol included probes to suggest further exploration into any strongly positive or negative reactions towards CSIRO Education that surfaced. The Focus Group Protocol can be viewed in Appendix N. Unfortunately, peer bias, due to the entire group's psychology, can influence a person's inclination to speak. Peer bias can often be observed in the subliminal interactions within the group, and if further examination of a reaction is too difficult in a focus group setting, an individual interview should be scheduled. Within our focus groups, extroverted individuals did tend to dominate conversation, so an attempt was made to encourage introverted participants to offer their thoughts. Also, as suggested by Wes Jamison (2001), by positioning participants in a focus group in a certain way, one can help eliminate peer bias. Participants who are familiar with each other's sentiments should be placed in rows, theater-style, while unfamiliar participants may be placed in a circle formation. As the educators in the focus group were very familiar with each other they were placed in theater style seating.

Confidentiality may also be an issue; it is suggested that the group sign a written form promising not to divulge information expressed in the focus group. This

way, research purposes are assured, though it is not guaranteed that other members of the focus group will maintain the promise. Confidentiality was not determined to be an issue within our focus groups, as none of the issues discussed were deemed sensitive in any way. For this reason, a written confidentiality promise was not necessary.

Information gained from the focus groups was interpreted using content analysis to quantify the most important elements of the data collected. The data were presented in detailed summary form in order to offer CSIRO suggestions directly from the teachers working towards its educational mission. Focus groups provided a good method for obtaining data directly from these educators.

3.4 Summary

The three methods of data collection used: surveys, interviews, and focus groups created a triangular collaboration for gathering information. By employing three methods and recognising that each has strengths and weaknesses, the chances of bias in our data collection were lessened and results were produced that hopefully represented the science educator population accurately. The results of the data analysis and research were summarised and presented in two reports: one oral and one written that provided CSIRO with an evaluation of the strengths and weaknesses of the existing programs. This summary included a series of recommendations to CSIRO of program modifications that would increase participation among Victorian schools. The timeline of how this project team executed its methodology is included in Appendix C.

4.0 Results

Information about the CSIRO Education programs and people's impressions of them was collected from a variety of sources. Responses were quantified in terms of content to ease in the analysis and combination of data. This chapter includes the raw responses to the surveys, the results from the interviews and focus groups, observations from a few CSIRO Education programs attended, and summaries of a few of the other organisations in the area offering science education programs.

4.1 Survey Results

The 289 surveys were distributed both to schools that had previously participated in CSIRO science education programs and schools that had not. These surveys were distributed among primary and secondary schools as well as schools in metropolitan Melbourne and those further into the country. Through the initial survey mail-out and the follow up faxes and mailings, a total of 32.5% of the respondent schools returned their surveys. The distribution of surveys and responses is shown in Table 4.1:

School Type	Survey Information		
	Sent	Returned	%
Metropolitan Participant Primary Schools	36	13	36.1%
Metropolitan Participant Secondary Schools	34	6	17.6%
Metropolitan Non-Participant Primary Schools	33	4	12.1%
Metropolitan Non-Participant Secondary Schools	38	12	31.6%
Country Participant Primary Schools	35	13	37.1%
Country Participant Secondary Schools	40	13	32.5%
Country Non-Participant Primary Schools	37	14	37.8%
Country Non-Participant Secondary Schools	36	19	52.8%
TOTAL	289	94	32.5%

Table 4.1: Survey Distribution

The response rate that was achieved was due to the effort to call every school that had not returned a survey two weeks after they were sent out.

4.1.1 School Types

The schools that responded to the survey were varied in nature, as was intended by the stratification of the respondent population. In all, 31% of the surveys sent to schools that had previously participated were returned. A total of 34% of the surveys sent to schools that had not previously participated were returned.

Table 4.1 shows the number of responses from each type of school the surveys were sent to. The breakdown of the types of respondents for each of the surveys sent out is as follows:

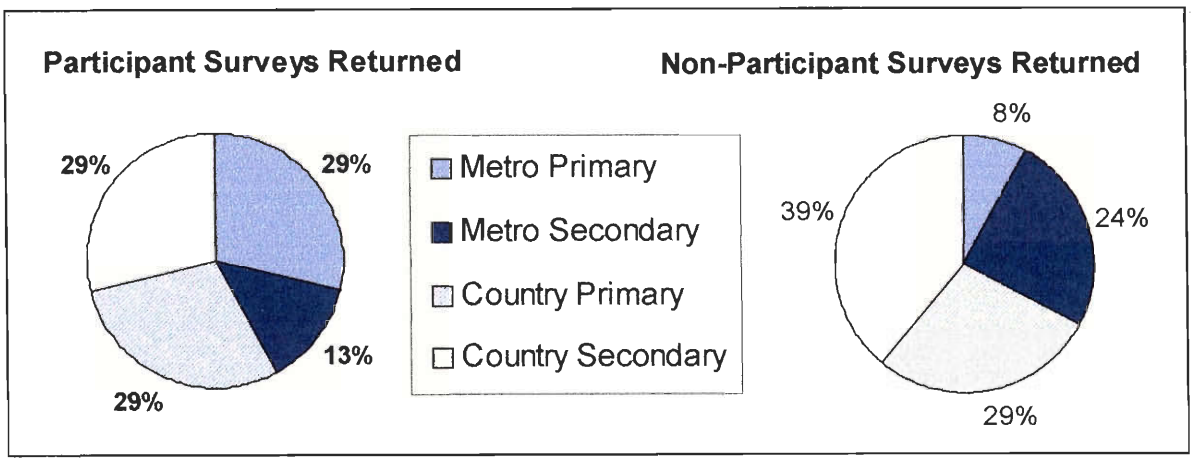

Figure 4.1 –Respondent School Types

Also, for illustrative purposes, the region from which each returned survey was sent was noted and located on an Australian Bureau of Statistics listing of localities by median family income (see Appendix Q). While this information would not directly reveal the affluence of the school, the financial status of the surrounding area might correlate with the school's ability to afford external science education programs.

The breakdown of responses from economic regions is shown in Figure 4.2:

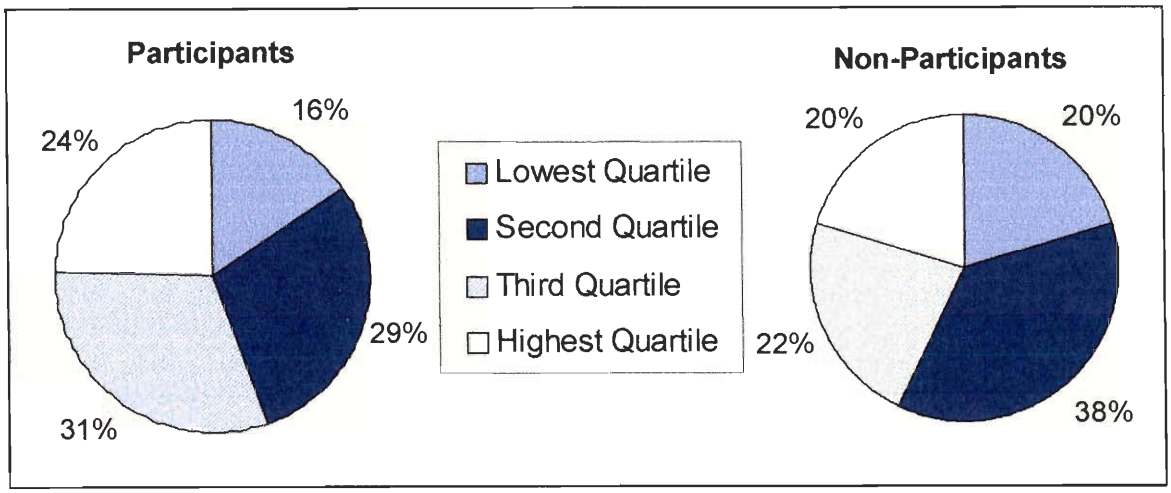

Figure 4.2 –Respondent Economic Regions

4.1.2 Survey Responses to Questions Common to Both Surveys

This section details the raw response data from questions common to both the participant and non-participant surveys. An analysis and comparison of the information in this section will be reserved for chapter 5.

1. Please place a √ next to the type of school at which you teach.

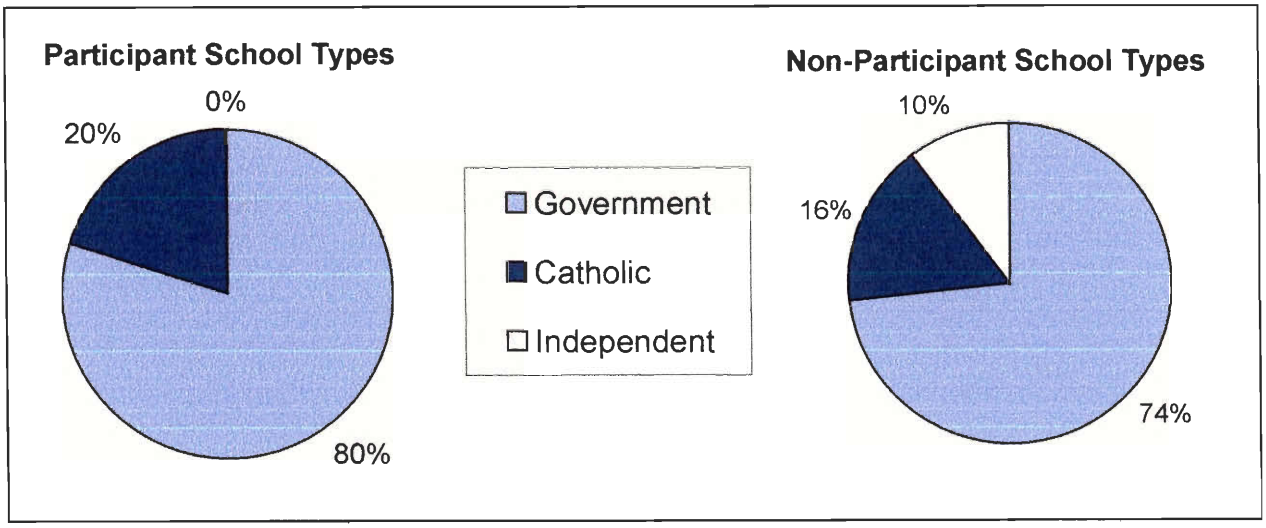

Figure 4.3 –Respondent School Types

2. What grade level(s) do you teach?

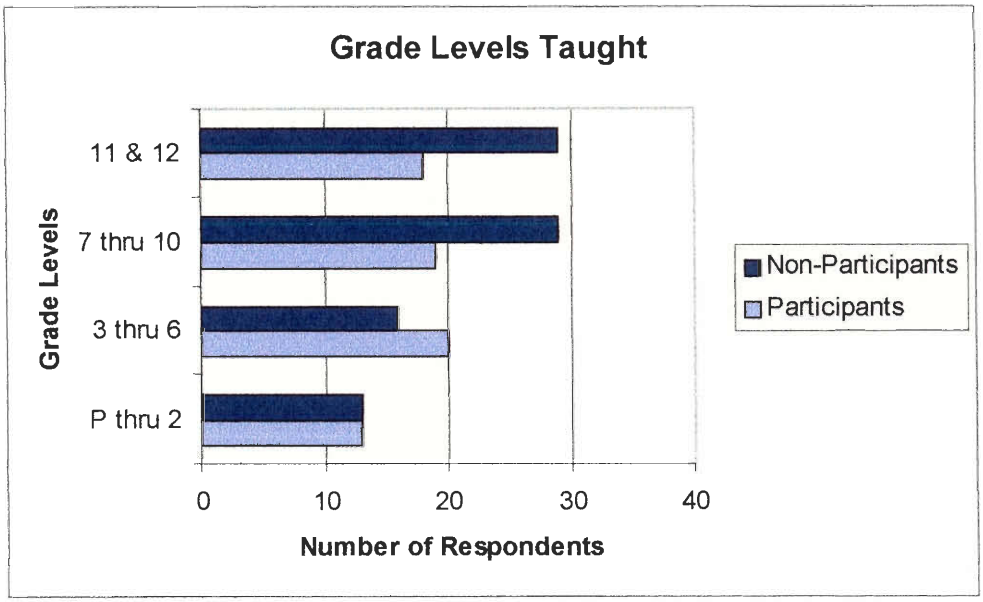

Figure 4.4 – Respondent Grade Levels Taught

All 49 non-participants and 45 participants answered this question. Some respondents provided answers that spanned more than one range.

3. [What is] the number of years you have been a full-time teacher?

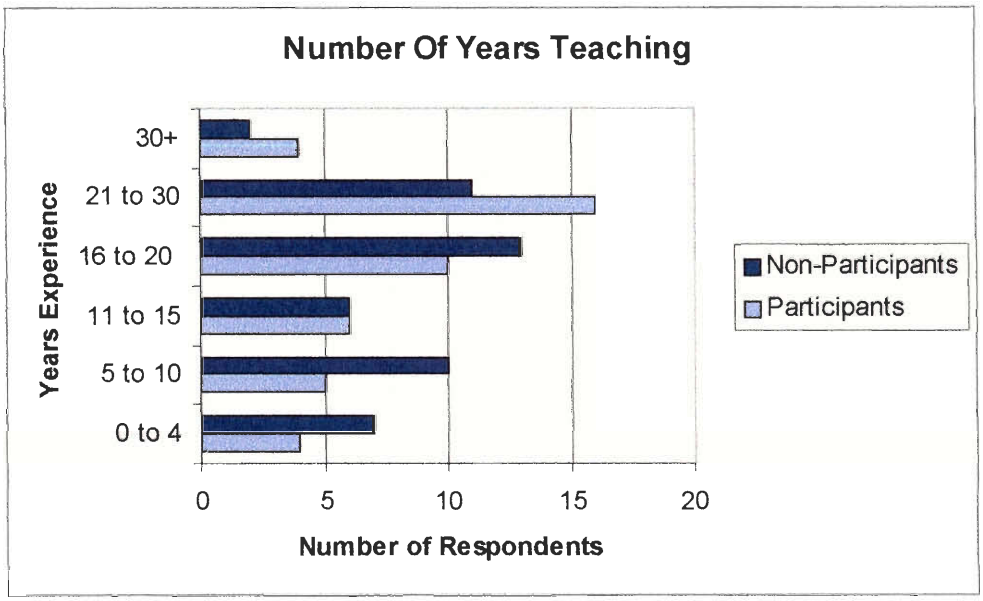

Figure 4.5 – Respondent Years Experience

All 49 non-participants and 45 participants answered this question.

4. What branch(s) of science do you teach?

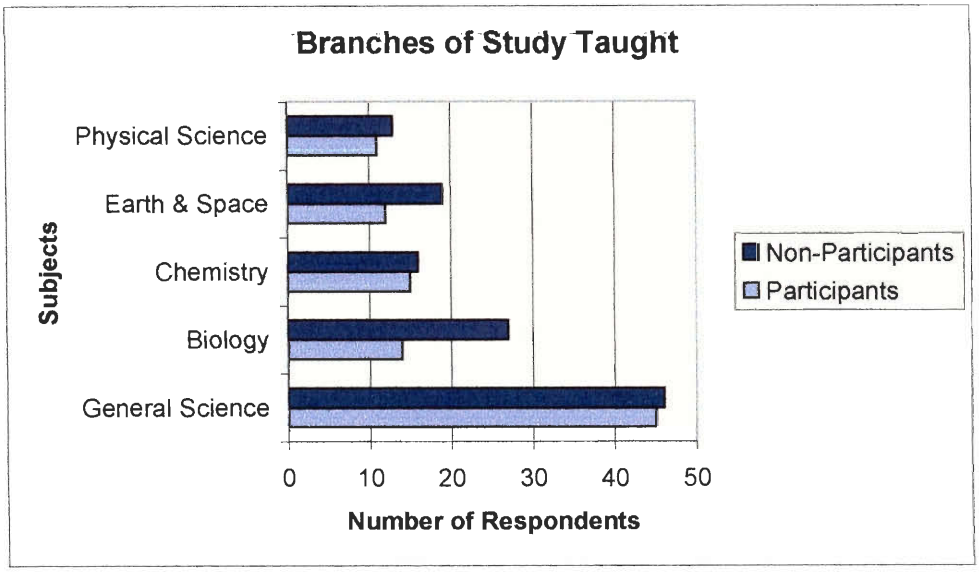

Figure 4.6 – Respondent Branches of Science Taught

A total of 49 non-participants and 45 participants were included in the results for this question. Many taught more than one subject.

5. How did you become aware of the available CSIRO Education programs?

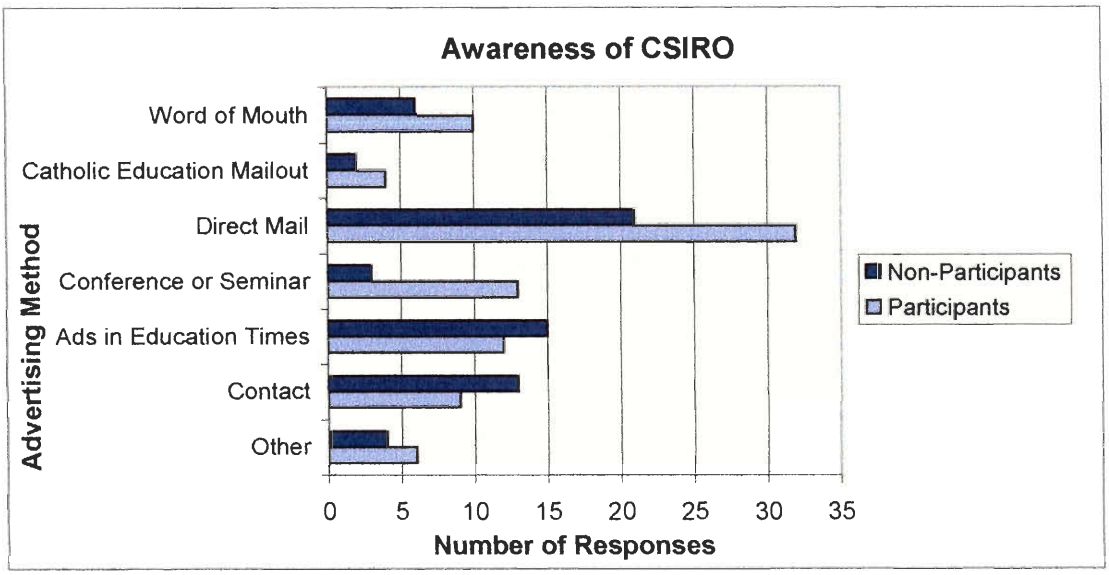

Figure 4.7 – Methods that Made Respondents Aware of CSIRO Programs

The responses to this question included all participants and 36 (73%) of the non-participant respondents.

6. Many criteria are involved in selecting a science education program. Please circle the level of importance of each of the following elements in your selection process. (1-Very Unimportant, 2-Unimportant, 3-Neutral, 4-Important, 5-Very Important)

Selection Criteria	Non-Participant Responses	Participant Responses	Average Rating	Standard Deviation
Cost of Program	48	44	**4.53**	0.75
Booking	48	45	3.84	0.85
Duration of Program	48	45	3.83	0.90
Availability	48	45	4.12	0.82
Written Support Materials	48	45	4.01	0.89
Outreach Opportunities	42	42	3.73	0.95
Program Presentation	48	45	**4.53**	0.72
Content's Affinity with Curriculum	47	45	**4.64**	0.64
Program Structure	48	44	4.29	0.81
Other	7	7	**4.79**	0.43

Table 4.2 – Factors Influencing Program Selection

The 'Other' responses are ranked the highest, because if a respondent takes the time to write in a response, it is clearly important to them and will receive a high ranking. Among the seven non-participants that filled in a response in the other field, four listed concerns about travel distance or expenses as key criteria. Other responses varied. The responses among participants was varied as well, but three country respondents mentioned that a program's ability to come to them and accommodate their school size were important aspects.

4.1.3 Responses to Participant Survey Questions

7. Please indicate the CSIRO Education programs in which your students have participated.
8. For each of the programs you have indicated above, please circle your overall satisfaction with the program. (1-Very Dissatisfied, 2- Dissatisfied, 3-Neutral, 4-Satisfied, 5-Very Satisfied)

Program	Responses	Average Rating	Standard Deviation
Genetic Engineering	6	4.67	0.52
Electricity and Magnetism	10	4.6	0.52
Light and Sound	10	4.3	0.48
Food Forensics	0	--	--
Science in Action	4	4.5	0.58
Gene Technology	4	5.0	0
LEGO Technic	2	3.5	0.71
NPM – A look at an Australian Industry	0	--	--
Cool Chemical Science	2	4.0	0
Forensic Frenzy	5	4.6	0.55
Science and Technology	0	--	--
Electronics	0	--	--
Reaction and Change	1	5.0	0
Weather	2	4.5	0.71
Life and Living	3	4.0	0
Air and Atmosphere	1	5.0	0
Force and Movement	4	4.5	0.58
Natural and Processed Materials	2	4.5	0.71
Flat Cats and Mind Games	4	4.5	0.58
LEGO Robotics	1	4.0	0
Science Procedures and Processes	0	--	--
Super Sleuth	0	--	--
Materials and Structures	5	4.8	0.45
Physical Science	1	4.0	0
Other (please specify)	4	3.75	1.89
TOTAL	71	4.45	0.67

Table 4.3 – CSIRO Program Impressions

Questions 9-11 and 15 were open-ended questions, which required the use of content analysis techniques to quantify responses. Appendix G has the data entry protocol used to log data and analyse these responses. The responses listed here are identical to those used in the analysis protocol.

In the 'Other' field on this question, respondents included some CSIRO offerings other than the science education programs. One teacher mentioned the Student Research Scheme and Global Project and ranked both a 5. Teachers also filled in 'Flight' and 'Regional Tour.' The former did not get a ranking and the latter received a 5. The last teacher mentioned the discontinued program 'Bubbles' in which her students participated in 1999. She ranked it a 1.

9. For each of the programs that received a 1 or 2 satisfaction ranking in question 8 (Very Dissatisfied or Dissatisfied) please indicate what specific aspects of the program were not satisfactory and how they could be improved.

Program Negative Aspects	Responses
Cost of Program	0
Booking & Availability	0
Duration of Program	1
Written Support Materials	0
Outreach Opportunities	0
Program Presentation	0
Content's Affinity with Curriculum	0
Program Structure	2

Table 4.4 – Major Reasons for Dissatisfaction with CSIRO Programs

Only one teacher ranked any programs less than three ("Bubbles" – given a 1). Consequently, this teacher was the only that was supposed to answer this question, based on the instructions. One other teacher volunteered an answer to this question as well.

10. For each of the programs that received a 4 or 5 satisfaction ranking in question 8 (Satisfied or Very Satisfied) please indicate what specific aspects of the program were most outstanding.

Program Positive Aspects	Responses
Cost of Program	2
Booking & Availability	0
Duration of Program	1
Written Support Materials	7
Outreach Opportunities	2
Program Presentation	26
Content's Affinity with Curriculum	14
Program Structure	26
Other	2

Table 4.5 – Major Reasons for Satisfaction with CSIRO Programs

All but nine teachers answered this question.

11. What are the major reasons you participate in the programs offered by CSIRO Education, Victoria?

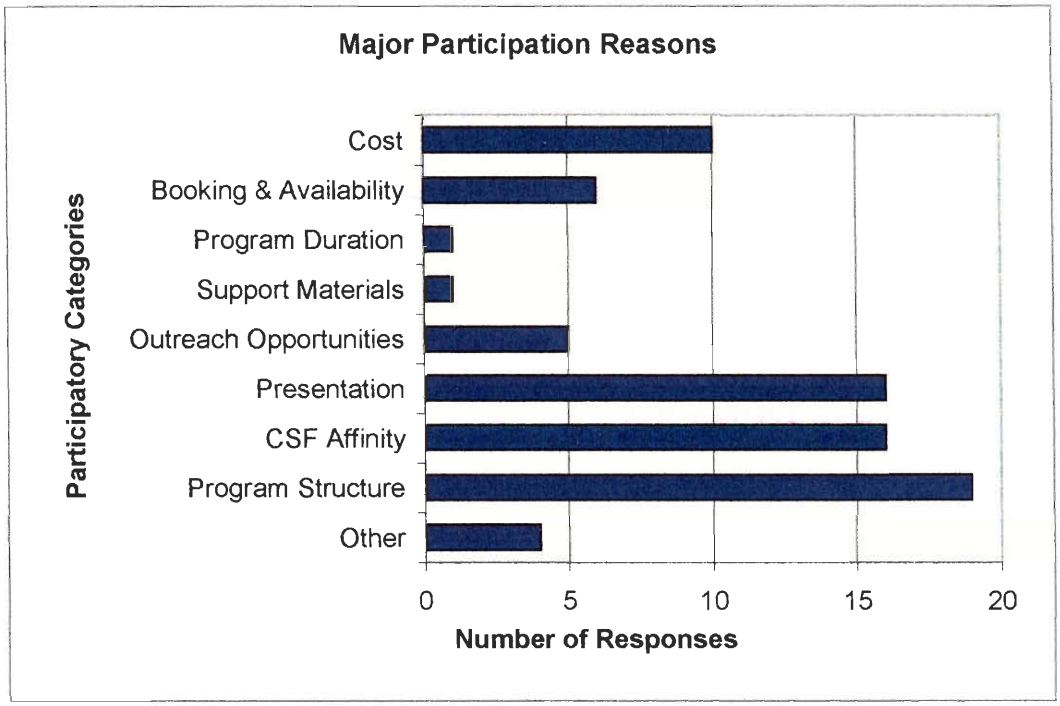

Figure 4.8 – Reasons for Participating in CSIRO Programs

Figure 4.7 represents the 38 out of 45 participants surveyed that responded to question 11. The 'Other' responses consisted of: "broaden children's learning level,"

"...CSIRO backing/name would ensure a quality program," "Children having contact with people that actually work in the science field and have more experience in a certain area," and "Interesting activities for students outside the normal."

12. Have your students participated in any science extension programs offered by an organisation other than CSIRO?

    Sixty-nine percent of teachers responded 'Yes' and 31% said 'No'.

13. What organisation(s) offered these programs?

    See Table 4.6 for the responses to question 13. A total of 19 different responses were received for this question. Only the organisations that were named more than once (between participants and non-participants) are listed here. A complete listing of these organisations can be viewed in Appendix O.

14. What were the names of these programs? *

    * This question only applied to programs with specific titles. There were a variety of responses, many of which were by those who misinterpreted the question. Consequently, efforts were focused on obtaining the organisations that provided the programs, rather than the names of any individual programs.

15. How did these programs compare to those offered by CSIRO?

Organisation	Responses	Better	Same	Worse	Unable to Tell
Starlab	5		2	1	2
Swinburne Travelling Science Show	4		2	2	
Lore of Flight	3		2		1
Minerals Victoria (Australia)	3		2		1
ScienceWorks	3		1		2
Shell Questacon	3		2		1
Deakin University	2	1	1		
EPA	2		1		1
Gould League	2		2		
CERES	1		1		
DEET	1		1		
Destination Education	1		1		
Melbourne University	1				1
Melbourne Zoo	1		1		
Natural Resources & Environment	1		1		

Table 4.6: Organisations Offering Education Programs Popular with Participants

4.1.4 Responses to the Non-Participant Survey Questions

This section details the raw response data from the non-participant surveys. An analysis and comparison of the information in this section will be reserved for chapter 5. The protocol used for entering data from these surveys is located in Appendix H.

6. Are you aware of the science education programs offered by CSIRO Education, Victoria?

   Seventy-three percent of non-participant teachers said they were aware of the offerings by CSIRO Education, Victoria. Twenty-seven percent were not. All 49 non-participants answered question 6.

7. What are the major reasons that you elect not to participate in the programs offered by CSIRO Education, Victoria?

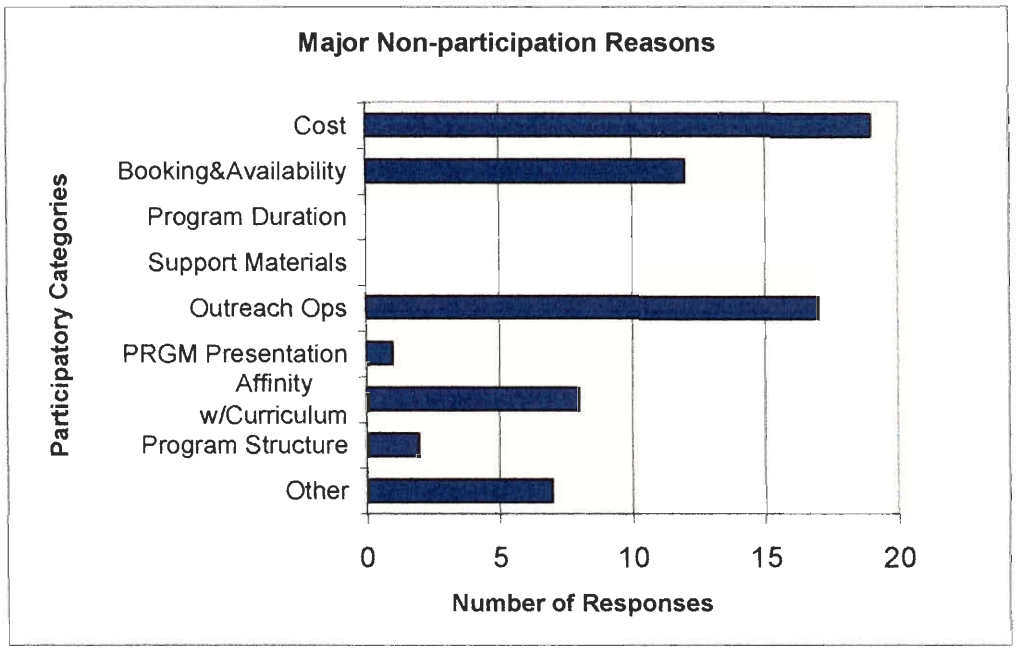

Figure 4.9 – Reasons for Not Participating in CSIRO Programs

Thirty-two of the 49 non-participant respondents wrote in answers for question number 7.

The responses in the 'Other' field varied, but four respondents mentioned that programs do not fit into their existing course structure or the interests of staff and students. Two other teachers said that their students do not generally respond well to excursion or incursion programs – they are seen as distractions. The last teacher made it clear that they were actually unaware of the science education programs offered by CSIRO.

8. Have your students participated in any science extension programs offered by an organisation other than CSIRO?

   Fifty-seven percent responded 'Yes' and 43% said 'No.'

9. What organisation(s) offered these programs?

Organisation	Responses
ScienceWorks	7
LaTrobe University	6
Melbourne Zoo	6
DEET	3
Melbourne Museum	3
Coliban Water	2
Deakin University	2
Swinburne Travelling Science Show	2
Minerals Education	2
CERES	1
Destination Education	1
Gould League	1
Lore of Flight	1
Melbourne University	1
Natural Resources & Environment	1
Shell Questacon	1

Table 4.7: Organisations Offering Education Programs Popular with Non-Participants

10. What were the names of these programs? *

* This question only applied to programs with specific titles. There were a variety of responses, many of which were by those who misinterpreted the question. Consequently, efforts were focused on obtaining the organisations that provided the programs, rather than the names of any individual programs.

4.2 Interview Results

A total of 24 interviews of science teachers and co-ordinators were conducted for the purpose of obtaining qualitative data that would add depth to the information gathered through the surveys. Sixteen of these interviews were with teachers who had been involved in a CSIRO science education program. Eight interviews were conducted with non-participant teachers.

Of these 24 interviews, twelve were with teachers from Government schools, six were from Catholic schools, and six were teachers at Independent schools. This total included eleven primary schools and thirteen secondary schools. Twenty-one were from the greater Melbourne metropolitan region and the remaining three were from regions further into the country. The metropolitan interviews were conducted face-to-face, whereas the country interviews were over the phone.

The actual collection of data was executed through the transcription of the recorded interview and a later review and summary of the transcripts. Content analysis was used to extract and quantify recurring concepts, themes, and keywords.

As mentioned, sixteen interviews were conducted with teachers who had previously participated in CSIRO science education programs. Thirteen of those sixteen teachers were asked to rank their satisfaction with the programs. These rankings are displayed in Figure 4.8 below.

School type	Ranking
Primary Government	100
Primary Government	95
Primary Government	95
Primary Catholic	95
Primary Catholic	75
Secondary Government	90
Secondary Government	90
Secondary Government	80
Secondary Catholic	85
Secondary Catholic	80
Secondary Catholic	80
Secondary Independent	90
Secondary Independent	87.5

Table 4.8 – Participant Satisfaction with CSIRO Programs

Eight of the interviews conducted were with teachers who had not previously participated in CSIRO science education programs. Of those eight, four regularly participated in other extension science education programs. Asked to rank their satisfaction level with these programs from 0-100, Figure 4.9 displays the rankings given. A participant teacher (*) is also included in this listing, since involvement in CSIRO programs ceased after 1994; the ranking shown applies to other science education programs in which the school had participated.

School type	Ranking
Primary Government	90
Primary Government*	90
Secondary Catholic	80
Secondary Independent	85
Secondary Independent	50

Table 4.9 – Non-Participant Satisfaction with Programs

4.2.1 Awareness of Offerings

The interviewees were asked about their awareness of the CSIROSEC offerings. More than one-fourth of the interviewees knew about CSIRO's science education offerings from previous experience either at a teacher professional development in-service or from experience at a previous school, either as a teacher or

a student. One-third of the interviewees had heard of the offerings through mail outs and two interviewees mentioned that the mail outs were nice and colourful. One-fourth of the interviewees had seen a CSIRO Education advertisement in a flyer given at a conference or in an educational journal, though two of these teachers commented that the ads were not eye-catching enough. Two interviewees knew about some of CSIRO's education services through word of mouth. Only one interviewee had not heard of CSIRO's offerings at all, this school was located in the country. One-sixth of the interviewees was not aware of the availability of the outreach offerings. One participant teacher was aware of the specific program that his school was involved in, but he did not have any information about the other programs offered.

Suggestions for notifying teachers of CSIRO science education programs included advertising through email, as well as continually sending informative, concise flyers via post and advertising in more publications. Another interviewee suggested that advocating programs through word of mouth is a successful way to make teachers more aware of offerings. One teacher felt that if CSIRO offered free short trial sessions with students that educators at the school could get a feel for the program, and that none would pass the opportunity up. The teacher believed this would initiate an ongoing positive relationship between the school and CSIRO. The same teacher also recommended that a representative visit the school, even during lunchtime to explain the program offerings and give a little professional development session.

4.2.2 Positive Impressions of CSIRO Programs

The sixteen participant interviewees were asked to explain their reasons for participation in CSIRO science education programs, as well as impressions of the

programs that they attended. One-fourth of participants mentioned that CSIRO's good reputation was part of the reason they became interested in the educational offerings and initiated involvement. Three interviewees suggested that it was inspirational for students to see real scientists at work. The scientists' knowledge of what is safe for the students also gave one teacher confidence in the programs.

Logistically, more than one-fifth of interviewees mentioned that booking a CSIRO program was convenient, and that booking co-ordinators were very helpful. As travel is an issue for many schools (many don't have school buses, and those that do find them too expensive), one-fourth described the availability of outreach programs was key to their participation. According to one-fourth of the participating teachers, the cost of CSIRO's programs is reasonable in comparison to other programs. Two interviewees also commented that the size of the program (in terms of students) was good for educational purposes, both of these teachers had been involved in programs with groups of 20-25 students.

Many participating teachers commented positively on the content, structure, and presentation of the CSIRO science education programs. Nearly one-half of the teachers commented that the program content met curricular requirements, as hoped. One-fourth of interviewees booked the programs more for enrichment purposes; to get the students excited about science. One-half of interviewees specifically said that CSIRO programs were particularly important for the equipment that was provided to the schools for the session(s), as many schools do not have access to good equipment. Additionally, one-fourth of teachers suggested that many teachers, in particular primary teachers, lack the knowledge base to teach the science material effectively. In these cases, the CSIRO expertise was invaluable. One teacher was particularly impressed, as she found that CSIRO's programs increased her science understanding

and knowledge, even as an adult. One-half of interviewees commented that they were pleased with the hands-on nature of the program(s) they were involved in. The high level of student engagement was particularly impressive to more than one-third of the teachers and three mentioned that the programs seemed to be really good fun for the students. Close to two-thirds of the interviewees thought that the educators were exciting and related well to the students. One-fourth of the interviewees thought that the set up of the program(s) was great, and approximately one-third mentioned variables that they found particularly impressive, specifically: the demonstrations, the workstations, the handouts and follow up material given.

Additionally more than one-third of participant interviewees complimented specific programs they were involved in, including Forensics, Light & Sound, Electricity & Magnetism, and Material and Structures.

4.2.3 Reasons for Non-Participation in CSIRO Programs

The eight interviewees not involved in CSIRO programs were asked to explain their primary reasons for non-participation. The reasons described by more than half of the non-participating interview respondents involved their lack of awareness of the offerings, particularly of the outreach capabilities of the centre. These teachers were under the impression that they would have to pay transportation costs to reach the CSIROSEC. Outside of transportation costs, one other interviewee believed that the costs of CSIRO's programs were too large for the school's budget. Many teachers, participant and non- mentioned the need to be selective in choosing extension programs due to cost and needed educational outcomes. Additionally, one interviewee mentioned that as a primary school they did not spend much money on science to begin with. Another interviewee suggested that there were some difficulties

in fitting CSIRO's science education programs into the school's curriculum timetable. One teacher felt that the CSIRO program that the school had researched was not sufficiently novel. He thought that extension programs should offer components that could not be mirrored in a normal classroom.

4.2.4 Suggestions for Improvement of CSIRO Programs

Many participant interviewees had helpful ideas for how CSIRO could improve its programs and/or offerings. The most popular suggestion, recommended by over two-thirds of the interviews, was that CSIRO offer more programs. Suggestions included: covering all aspects of science in the CSF, adding more variety to offerings, creating programs for gravity, organic chemistry, pest eradication, computer interfacing, interactive web programs like the Virtual Cell, adding more programs in chemistry, developing more programs for specifically mentioned grade levels in the weaker curriculum areas, and offering programs just to inspire children to do science as careers and for fun. More than one-third of interviewed teachers offered suggestions for improvements in specific CSIRO programs, these involved development of more experiments, more, better diagrammed, instructions for the workstations to aid students and decrease explanation time, as well as ideas to increase student engagement and comprehension. One teacher also suggested that the CSIRO Education publications *Scientriffic* and *Double Helix* were written at a reading level above the ages that they are advertised for. A full listing of interviewee impressions and suggestions is located in Appendix M.

Three of the sixteen participants suggested program content changes, including making the programs more entertaining, and better correlating the programs with curricular focuses. Structurally, two teachers again mentioned that program set

up/explanation time should be limited and hands-on work increased. Two teachers commented that presentation could be improved by adding more demonstrators, not only to lower set up time, but also so the students at workstations are not so dependent on teacher input and aid, a 1:10 or 1:5 ratio was suggested

Logistically, three teachers said that booking was difficult so far in advance, additionally two other teachers thought that the cost should be lowered. Three interviewees were concerned with the timing of the programs; they suggested that program timing should be adjusted to the school's class periods; programs should either fit into a single period or extend to a double period. Two interviewees mentioned that the venue should be changed, since the CSIROSEC building is old and not inspirational for students thinking about doing science as a career.

Four interviewees suggested that CSIRO provide additional teaching support. One teacher suggested creating additional resource aids for teachers, either through a website with recommended material or actual unit boxes of equipment that teachers could borrow. Two interviewees would like help in the development of their curriculum with suggested topics, flyers suggesting easy-to-make equipment and appropriate experiments with instructional diagrams.

4.2.5 Participation in Other Science Education Programs

Many interviewees, both participants and non-participants, were involved in other science education programs. The interviewees were asked to give descriptions and impressions of these programs. Three interviewees were pleased with the science activities conducted in the schools by scholars and students from Monash and Melbourne University. One-eighth of the teachers mentioned involvement in the Museum programs. Two other teachers mentioned the statewide Victorian Science

Talent Search and Australian Science Competition, involving some written tests that are not as popular with the students. Three interviewees have previously participated in ScienceWorks programs (a division of the Victorian Museum), but according to one teacher these programs were difficult to follow up and that they give negative reinforcement that science is a circus. Yet another teacher mentioned that ScienceWorks programs were less organised and less applicable to the curriculum than those offered by CSIRO. Two interviewees were also involved in the Swinburne Travelling Science Show, this show was also described as 'whiz-bang' science, but the teachers involved liked the exciting quality of the program. The interviewees mentioned involvement in programs at Lindenburg Beach, at Healesville Sanctuary, at the Zoo for animal classification activities, at Queenscliff for the marine biology and mudflat ecosystem activities, and at Mary Creek where students investigate the environment, invertebrates and geography at the creek. Other programs used were the NASA's STARS programs, the Starlab, the Series the energy park where students learn about energy use, Virtual Reality tours and activities, the Ford's assembly line program. One teacher mentioned that his students go to hospitals to learn about different diseases.

4.2.6 Factors in Good Science Education Program Development

Interviewed teachers were asked to describe which factors they would address if they were to develop a science education program. Approximately one-fifth of the teachers said that program content should be focused on extending the CSF. Three teachers stressed that content should reflect the progression of grade levels, that education should be linked level to level in order to develop student understanding at all stages of learning. According to two interviewees, content should be accessible, and easy for students to understand. Three teachers said that the program must be

unique and not easily done in a regular classroom. Two other interviewees commented that the program should also reflect current technology. One-sixth of the teachers emphasises that the program will best engage students if it structured in a hands-on manner. One teacher mentioned the importance of having a wide range of experiments for students of all skill levels.

It is also important to have a good presenter, two teachers suggested. Three other teachers recommended that the program be 'whiz-bang,' exciting. One teacher said that educators that have a good grasp of the needs of students, teachers, and the science curriculum at the school should run the sessions. As all kids need to be involved, another teacher stresses, the programs must be adequately staffed.

One teacher pointed out that the bookings should be easy to arrange. Ideally, another teacher suggested that the science presenters visit the school once a week, instead of packing experiments and demonstrations into one day. This suggestion for continued teaching support was echoed by almost one-fifth of the interviewees who emphasised the importance of professional development. According to these interviewees, many teachers are not confident in their knowledge of science; offering professional development would increase teacher comprehension and enthusiasm for science. In the meanwhile, the science education programs provided for students hopefully can make up for gaps in curriculum caused by the limited knowledge base of teachers.

4.2.7 Participation in Extension Education Programs

When asked what factors were most important in the decision to become involved in extension science education programs, a recurrent answer given by one-fourth of the interviewees was that participation is based upon the focus for the term.

Programs should help show the children the links between the different Key Learning Areas (KLA's) said one teacher. If the teaching staff lacks knowledge on certain topics, programs are particularly necessary for that term, one-sixth of the teachers reiterated. In addition, three teachers mentioned that if certain learning outcomes require experimental work, often an education program could be invaluable in providing technical resources for these practical experiences.

An even more pressing issue, suggested more than one-third of the teachers, is the cost of the program. Cost of transportation is also an issue in program participation; this was stressed by almost half of the interviewees. For these schools the availability of outreach programs is particularly important. Other factors mentioned regarding participation were the accessibility, flexibility, and quality of previous experience (if applicable).

4.3 Focus Groups with CSIRO Educators

Two focus group sessions were held with CSIRO educators in an effort to obtain the perceptions of the educators of the programs they conduct. There were six educators in the first focus group and seven in the second. The group setting allowed for the free exchange of ideas, and the project team hoped to collect some of the educators' suggestions for improving the programs. A printed copy of the field notes taken during the focus group can be found in Appendix O.

The first question that was asked of both groups was about what they believed to be the factors that contribute to an ideal program. Both groups immediately pointed out that a program should be fun and exciting to students. There is an obligation to address certain topics, particularly those outlined in the Curriculum and Standards Framework, but the educators did not believe that it was their responsibility

to teach entire topics. The programs must incorporate activities that teachers cannot see themselves doing on their own. The best programs, it was stated, exercise problem-solving skills as well.

The CSIRO educators were asked about the level of 'whiz-bang' experiments that are appropriate for their science education programs. Generally, they agreed that the more thrilling experiments and demonstrations were excellent for captivating audiences, but without discussion, they are lacking in educational value.

When asked how well they believed their programs met the goals and ideals they had outlined, the educators stated that they believed that CSIRO Education did quite well. The programs are engaging, integrating hands-on activities for students, while addressing CSF topics. CSIRO has high quality, knowledgeable presenters, and their outreach offerings are a strong benefit. An important strength of the CSIRO programs as well was the flexibility afforded to its educators. The presenters have the opportunity and skill to adapt the shows to meet the needs of a particular instructor or audience.

In discussing how the programs could be improved, however, both groups mentioned problems relating the program offerings to teachers. Programs do not always meet the expectations of teachers. Some expect a different program structure, wanting the CSIRO educators to fully teach a certain topic, without reinforcement in the classroom, and still others are disappointed that the young, enthusiastic presenters are not old nerds wearing white lab coats. One group found that this issue of communication is one that cannot be addressed directly – CSIRO does not have the option of asking a teacher what they really expect when they book a program. The best approach, then, would be simply to give teachers as much information about the

programs as possible, highlighting key points, and offering a variety of services to meet teachers' needs.

One major problem with the marketing techniques already employed by CSIRO is that information on the programs often fails to reach the teachers that might actually be interested in booking a program. A possible way to remedy this was to begin to use email as a means for contacting instructors. This would be a far more direct method, and forwarded emails could increase the scope of teachers who are knowledgeable about the CSIRO Education offerings. The email database, however, should be constructed only from those who volunteer their address to CSIRO.

The educators also offered some suggestions as to ways that the programs they offer could be improved. Many suggestions stemmed from the logistics of conducting programs: the number of staff, cars and program kits available plays a very large role in determining how many programs can be put on at any given time. A repeated theme throughout both focus groups was that increasing the availability of these items requires more funding.

Another suggestion was to increase the variety of program offerings, including more programs for preparatory students. This suggestion, aside from the development effort required, means that the mostly secondary-trained staff would have to obtain more lower primary school teaching knowledge and experience. These programs, according to the educators, would have to be hands-on, but cannot have material that is very advanced.

Other ways that CSIRO Education programs could be improved included the distribution of more extensive teachers' notes to accompany each session. Teachers appreciate the information that offers a more complete understanding of the subjects being taught.

As suggested by members of one of the focus groups, CSIRO could also offer multiple session programs. A single topic, such as forensics, could be covered in great detail for a group of students over a period of several weeks. This type of experience would likely be more expensive to schools, but there could still be a market for this type of activity.

More teacher support services could be offered as well. These could include in-service programs, experiment notes or booklets, or program kits that could be rented out to schools.

Finally, it was suggested that the quality of programs could be improved further by CSIRO staff development. Educators, given the opportunity, could watch each other's presentations to pick up technique and style suggestions. In addition at conferences, presenters could take the time to view programs from competing organisations for purposes of comparison and for gaining suggestions for improvement.

4.4 CSIRO Programs

In order to effectively discuss and evaluate the program offerings of CSIRO Education, Victoria, it was important for the project team to attend several of the programs in action. A total of six programs were attended and these are listed in Table 4.12.

Program	Grade Level	School Type
Electricity & Magnetism	3/4	Government Metropolitan
Light & Sound	3/4	Government Metropolitan
Air & Weather	4	Government Metropolitan
Forensic Frenzy	10	Independent Metropolitan
Gene Technology (2)	10	Catholic Metropolitan
Materials & Structures	12	Government Country

Table 4.10: CSIRO Programs Attended

The project team observed a total of six CSIRO education programs. The purpose of this research was to obtain an understanding of the structure of the programs. This would allow for more sophisticated conversation with participant educators and would allow the project team to note any content or stylistic changes that needed to be made to the programs.The Electricity & Magnetism and Light & Sound shows were conducted at Glenroy North Primary School for classes of students in years 3 and 4. Both programs consisted of an introductory demonstration of topics in the respective fields and then students were given the opportunity to conduct experiments with equipment placed at stations around the room. Each session had approximately 50 students and 20 workstations with about 15 different experiments. The hour-long programs each had about 15 minutes of demonstrations at the beginning, 30 minutes of experimentation, and another 10-15 minutes of discussion afterwards.

To the observers, the students appeared well engaged throughout the program, but more effort was required to maintain focus during the demonstrative parts. The instructor often was the key to the students' engagement in the program. An entertaining presentation generally held their attention and disciplinary remarks from the teachers and presenter kept disruptive students in check.

The project team observed two sessions of the Gene Technology program, each by a different instructor. These programs were held at Our Lady of Mercy College, an all-girls school in Heidelberg for year 10 students in their Chemistry class. This program also had both demonstrations and hands-on experiments, but included periods of lecture style instruction as well.

The Air & Weather program observed was held at Penleigh & Essendon Grammar School in Essendon. This program was structured differently from the

others, and was mainly lecture-oriented with small demonstrations interspersed throughout the presentation. The presenter had less direct interaction with the students than past programs observed, and the program was structured as a show. The students were generally attentive and focused on the presentation, with minimal disruptions. The students were most attentive during and directly after the small experiment portions of the program, and seemed to hold their focus in anticipation of the next demonstration.

The Forensic Frenzy program was held at the CSIROSEC in Highett. This program had Year 10 students of the Woodleigh School pretend to be detectives in a murder mystery. This program had a brief introduction and the class broke up into groups to attempt a series of investigative experiments located around the room. After about 45 minutes of hands-on experimentation, the class reconvened and discussed their findings and the scientific merit of the experiments they conducted.

The students were very much engaged in the program, especially after the discussion focused on solving a murder mystery. The instructor kept the students' interest by requesting suggestions for results.

The Materials and Structures presentation was held in the Physics room at the CSIROSEC. Boys in Year 12 from Bairnesdale Secondary College gathered to watch the presenter as he introduced materials science concepts and experiments. Because the experiments were quite involved, it took a fair amount of explanation to prep the students for the materials testing. The presenter went around to each station, explaining procedures and precautions. The students then went around to each workstation for an hour and a half. The presenter and the two Bairnesdale teachers aided the students at the stations. Following this the presenter gathered the students for a discussion time to ask questions and the session was concluded.

It appeared that the students became slightly disengaged during the introductory explanations, but a quick joke from the presenter brought them back. If there had been instructions and diagrams at each workstation it would have cut down this introduction time and allowed them to spend more time on the hands-on experiments.

4.5 Competing Programs

While conducting research it became apparent that in order to develop valuable strategies to refine CSIRO's program offerings, it was important to examine comparative program offerings of other similar organisations. The following provides snap shots of competing organisations including their locations, program offerings, costs, and outreach efforts. This outline serves as a basis from which to compare CSIRO program offerings to those of similar organisations.

4.5.1 Swinburne Travelling Science Show

The Swinburne Travelling Science Show was mentioned most often throughout the interviews conducted with educators around Victoria. The travelling show was sponsored by the Swinburne University of Technology and offered only outreach programs. The show is no longer operational due to budget cuts, but serves as a model of a successful program. Program topics ranged from analytical chemistry and applied genetics for VCE chemistry and biology, to light and sound and electricity and magnetism workshops. According to teacher interview responses, these programs were primarily structured as 'whiz-bang' shows geared to dazzle, amaze and motivate students to become interested in science rather than teach them specific concepts suggested from the CSF. The costs associated with the travelling show ranged from $75-$350 per session with a size restriction of 25 students

maximum per session $3-$16 per student or more). The travelling show advertised through direct mailings and the web, but apparently prospered from positive experiences conveyed through word of mouth.

4.5.2 Melbourne University

Interviewed and surveyed teachers from schools near the Carlton campus in North Melbourne mentioned Melbourne University as a source of science education programs. The university's educational contributions are interesting in that the university's students conduct the extension programs. These students, pursuing careers in education, gain valuable experiences and school credits from conducting these programs. Typically in their third or fourth year, these students are involved in the primary or secondary school for 6-week periods. They run science programs in correlation with the CSF. The sessions are designed for children, with hands-on activities developed to integrate the school's current curriculum focus. One teacher involved with the university described programs using magnets and launching rockets in the playground. Evidence of the university taking an active role in advertising their offerings was non-existent, perhaps because they are not in need of an expanded market population, and only seek to fulfil degree requirements for University students majoring in education.

4.5.3 Melbourne Museum

In the same neighbourhood, the Melbourne Museum also operates extension science education programs. Establishments such as museums, zoos and libraries have existed as an educational resource for some time, and thus they naturally have a substantial marketing advantage over less familiar resources. Museum programs are structured as interactive exhibitions that aim to educate students in a wide range of

topics pertaining to the environment, Australian history, evolution, and technology to name a few. Many survey responses mentioned that these programs are booked more frequently for their equipment and educational props than the quality of their presentation. The sessions provide content appropriate for all ages affiliated with CSF requirements. The costs for programs at the Melbourne Museum are $3.50 per student with a 20-student minimum per show. The museum advertises on the World Wide Web as well as through flyers and direct mailings to schools and educational organisations.

4.5.4 Melbourne Zoo

Another of the established educational resources listed as used widely by teachers in Victoria was the Melbourne Zoo. The Zoo's educational officers are able to tailor programs to best-fit specific year levels, from Preparatory to VCE. For example, programs can be altered to suit teacher, student, and curricular needs to cover topics across all key learning areas with emphasis on Science and Studies of Society and Environment (SOSE). Moreover, the Melbourne Zoo can provide comprehensive teacher notes and student trails to complement many of the programs on offer. However, these notes are only available to teachers once a zoo school booking has been confirmed. The programs on site are held both inside one of the seven purpose-built activity rooms and outside in the habitat areas utilising live animals, animal bio-facts and other resources. The Zoo markets itself very effectively because it is a monopoly in its market (not many competitors with similar offerings), and advertises on the World Wide Web, through flyers and direct mailings to schools and educational organisations. Costs for the zoo excursions ranged from $5.50-9.40 per person based on admission charges and the type of program booked.

The only outreach program evident to the project team was a video conferencing program called Zoo Trek. Zoo Trek is a videoconferencing program that, in effect, brings the zoo to students in the classroom. Students dial in to meet zookeepers, interact with education officers, and see animals live through cameras. These virtual visits are offered through the Melbourne Zoo webpage.

This program is designed to take advantage of current influx of V-Tel teleconferencing machines into Victorian schools. Currently 100 schools in the state are equipped with these machines and are able to take advantage of the Zoo's interactive programming. DEET has plans to subsidise the purchasing of more V-Tel teleconferencing machines for the state's schools so more students will have access to this technology. However, Zoo representatives speculate that these plans will become more feasible as the cost of V-Tel machines goes down, and the technology becomes more mainstream. One program designed to take advantage of this technology involves an interactive session with a zookeeper who answers students' questions about wildlife.

4.5.5 ScienceWorks

ScienceWorks, located on Booker Street, Spotswood was also very popular amongst the teachers interviewed. The museum-style learning centre offers programs that address forensic science, the future of food and farming in Victoria, as well as exhibitions on how technology is used to survive in extreme environments, the technologies used to create special effects generated for film, and the science and technology involved in sports. Within ScienceWorks is the Planetarium, which offers a variety of programs. All the programs are interactive and seemingly take on a favourable balance and include both educational and 'whiz-bang' aspects of science. An exhibition booking costs $4.10 per student, while a planetarium show costs $7.20

per student. The centre also offers sleepover programs at the facility for $30.00 per student, excluding other program costs. The centre's museum-like exhibits and included hands-on activities provide a marketing advantage. ScienceWorks provides both relevant educational materials and circus-like fun. The centre advertises its offerings through direct mailings to schools and maintains comprehensive explanations of their offering on the World Wide Web.

5.0 Analysis

The data collected in the research phase of this project yielded a series of patterns and observations about science education programs, and more specifically, the impressions of CSIRO programs. This chapter will present an analysis of the strengths, weaknesses, opportunities, and threats of the existing CSIRO education programs. In addition, a profile of the Victorian teachers interviewed and surveyed can be found in Appendix U. These profiles will allow CSIRO educators to have a glimpse at some of the concerns and opinions common to teachers from different types of schools.

Responses from teachers surveyed and interviewed are to be incorporated in this chapter of analysis. For this matter, it is important to preface this information with the structure with which interviews and surveys were formatted. In both the interview questions and the short-answer responses on the surveys, teachers were asked to suggest reasons for participation or non-participation. These responses were not prompted, so the aspects mentioned are assumedly those aspects that came to the forefront of the teachers' minds. If an aspect was not mentioned, no inferences were made on the positive or negative nature of that lack of response, but the responses given may reflect the importance of these issues.

5.1 What are teachers looking for in extension science education programs?

Teachers look for an organisation whose reputation they can trust to provide safe, inspirational educational experiences for their students. Learning from real scientists is exciting for children; they get a chance to view science as a career.

CSIRO Education offers opportunities to expand children's science learning, but some debate exists in defining the overall objective of an extension science education program. There are three opinions on this objective expressed through interview and survey responses.

A small minority of teachers viewed the programs as a means of meeting certain curricular requirements that could not be met otherwise. These teachers did not feel confident teaching these areas of science and depended on CSIRO presenters to do so. One-fourth of teachers interviewed suggested that the lack of a science knowledge base, particularly in primary schools, was a reason for participation in CSIRO science education programs. According to one interviewed teacher, using science education programs to supply coverage on a curricular concept does not provide the best long-term learning solution. Over time, the teacher suggested, students do not retain enough of the information learned in a single program session. For this reason, it is extremely important that the teacher's knowledge of science be developed in the program, so teaching can be continued effectively with the use of follow up material. CSIRO should make it clear that their programs should serve as springboards for learning certain concepts outlined in the CSF. This way CSIRO is not responsible for teaching concepts in entirety; instead presenters can focus on introducing or extending the concepts in unique ways.

A majority of teachers see the programs for what CSIRO envisions them – as a tool to supplement or extend topics being discussed, or that will be discussed in class (Krishna-Pillay, 2001). Teachers recognised that CSIRO programs garnered student attention towards science concepts through exciting demonstrations and exciting presentations. For extension purposes, CSIRO programs serve well as they now exist.

Most programs revolve around key CSF concepts and include good experiments or activities to enhance the learning of these concepts.

Lastly, many teachers see science education programs, like those offered by CSIRO, as opportunities to merely foster an interest among students in the sciences. These teachers expressed an interest in the use of 'whiz-bang' science shows. They wanted flashy, entertaining demonstrative programs that had a basis in science, but very little scientific theory needed to actually be conveyed. This approach can turn students on to science, but as one teacher mentioned, it encourages the idea that science is a circus. Another teacher suggested using this method for prep children, in order to get them enthused about scientific learning and exploration, but using more mature methods for older students.

An understanding of these views can help CSIRO educators to further develop their programs' content, structure and presentation. Programs could be designed, based on teacher preference, to be introductory, supplementary, or purely demonstrative. The content of programs in general should reflect all of the above-mentioned aspects: outcomes of curricular requirements, an extension of this framework, and exciting enrichment. It should show that science can be interesting and easy to understand.

In addition, two interviewed teachers suggested that program content should mirror the links between different grade levels; this important progression is recognised in Australia's growing centrally based curriculum. Most interviewed teachers suggested that science education programs should have components that could not be done in the regular classroom, in particular, providing equipment that is normally too expensive and time-consuming to set up can be very valuable.

Providing the expertise to teach science material effectively is also especially helpful, as many teachers are not confident in their science knowledge.

For younger children, programs just to get them enthused about science would be most valuable according to one teacher. For middle-upper primary and secondary students, it is important to cover the aspects of science that are weaker points in a teacher's curriculum. In addition the more variety and more strands in the CSF that are covered by the programs, the better opportunity the teacher has to fill these coverage gaps. Additionally, the more diverse the program offerings, the more likely it is that the extension activities will fit the focus for the term, which is ever-changing and an important aspect in participation choices. Two-thirds of the teachers interviewed suggested that many, diverse programs would be helpful.

Most teachers interviewed and surveyed suggested that they look for hands-on programs that will engage the students in learning and are fun at the same time. Visual demonstrations and good workstations with diagrammed instructions can also increase the learning value of the program. Experiments should be provided for all skill levels anticipated within the classroom.

From the observations of project members, it was determined that the worth of a program depends on the way in which the material is presented as much as it depends on the program content. By giving a high-energy presentation presenters can transfer their enthusiasm for science to the students. Though discussion is valuable in the beginning and end of the program, uninteresting material regarding set up and explanation should be limited so the students will have more time to get involved in the valuable hands-on activities. Limiting this time also helps prevent student restlessness in anticipation of the more exciting aspects of the program. In addition, the more program educators that are available to help students at the workstations, the

less pressure there is on the regular teachers to aid all the students, a 10:1 or 5:1 student to teacher ratio was suggested.

Follow up material also seemed valuable since many programs just fit into the time allotment and most cover a large amount of information in that time period. Even with the valuable equipment and expertise, student comprehension will fade if the learning is not continued. Additional teaching support such as resource aids suggested on a website or provided in unit boxes would also be extremely helpful. Four interviewed teachers request more support, a few would like assistance developing their own experiments. Support in the form of professional development sessions (separate from classroom programs) could help teachers impart knowledge to their students more effectively. The importance of professional development is becoming more apparent, as many teachers feel that their understanding of science needs to be extended.

Logistically, the programs themselves should be convenient to book, at a low cost. More than 90% of surveyed schools said that the cost of a program was an 'important' or 'very important' consideration in its selection. The timing of the programs should fit into the schools timetable, either in one regular class period, or extended into two class periods, not broken up. For many schools, as the cost of transportation is so high, it is extremely important that outreach programs be available. The importance of this aspect was observed in survey results where more than one-third of teachers surveyed mentioned outreach opportunities as a reason for participation or non-participation in education programs. This way the experience can be brought to the school, saving the teachers time and causing less disruption in the school day. The size of the programs holds some importance as well, as some teachers suggested that a group over 25 students in one classroom becomes difficult to

manage and engage. If the session is held at the organisation's venue, the room must be big enough to comfortably house this many students doing experiments.

5.2 Strengths of CSIRO Science Education Programs

All interviewed teachers that had previous experience with CSIRO science education programs expressed enthusiasm over the programs. The interviewees that ranked their experiences with CSIRO gave an average satisfaction level of 88 (on a scale of 0-100). In surveys with participant teachers, the overall average satisfaction ranking with programs was 4.45 (on a scale of 1-5, 1 being Very Dissatisfied, 5 being Very Satisfied). These results indicate that, in general, teachers participating in CSIRO programs are more than satisfied with their experience.

The primary reason for participation in CSIRO science education programs listed by almost half of surveyed participant teachers is program structure; in particular, the hands-on nature of programs is extremely popular. From observing CSIRO programs, project members noticed that hands-on experiments were the most effective tools to excite the students about science. In particular, when the experiments were followed with explanations, it allowed the children to suggest some of their own conclusions. This exploration seems to be the best combination of learning with fun. Older students also extended the concepts learned from experiments by discussing the relevance of these concepts in the science that is really affecting the world today. By stressing the importance of future science research and exploration into the controversy surrounding much of the research, the students began to formulate their own views on something that they had just learned. CSIRO programs, structured primarily as sessions with hands-on activities and discussion of important concepts, are fitting teachers' needs, as suggested by more than one-half of

surveyed teachers who described program structure as one of the most outstanding aspects of programs in which they had previously participated. In addition, one-half of interviewed teachers felt strongly that that this aspect was key to participation in CSIRO programs. As a selection criterion, program structure was given an average importance rating of 4.3 by surveyed teachers; this was the third highest rating.

Program content's affinity with curriculum tied for second (with program presentation) for most popular reason for participation, listed by more than a third of participant teachers surveyed. Respondents pleased with program content affinity with curriculum described their satisfaction with programs meeting state curricular requirements, as well as the appropriateness of programs to the teachers' curricular foci for the term. Program content's affinity with curriculum also received the highest importance rating of a selection criterion; participant and non-participant teachers on surveys gave this aspect an average rating of 4.6. Almost one-third of teachers that had previously participated in CSIRO programs listed this aspect as most outstanding on surveys. Additionally, one-half of the participant teachers interviewed suggested that program content, particularly in a curricular sense, was important and impressive in CSIRO programs.

Tied for the second (with program affinity with curriculum) for most listed reason for participation in CSIRO programs, program presentation was mentioned by more than one-third of participant teachers surveyed. This aspect also tied for the second (with cost of program) for highest average importance rating of a selection criterion, given a 4.5 by surveyed teachers. Aspects of program presentation are: the effectiveness of the educator running the program, the set up of the program, and the equipment included in the program. From the CSIRO programs observed, it was noticed that with most children, their engagement depended on the enthusiasm of the

presenter. Close to two-thirds of participant teachers interviewed were impressed by the educators' energy and enthusiasm. Another one-fourth specifically mentioned that the set up was great, and one-half of participant interviewees said that CSIRO programs were particularly useful for the equipment that was provided. Also, more than half of participant teachers surveyed suggested that presentation was outstanding when asked to suggest positive aspects of the program in which they had previously participated.

Surveyed teachers, both participant and non-participant gave cost of science education programs an average importance ranking of 4.5 (again, on a scale of 1-5, 1 being Very Unimportant, 5 being Very Important) as a selection criterion, tied with program presentation for second highest criterion ranked. The cost of CSIRO science education programs is definitely competitive, as it falls on the lower range of the spectrum of prices per student for comparative programs described in the Results Section 4.6. Competing program prices range from $3-$16/student while CSIRO program prices range from $2.20-$7.20/student, this includes price differences for outreach. One-fourth of participant teachers interviewed and surveyed mentioned that CSIRO's cost effectiveness was a reason for participation in the programs. This established cost as the fourth most common reason for participation in CSIRO science education programs on the surveys.

The outreach capabilities of CSIRO science education programs also contribute greatly to the success of CSIRO offerings. As a selection criterion, the average importance ranking of this aspect was 3.7 according to participant and non-participant teachers surveyed. More than one-fifth of participant teachers surveyed and one-fourth of participant interviewees suggested that the availability of outreach opportunities was a major reason for participation. It was mentioned that outreach is

particularly important because many schools do not have school buses, and the cost of transportation is high.

5.3 Weaknesses of CSIRO Science Education Programs

It was discovered in the interviews conducted and surveys received that many teachers are unaware of CSIRO educational offerings. Approximately 27% of non-participant teachers surveyed were not aware that CSIRO science education programs are available. This weakness is possibly attributed to marketing issues, such as not providing enough eye-catching advertisements and marketing efforts not reaching interested teachers. Some teachers who are aware of CSIRO educational programs are not aware of the extent of the offerings, especially outreach offerings. Throughout non-participant surveys and interviews, teachers mentioned their concerns about the costs of transportation and their distance from CSIROSEC. For this reason, as mentioned as a strength above, the availability of CSIRO's outreach programs is extremely beneficial to schools. Unfortunately, many schools are unaware of these offerings; the second most suggested reason for non-participation was the lack of outreach opportunities; almost half of non-participant survey respondents who are aware of CSIRO offerings suggested that lack of outreach factored into their non-participation. This lack of awareness of outreach offerings could be due to marketing issues, as suggested above. Another reason for the response that lack of outreach prevented participation is the possibility that the teacher had hoped to book an outreach program, but found that the program topic of choice was conducted only at CSIROSEC.

As suggested above, the marketing tactics of CSIRO Education could be further developed. CSIRO Education makes a considerable effort to send flyers to

schools across Victoria. Most participant teachers (71% surveyed) learned of CSIRO's science education programs from such mail-outs. Though the mail-outs do state the CSIRO offerings thoroughly, including the outreach offerings, the ignorance of many schools to these opportunities is an indicator that the mail-outs are not totally effective. Some teachers first became aware of CSIRO educational offerings through advertisements in journals like *LabTalk, Contact,* and *Education News*. More than half of participant teachers surveyed (55%) became aware of CSIRO Education programs, at least in part, through advertisements in such periodicals. One non-participant teacher interviewed expressed that these advertisements were not flashy enough, though he had seen them in the past, they did not attract his attention. The marketing of CSIRO program needs improvement, as lack of awareness should be further addressed.

As mentioned previously in Section 5.1.2, program cost tied for the second highest average importance rating given to a selection criterion; program cost was rated an average of 4.55 by participant and non-participant teachers surveyed. Though the reasonable cost of CSIRO programs can be considered a strength, it is recognised that cost, no matter how low, is a weakness of any education program. Cost is an inhibiting factor of participation for many schools, as shown by more than half of non-participant survey respondents (who are aware of CSIRO offerings) who listed cost as the major reason for non-participation. Of the non-participants, 43% do not participate in any extension science education programs; associating cost with this lack of participation indicates that cost is a big factor for these schools. It should be noted that 58% of non-participant survey respondents came from schools located in regions in the lower half of the economic classifications of median family income identified by the Australian Bureau of Statistics.

Availability of programs is an issue suggested by one-third of surveyed non-participant teachers (who are aware of CSIRO offerings) as the third major reason listed for non-participation. In addition, availability was given the fourth highest importance rating for selection criteria, 4.1/5 rated by surveyed participant and non-participant teachers. Program availability, as a weakness, incorporates the inconvenience of booking programs so far in advance as mentioned by many teachers who found it difficult to be confident of their timetables so far ahead of time. While it was commented that booking coordinators are helpful and polite, flexibility of booking is an issue that concerns many teachers. The programs must be available for use in correlation with the foci of the term, and with the appropriate time of day. Flexibility is an area CSIRO Education could improve. Programs are limited to the number of trained staff available to teach each day. In addition, there is limited equipment for each program, so only a certain number of programs can run simultaneously. Lack of transport also limits program availability, as there is only certain number of vehicles available for outreach at once.

Another weakness is the venue in which the CSIROSEC is located. Though this aspect was not mentioned often, this is possibly because many teachers had not attended sessions at the CSIROSEC. The teachers that did comment on the venue suggested that the venue is too small for large groups of children, especially older children. By observing the programs, it is easy to see that, especially with hands-on activities, the children are crowded and activity is congested in the room. The Materials and Structures program observed in the physics room involved older, bigger students and bulky workstation equipment; it appeared even more uncomfortable. It was also mentioned that the venue is not particularly inspirational for students looking to become involved in science as a career. Indeed, the building is not glamorous and

is located in the condemned section of the CSIRO building site. It should also be noted that administrative office space is limited at CSIROSEC.

Four interviewed teachers commented that they were dissatisfied with the introduction aspect of program structure. These teachers felt that the introduction period was too long, and made the students restless to begin the activities. In observing CSIRO programs, project members noticed that students seemed to become less engaged when extensive explanation transpired (particularly as experiments were being explained). It seems better for this time to be limited, either by providing introductory information to allow teachers to prepare students for the session, providing more instruction at workstations, or by keeping the students clear of the equipment and actively answering questions about the presentation. It was also observed that during the hands-on activity periods, students given the chance to interact with presenters at the workstations seemed to understand the purpose of experiments better. For this reason, more of this practical work where closer interaction occurs would be very valuable. More presenters available to attend the workstations to encourage students to understand the concepts would also be helpful.

5.4 Opportunities Available to CSIRO Science Education Programs

As demonstrated already in chapter four, many Victorian teachers are unaware of part or all of the educational opportunities provided by CSIRO Education, Victoria. This means that a large portion of the teachers and, consequently, students in the state are not able take advantage of the programs. While this reality exposes a weakness in the marketing strategies of the CSIRO at this point, it also means that a modified approach could yield many more potential participants for the programs. An effective

marketing strategy will get information on the programs and their offerings to teachers and coordinators that might actually be interested in the programs, not just a principal or uninterested coordinator.

Another means by which more teachers and students could utilise CSIRO Education would be an expansion of the program offerings. At this time, programs are only offered on a fraction of CSF science topics, at certain year levels. Varying the content, structure, or level of the programs offered could appeal to more teachers, leading to increased participation.

In addition, CSIRO could extend its market base by creating programs specifically for more subgroups of children. In particular, programs for P-2 students and home school students would be useful. Programs for these students could possibly be developed from programs in service now, made more entertaining for P-2 students and more challenging for home school students.

Keeping in line with the mission of CSIRO Education to introduce students to science, CSIRO could develop more varied methods of improving science education in Victoria. The use of the Internet offers a whole new realm of possibilities for expansion of CSIRO's programs. Web-based interactive programs are growing in popularity. The Internet could also be used to provide more extensive support materials for teachers, such as a website with recommendations of resources and experiments. Increased teacher support is a key area for CSIRO to extend its offerings. CSIRO has the opportunity to improve teacher understanding of science, encouraging enthusiasm for science in the classroom. It was suggested by teachers that CSIRO could develop more professional development programs. Also, CSIRO could provide rental resource kits of equipment to teachers who would not otherwise have access to such equipment. Teacher support could also be offered in the form of

introductory material to precede programs and more extensive follow up material to continue the learning of the concepts explored in the session. This material would be helpful for teachers, and would lead to more productive sessions with students.

Perhaps a forgotten subgroup of the school community, parents can be useful marketing tools. Parents are often involved in educational events with their children such as the holiday science programs at CSIRO; many parents have expressed interest in gathering information about other CSIRO offerings to bring to their children's schools. Parents have direct contact with teachers, and these lines of communication should be encouraged and used to CSIRO's benefit. More programs could be provided for families, perhaps at local public libraries. Satisfaction with these extracurricular programs may lead parents to recommend CSIRO classroom offerings to their children's school.

5.5 Threats Facing CSIRO Science Education Programs

In every industry there exists competitors that seek to target the same audience for business, and education is no different. A variety of competing science education programs exist, some that have similar offerings and structures to the CSIRO. Thus, CSIRO bookings are surely affected due to this competition. Teachers may prefer different organisations based on location, style, reputation, and past experiences.

Often the entities with the most effective marketing campaigns draw the most bookings forcing competitors to re-evaluate their focuses, and/or abandon programs. Current marketing efforts and strategies help insure that CSIRO Education continues to hold a stable place in the science education market. CSIRO has also been able to combat some of the threats of competition by providing slightly different programs,

with a focus on hands-on science. CSIRO does not normally cover subjects involving animals, plants and the environment, as it is felt that other organisations cover these aspects of science well.

Perhaps the biggest threats that CSIRO Education faces are budgetary constraints that limit growth and potential. If the funds were available, CSIRO Education would be able to put more money towards marketing and program development needs. Booking potential is also reduced since the centre has limited staff available to conduct multiple programs simultaneously. Moreover, not all existing staff are trained to conduct all of the programs offered by the centre. Realistically all staff should be familiar with the most frequently booked programs. If educators are not able to conduct multiple programs, CSIRO cannot be confident in its ability to maintain versatility in booking.

Limited budgetary resources for transportation present similar problems. Much of CSIRO's program success revolves around outreach capabilities. As outreach is a major marketing component and aspect of CSIRO's educational philosophy, having limited access to transportation can restrict a program's potential. For these reasons more funds for transportation are necessary if outreach capabilities are to be expanded.

The lack of funds for equipment also hinders the booking potential of CSIRO programs. The equipment needed for each session limits the number of programs that can be run at one time. More than one-third of the participant teachers surveyed commented that program presentation (which includes the equipment demonstrated and used in the program) was a major reason for their participation. They also commented that programs should include technologically current equipment that could not be accessed otherwise. Given the importance of CSIRO's reputation for

providing advanced presentations, the need for updated equipment may need to be addressed.

6.0 Recommendations

The information collected throughout this project has pointed toward several key areas where CSIRO Education could improve, in order to better meet the needs of Victorian teachers and students. The recommendations described in this chapter are centered around the following ideas: the addition of more programs, the increase of program flexibility, the improvement of marketing strategies, the introduction of more professional development, and the possible use of web-based tools for education. Additional suggestions, beyond the scope of this project, are also included at the end of the chapter.

6.1 Changes in Program Offerings

The most popular suggestion, recommended by over two-thirds of the interviewees, was that CSIRO offer more programs of a variety of content (all CSF strands) for different ages. As stated in the analysis, teachers are pleased with the curricular content and enrichment capability of CSIRO programs. When asked about successful program development, it was stressed that the programs must be novel and unique. Methods based on frequency of booking and program content should be developed to evaluate a given program's potential and need. If a program has not been booked for a certain length of time educators should try to utilise the content and equipment in other programs. CSIRO's offerings require continuous assessment and should continually evolve to reflect teachers' needs.

The P-2 year level students are a key target area that CSIRO can look to for additional bookings. This group in particular as been overlooked as voiced by teachers during the interview process. Teachers felt that for the lower year levels it was not as important for a comprehensive lesson to be taught and retained, than for

their students to be inspired and motivated to learn science. In addition, students in the P-2 levels lack the attention spans to follow the structure of the programs designed for the higher year students. While attending various programs it was observed that students, lower year students in particular, seemed to focus and exhibit higher interests in the presentation directly after interactive demonstrations and experiments. The generation of new programs that provide a less in-depth approach to the subject matter, but filled with interactive demonstrations (as inherent in the Air and Weather program) might prove most effective. However, it might also be possible to modify existing programs by lowering subject matter levels to suit P-2 audiences. The P-2 program development would likely require not only a possibly significant amount of development time, but might also require some staff professional development. Most CSIRO staff members are trained to teach primarily secondary school students, and have limited experience with younger classes.

Home-schooled students are also a subgroup often overlooked. It is expected that home school parents would be interested in extending the education home schooling provides with exciting enrichment programs for their children. The CSIRO could offer day programs to gather home school families together for science activities. This offering would provide an educational and social experience for home-schooled children, who are likely in need of more interaction with children their age. Home school families may have higher expectations for learning outcomes of programs, so CSIRO programs should be redesigned slightly to provide greater challenges for these students. While this may not prove beneficial in Victoria, where there are only 180 members of Victoria's Home Education Network (2001), other states may see this as a more advantageous option.

In addition to targeting different types of students, CSIRO Education could also modify programs to teach a subject over several sessions. Having presenters work with schools for the duration of the respective topic studied was one idea that surfaced from a non-participating teacher in Melbourne. This particular teacher thought that the comprehension of knowledge gained in a single day program was not sufficient. The teacher suggested that presenters visit the school once a week during a particular focus for a term. This would extend the learning potential of the program experience. Extensive supplementary material, possibly including web-based programs, could be designed to prepare students and complement materials presented in a CSIRO program and thereby eliminating the need for ongoing multiple visits.

Interviewed teachers also expressed interest in custom-made programs. Programs would be tailored to fit specific school curricular needs to insure their applicability. More basic information would have to be conveyed if a class had no previous experience in the subject area to be taught. If a teacher's objective is only to excite students about science, then a program could be modified to include more experiments and demonstrations and omit some of the explanations. Stylistic preferences with regard to the presentation of information would also be considered and incorporated into the plans for the newly designed program. The structure of the programs could be somewhat determined on an individual school basis.

Teachers commented that structurally the current program set up and explanation time should be limited and hands-on work increased. Easy-to-understand instructions and diagrams should be provided for all workstations. This would eliminate the need for large amounts of introductory information to be given during programs. In addition, more staff to help explain the concepts that are meant to be

discovered in each experiment would be helpful. With more staff at these programs, set up time would also be reduced.

6.2 Marketing Improvements

Teachers have expressed, through interviews and surveys, that a principal reason for non-participation is the lack of a complete awareness of CSIRO Education and its offerings, particularly outreach programs. To counter this lack of awareness, marketing should focus on relaying to teachers the details of the programs and their potential outcomes for participants.

As a primary means of reaching teachers, mail-outs must clearly relate the details of the programs to potential participants. The flyers used must catch the eye: they need to be flashier, in bigger, bolder text, possibly including a statement such as "We will come to your school!" in an exaggerated font to advertise the outreach capabilities of CSIRO Education. Advertisements must relay major concepts about the programs without requiring the reader to invest much time.

To improve impact of advertisements in journals, these too must be more eye-catching and contain complete information about the programs in order to attract and hold teacher attention. Another teacher mentioned that of the journals available, it was most important for CSIRO Education to have a strong presence in STAV's *Contact* publication. Other suggestions given were to advertise in more journals such as the *Lab Lines* newsletter of STAVLTB, the *Union* newspaper (since teachers have a strong union base), and the principals' documents from the Principals' Association. It is evident that a boost in marketing could increase the number of bookings and improve the clarity of the impressions of CSIRO Education.

In addition to stylistic considerations and the strategic placement of advertisements, the mail-outs must be sent continually in case they are overlooked. A

large problem seems to stem from the absence of direct contacts and names. The flyers never reach the people who might actually book a program. Often, these flyers are put into the rubbish bin or simply not passed on to teachers who might find them useful. One way to combat this would be to generate a CSIRO teacher profile database to utilise as a marketing tool to support direct contact with the teacher population. Each teacher profile would theoretically be a short synopsis of a teacher's basic information from the type of school they taught at, subjects of interest, to curricular needs, past program participation, email, address, etc. As a result, educators would receive the most relevant information and thus would be more likely to examine the materials more closely. The proposed database would also effectively target a large portion of the teacher population that may have been previously bypassed due to science coordinators or heads of science failing to pass on pertinent information.

The easiest way to implement this system at the CSIROSEC in Highett perhaps would be to integrate it into their current system using File Maker. A new sub-category and data entry interface can be added to extend the depth of the system to include individual teacher profiles linked to each school profile. Teacher profiles could be obtained and entered as bookings are taken; teacher specific information could be requested at this time. Additionally, the program evaluations that teachers are asked to complete after each program could include questions requesting profiling information. Project members have modified the existing program evaluation sheets to request these data, as well as provide additional information for program improvement. To view the old and new Program Evaluation Sheets in Appendices S and T, respectively. Hopefully by gathering additional information about teachers, clear, accurately targeted advertising can be produced.

The problem of information regarding programs failing to reach potentially interested teachers can be combated in other ways as well. It is possible that CSIRO could more effectively advertise their offerings in person. Visiting schools during lunchtime to describe the programs was suggested in order to avoid the difficulties of gathering an audience at the end of the school day. This time, if used effectively could identify contacts within schools that are interested in booking programs. Another marketing suggestion was to offer trial programs for schools to familiarise them with CSIRO's educational capabilities through short sessions or informative workshops. While CSIRO does offer demonstrations at teacher conferences and seminars, not all teachers are able to attend these events. Actually visiting with teachers at schools would allow all teachers to experience what CSIRO has to offer. Another possibility would be to offer a short video clip of a presentation on CSIRO Education's website to give teachers a sense of the structure and presentation of programs.

Utilising libraries to demonstrate programs and offering is another marketing strategy that can be used to spread the word about the CSIRO and its programs, particularly amongst parents. The library provides an established educational environment that is known by most as a place to search for resources and knowledge. Like the holiday programs that are held when students are on school vacation, library programs could be held on weekends or after school. Holding programs at the library would take advantage of the steady flow of parents and students who generally frequent the establishment. Estimates of participation levels can be made before programs are run based on the average number of visitors experienced on a given day at the library. Once the program's reputation had been established, a formal signup for the program could be set up. The frequency of these types of programs would

need to be reflective of continued demand, and scheduled accordingly. The programmed would be marketed via word of mouth, but also many parents and children frequent the library, so a poster describing the programs may be sufficient. The library may also be willing to distribute bookmarks with information about the programs on them. Another interesting aspect of a library program is that if parents and children want to explore concepts further, CSIRO educators could suggest relevant library resources, providing mutual benefit for the library.

One of the major objectives of CSIRO Education, Victoria, according to education officer Chris Krishna-Pillay, is to be seen as a general science education resource to Victorian teachers. In order for this objective to be realised, this message must be spread. CSIRO Education should conduct advertising, in addition to any current campaigns, that promotes the versatility of their support for educators in Victoria.

6.3 Further Educational Offerings

An important aspect of awakening schools to the contributions and value of science is to increase interest in science. Teachers can excite their students about science if they themselves are confident and enthused teaching scientific subjects. The demand for professional development for teachers is growing; one-fourth of participant interviewees mentioned that CSIRO's programs were useful because teachers lacked the knowledge base to teach the science concepts effectively, many looked to the programs to increase their own knowledge, and suggested that CSIRO provide additional support.

Survey and interview questions did not directly request input on professional development, but many teachers suggested that CSIRO Education should cater to the

growing demand for professional development. Besides direct requests, the need for professional development is inferred from the trends seen in responses that suggest that teachers' knowledge bases are limited. If a teacher is uncomfortable with their level of knowledge of a given subject, it is unlikely that they will be able to teach it effectively. By helping teachers learn more about CSF relevant topics, their confidence in teaching science will grow as will their enthusiasm for sharing science knowledge with students. Thus, professional development promotes science education by helping teachers motivate students to learn science, thereby achieving one of CSIRO's overall goals.

As teachers are constantly looking for additional resources to enrich portions of their curriculum, providing more support materials would be well received. CSIRO could provide additional resources listed on a website or compiled in actual boxes of materials that teachers could borrow for two to three weeks to cover a certain aspect of their curriculum. These kits would be designed to provide equipment and instructions for demonstrations used to visualise topics and better explain subject matter. These kits could be heavily marketed during times when programs are booked the least, so the equipment would be in use rather than on the shelf. As additional support for teachers would seemingly eliminate the need for a booked program, a small fee would have to be charged for the kits to cover general expenses incurred in the kits' development, the equipment included in the package, etc. The cost, comparative to a program, would be very low, and the teacher would have the flexibility to implement the activities at the most convenient time. Some effort would also be required to develop thorough directions for demonstrations or instructional videos that would accompany the experimentation equipment. Other teachers

suggested that CSIRO provide flyers or a website with instructions for experiments and easy-to make equipment.

A more integral approach to providing support materials to teachers is to couple them as a basic offering with existing programs. Of the educators surveyed, the average importance rating given to describe the significance of support materials was 4.01 (on a scale of 1-5, 1 being Very Unimportant, 5 being Very Important). Most likely easier to market, support materials offered with existing programs allow teachers to take advantage of CSIRO's programs, increase their own knowledge, and also improve preparatory and follow up lessons. Written materials, such as teacher notes, already exist for many CSIRO programs; the continued development of these materials would be beneficial.

Educators would like to utilise alternative resources such as interactive web-based programs as a teaching tool. One teacher suggested using such web-based materials as support for classroom teaching the same way CD-ROMs are included in textbooks. Web-based teaching is a growing field and could provide an alternative for reaching more students irrespective of distance.

Distance learning, through technology such as video teleconferencing, is playing a growing role in education today. Other organisations, such as the Melbourne Zoo have taken advantage of this technology already. CSIRO Education should investigate the effectiveness and feasibility of conducting programs using streaming video transmissions and whether such an endeavor would be affordable.

6.4 Additional Recommendations

Teachers throughout Victoria made a number of recommendations during the interview process. Topics that fell outside the project's intended focus were not

examined in depth but remain relevant, and thus will be presented in this section for consideration.

It was suggested by two teachers that the CSIRO Education publications, *Double Helix* and *Scientriffic,* are written beyond the reading skills of the recommended student year level. Both teachers claimed that though *Double Helix* is advertised for 10+ year olds, it is written in a manner for late primary or early secondary students, and that *Scientriffic*, advertised for 7 year olds, would be more applicable to year 5 and 6 students. Perhaps another publication could be designed to target younger students, and the existing publications modified to match suggested year levels.

Many smaller country schools interviewed and surveyed wish to book CSIRO programs but have class sizes too small to satisfy the minimum size. One country schoolteacher explained that he was in the process of organising groups of smaller country schools so CSIRO educators could travel out to an area and run a program for multiple schools at once. If the centre wanted to target more rural areas of Victoria, it might be advantageous to explore similar methods of grouping area schools together to run a large program. This set up would allow smaller schools to split the cost of the program and still take advantage of outreach opportunities. By grouping smaller classes, the size requirement for a program would be filled, though the schools should be advised not to form too large of a group, as it would be difficult to incorporate all of the hands-on work.

6.5 Conclusion

The mission of CSIRO Education is to promote scientific learning amongst students in Victoria. Currently, the centre reaches less than 10% of the student

population. CSIRO as an organisation is at a stage where it must decide how it can change to best serve its target population, and evaluate its readiness to do so. This study seeks to identify the possible areas for change and refinement that CSIRO should examine.

The education programs offered by CSIRO are an entertaining and effective means of presenting scientific topics to participating students. The programs serve as tools to teach curricular requirements, extend the exploration of scientific concepts and enrich the learning process as a whole. The programs viewed by the project team presented material to students in an engaging and informative manner. Participant teachers interviewed and surveyed echoed this sentiment.

In order for these quality-learning experiences to be shared with a greater number of students, tactics need to be adopted to increase participation. Program structure can be modified to better address topics for a wider range of students. In addition, CSIRO could develop educational offerings to meet the needs of teachers, including professional development. Most importantly, refined marketing efforts will help to inform educators of CSIRO educational opportunities.

Most teachers are aware of CSIRO as an organisation, and its reputation for its contribution to science is well known, but many had not been alerted to CSIRO's educational contribution. Hopefully, implementation of carefully selected advancement strategies can help to build upon CSIRO Education's reputation and will help achieve increased attendance levels. Thus CSIRO will be better positioned to fulfill its overall goal of encouraging students to participate in scientific activities.

Glossary of Terms

ABS – Australian Bureau of Statistics (nationwide organisation).

AISV – Association of Independent Schools of Victoria, Inc. (statewide organisation).

Board of Studies, Victoria – Charter organisation responsible for the development of curriculum and assessment standards for the state of Victoria, Australia. Known as the Victoria Curriculum and Assessment Authority after March 1st 2001.

CEO – Catholic Education Office, located in Melbourne, Victoria (statewide organisation).

CSFII (CSF) – The Curriculum and Standards Framework for the State of Victoria. This second-generation document provides a comprehensive list of outcomes for primary and secondary school students in the state of Victoria, Australia.

CSIRO – Commonwealth Scientific Industrial Research Organisation. The organisation is nationwide, but we refer to the Victorian division.

CSIROSEC – CSIRO Science Education Centre located in Highett, Victoria (Australia).

DEET – Department of Education, Employment and Training, Victorian governmental organisation.

DNA – Deoxyribonucleic Acid, term used in biological sciences to define genetic material.

JCSAV – Joint Council of Subject Associations of Victoria (Australia).

KLA – Key Learning Area (of CSF).

NIST – National Institute of Standards and Technology, United States organisation.

NSF – National Science Foundation, United States organisation.

PBS – Public Broadcasting Service, United States organisation.

SOSE – Studies of Society and Environment

STAV – Science Teachers Association of Victoria (Australia).

VCAA – Victoria Curriculum and Assessment Authority

VCE – Victorian Certificate of Education. Secondary students in Victoria, Australia that complete years 11 and 12 are awarded this certificate by the State of Victoria. This certificate is required for admittance to tertiary institutions.

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Appendices

Appendix A – Program Content Matrix

CSIRO Program	CSF Level	Program Content		Lab on Legs	1999 Participation Levels		CSF Curriculum Correlation				
		Hands-on	Demonstration		Sessions	Attendance	Science	Biology	Chemistry	Earth Sciences	Physics
Air and Atmosphere	1 2 3 5		X X X X	X X X X	29	1447	S 1.1 S 2.1		 S 3.1 S 5.1		
Cool Chemistry	4 5	X X		X X	17	389			M 4.1 L 5.2		
Electricity and Magnetism	1 2 3 4	X X X X	X X X X	X X X X	265	11451	M 1.1 M 2.1				 S 3.1 M 4.1
Electronics	6	X		X	N/A	N/A					S 6.2
Flat Cats and Mind Games	5 6		X X	X X	49	2098			L 5.1 L 6.1, S 6.5		
Food Forensics	5 6 VCE	X X X			N/A	N/A					
Force and Movement	1 2 3 4	X X X X	X X X X	X X X X	133	5789	S 1.1 S 2.1				 S 3.2 S 4.2
Forensic Frenzy	4 5 6	X X X		X X X	246	5956					
Gene Technology	6	X		X	148	3374		S 6.5, L 6.6			
Genetic Engineering	VCE	X			112	1989					
Lego Robotics	4	X		X	9	226					
Lego Technic	3 4	X X		X X	124	3120					
Life and Living	4	X		X	11	265		S 4.2			
Light and Sound	1 2 3 4	X X X	X X X X	X X X X	131	5871	S 1.1 S 2.1				 M 3.1 L 4.1
Materials and Structures	VCE	X			112	1740					
Natural and Processed Materials	4	X		X	44	1188			M 4.1, M 4.2		
NPM - A Look at an Australian Industry	4	X		X	6	175			M 4.1		
Physical Science	5 6	X X			N/A	N/A					M 5.2, S 5.3 M 6.1, M 6.4

Appendix A – Content Matrix, cont.

CSIRO Program	CSF Level	Program Content		Lab on Legs	1999 Participation Levels		CSF Curriculum Correlation				
		Hands-on	Demonstration		Sessions	Attendance	Science	Biology	Chemistry	Earth Sciences	Physics
Reaction and Change	1 2 3	X X X		X X X	N/A	N/A	S 1.1 S 2.1		 S 3.2		
Science and Technology	4	X		X	19	477			M 4.1		M 4.1
Science in Action	1 2 3		X X X	X X X	46	1980	S 1.1 S 2.1				 M 3.2
Science Procedures and Processes	4 5	X X		X X	N/A	N/A		L 4.1 L 5.1	L 4.1		L 4.2
Super Sleuth	4	X			2	28					
Weather	1 2 3 4		X X X X	X X X X	107	5036	S 1.1 S 2.1			 M 3.1 S 4.1	
		Other 1999 programs no longer offered:			96	5691					
				Total:	1706	58290					

S – Strong Correlation
M – Moderate Correlation
L - Slight Correlation

Appendix B – Methodology Information Matrix

Desired Information	Source	Method	Instrument Design for current / former participants	Instrument Design for non-participants	Collection Method	Analysis	Presentation
School Statistics:							
List of Victorian schools	ABS	Phone / Web					
Identify participating schools	CSIRO - Chris Krishna-Pillay	Phone / Email					
Identify former participant schools	CSIRO - Chris Krishna-Pillay	Phone / Email					
Identify non-participating schools	ABS / CSIRO	Phone / Email					
Attend CSIRO Programs	CSIRO	Observation					
Logistical Questions:							
Cost Barriers / Satisfaction with Price	Teacher / Administrator	PS	P4I	P2I	SRS	CA	DS
Ease of Booking	Teacher / Administrator	PS	P4I	P2I	SRS	CA	DS
Schedule Flexibility	Teacher / Administrator	PS	P4I	P2I	SRS	CA	DS
Distance Constraints	Teacher / Administrator	PS	P4I	P2I	SRS	CA	DS
Marketing (Effectiveness)	Teacher / Administrator	PS	P4I	P2I	SRS	CA	DS
Customer Service	Teacher / Administrator	PS	P4I	P2I	SRS	CA	DS
Competition to CSIRO Education	Teacher / Administrator	PS	P4I	P2I	SRS	CA	DS
Teacher Opinions:							
Teacher Impressions of program content	Teacher	PS / Interview	P4I		SRS	CA	DS
Teacher Impressions of program quality	Teacher	PS / Interview	P4I		SRS	CA	DS
Teacher Impressions of student interest	Teacher	PS / Interview	P4I		SRS	CA	DS
Suggestions for improvement	Teacher	PS / Interview	P4I		SRS	CA	DS
	[CSIRO Educators]	[Focus Group]	Focus Group (AB)				
Profile Questions:							
In-house/Outreach	Teacher	PS	P4I		SRS	CA	DS
Topic of program	Teacher	PS	P4I		SRS	CA	DS
Grade Level	Teacher	PS	P4I	P2I	SRS	CA	DS
Level of Education Achieved	Teacher	PS	P4I	P2I	SRS	CA	DS

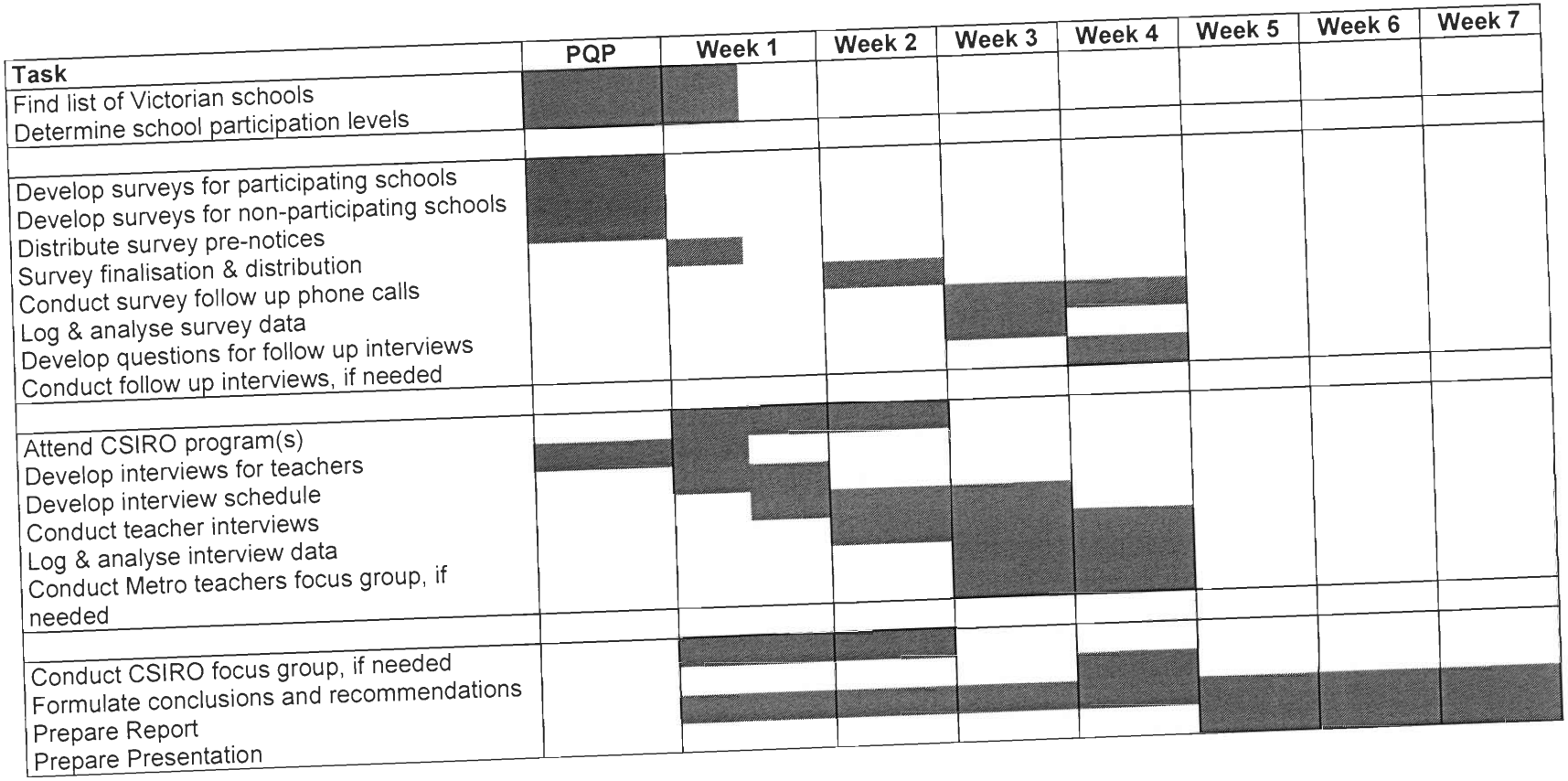
ABS - Australian Bureau of Statistics

PS - Postal Survey

P4I - Paper, 4-page, Informational
AB - Attitudinal & Behavioral, funnel style
P2I - Paper, 2-page, Informational
SRS - Stratified Random Sample (By Region, Grade, Participation)

CA - Content Analysis
DS - Descriptive Statistics

Appendix C – Methodology Timeline



Appendix D – Survey Format for Participant Schools

WPI WORCESTER POLYTECHNIC INSTITUTE

CSIRO Science Education Centre
PO Box 56
Highett VIC 3190

Dear Victorian Teacher,

This survey is a part of a study investigating the effectiveness of extension science education programs, particularly those offered by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Education, Victoria. Students of Worcester Polytechnic Institute, located in Worcester, Massachusetts, USA, are conducting this study in cooperation with the CSIRO Education in Highett, Victoria. The results of this survey will be disseminated widely and used to improve the quality of the programs on offer to schools.

Your school was selected from among a listing of schools, which have participated in CSIRO Education programs. As a teacher of science, your input on the effectiveness of these science education programs is essential to improving program development. Your responses to all parts of this survey will be pooled with other responses and will remain strictly confidential. A code, consisting of a letter and a number, has been placed in the upper right-hand corner of the first page of the survey. This number provides a mechanism by which we can track responses and possibly contact educators who have not returned the survey. Please be assured, your responses will remain confidential.

This survey is six pages long, consisting of sixteen questions, and should take only 10-15 minutes to complete. Your responses will help to develop effective science education programs for students in Victoria.

Thank you for your assistance.

Matt Douglas

Worcester Polytechnic Institute

WPI WORCESTER POLYTECHNIC INSTITUTE

The following survey consists of a series of fifteen questions related to science education programs in Victoria.

The first four questions will help us determine which students the different CSIRO Education programs best serve. Please indicate which responses apply most directly to your teaching experience. In some questions, multiple responses may apply; please indicate **ALL** responses that describe your experience.

The remaining eleven questions in the survey pertain directly to your experience with the programs offered by CSIRO Education, Victoria. The final three questions ask you to explain, in your own words, what were the strengths and weaknesses of the programs you attended.

Upon completion, please use the enclosed envelope to return this survey to:
CSIRO Science Education Centre
PO Box 56
Highett VIC 3190

If you would be interested in having a member of our study contact you to discuss these programs further, or if you would like to receive a copy of the results of this survey, which will be available after May 1, 2001, please fill out the following and include this sheet with your response. Should you return it, **this form will remain separate from your responses** following any additional contact:

Name: _____

Phone: _____

School: _____

Email: _____

____ I decline to participate in any further discussions, but would still like to receive a copy of the survey results.

Survey results will be sent through the mail in paper form or by email in a Microsoft Excel spreadsheet. Please indicate which form you would prefer:

_____ Paper
_____ Email

Survey of Victorian Science Education Programs

1. Please place a check next to the type of school at which you teach.
   _____ Government
   _____ Catholic
   _____ Independent

2. What grade level(s) do you teach? (Circle all that apply)

   P 1 2 3 4 5 6 7 8 9 10 11 12

3. In the space below, please write the number of years you have been a full-time teacher.

   _____ years

4. What branch(es) of scientific study do you teach (check all that apply)?

   _____ General Science
   _____ Biology
   _____ Chemistry
   _____ Earth and Space
   _____ Physics

5. How did you become aware of the available CSIRO Education programs (check all that apply)?
   _____ Advertisement in the Catholic Education mailout
   _____ Advertisement in *Contact*
   _____ Advertisement in *Education Times*
   _____ Conference or Seminar
   _____ Direct mail
   _____ Word of mouth
   _____ Other (please specify): _____

6. Many criteria are involved in selecting a science education program. Please rank each of the following elements by their level of importance in your selection process. (1-Very Unimportant, 2- Unimportant, 3-Neutral, 4- Important, 5-Very Important, N/A-No answer)

Selection Criteria	**Importance Level**					
	VU	U	N	I	VI	
Cost of Program	1	2	3	4	5	N/A
Ease of Booking	1	2	3	4	5	N/A
Duration of Program	1	2	3	4	5	N/A
Availability of programs for certain group sise	1	2	3	4	5	N/A
Written support material provided with program	1	2	3	4	5	N/A
Outreach Opportunities	1	2	3	4	5	N/A
Program Presentation	1	2	3	4	5	N/A
Program Content	1	2	3	4	5	N/A
Content's affinity with the Curriculum and Standards Framework	1	2	3	4	5	N/A
Other (please specify):	1	2	3	4	5	N/A

7. From the following list, please place a check next to each of the CSIRO Education programs in which your students have participated.

_____ Genetic Engineering
_____ Electricity and Magnetism
_____ Light and Sound
_____ Food Forensics
_____ Science in Action
_____ Gene Technology
_____ LEGO Technic
_____ NPM – A look at an Australian Industry
_____ Cool Chemical Science (previously Cool Chemistry)
_____ Forensic Frenzy
_____ Science and Technology
_____ Electronics
_____ Reaction and Change
_____ Weather
_____ Life and Living
_____ Air and Atmosphere
_____ Force and Movement
_____ Natural & Processed Materials
_____ Flat Cats and Mind Games
_____ LEGO Robotics
_____ Science Procedures & Processes
_____ Super Sleuth
_____ Materials and Structures
_____ Physical Science
_____ Other (please specify): _____

8. For EACH of the programs you have indicated above, please rate your level of overall satisfaction with the program.

(1-Very Dissatisfied, 2-Dissatisfied, 3-Neutral, 4-Satisfied, 5-Very Satisfied, N/A-No answer)

Program Name	**Satisfaction Level**					
	VD	D	N	S	VS	
Genetic Engineering	1	2	3	4	5	N/A
Electricity and Magnetism	1	2	3	4	5	N/A
Light and Sound	1	2	3	4	5	N/A
Food Forensics	1	2	3	4	5	N/A
Science in Action	1	2	3	4	5	N/A
Gene Technology	1	2	3	4	5	N/A
LEGO Technic	1	2	3	4	5	N/A
NPM – A look at an Australian Industry	1	2	3	4	5	N/A
Cool Chemical Science (preciously Cool Chemistry)	1	2	3	4	5	N/A
Forensic Frenzy	1	2	3	4	5	N/A
Science and Technology	1	2	3	4	5	N/A
Electronics	1	2	3	4	5	N/A
Reaction and Change	1	2	3	4	5	N/A
Weather	1	2	3	4	5	N/A
Life and Living	1	2	3	4	5	N/A
Air and Atmosphere	1	2	3	4	5	N/A
Force and Movement	1	2	3	4	5	N/A
Natural & Processed Materials	1	2	3	4	5	N/A
Flat Cats and Mind Games	1	2	3	4	5	N/A
LEGO Robotics	1	2	3	4	5	N/A
Science Procedures & Processes	1	2	3	4	5	N/A
Super Sleuth	1	2	3	4	5	N/A
Materials and Structures	1	2	3	4	5	N/A
Physical Science	1	2	3	4	5	N/A
Other (please specify):	1	2	3	4	5	N/A

9. For each of the programs that received a 1 or 2 satisfaction ranking in question 8 (Very Dissatisfied or Dissatisfied), please indicate what specific aspects of the program were not satisfactory and how they could be improved.

10. For each of the programs that received a 4 or 5 satisfaction ranking in question 8 (Satisfied or Very Satisfied), please indicate what specific aspects of the program were most outstanding.

11. What are the major reasons you participate in the programs offered by CSIRO Education, Victoria?

_____

_____

_____

_____

_____

_____

12. Have your students participated in any science education programs offered by an organisation other than CSIRO?

_____ Yes

_____ No

If you answered No to question 11, please skip the remaining questions.

13. What organisation(s) offered these programs?

_____

_____

14. What were the names of these programs?

_____

_____

15. How did this program compare to those offered by CSIRO?

_____

_____

_____

Thank you for your time in completing this survey.

Upon completion, please use the enclosed postage-paid envelope to return this survey to:

CSIRO Science Education Centre
PO Box 56
Highett VIC 3190

Appendix E – Survey Format for Non-Participant Schools

WPI WORCESTER POLYTECHNIC INSTITUTE

CSIRO Science Education Centre
PO Box 56
Highett VIC 3190

Dear Victorian Teacher,

This survey is a part of a study investigating the effectiveness of extension science education programs, particularly those offered by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Education, Victoria. Students of Worcester Polytechnic Institute, located in Worcester, Massachusetts, USA, are conducting this study in cooperation with the CSIRO Education in Highett, Victoria. The results of this survey will be disseminated widely and used to improve the quality of the programs on offer to schools.

Your school was selected from among a listing of Victorian schools, which have not participated in CSIRO Education programs, obtained from CSIRO Education, Victoria. As a teacher of science, your input on the effectiveness of science education programs is essential to making programs more accessible and relevant to student needs. Your responses to all parts of this survey will be pooled with other responses and will remain strictly confidential. A code, consisting of a letter and a number, has been placed in the upper right-hand corner of the first page of the survey. This number provides a mechanism by which we can track responses and possibly contact educators who have not returned the survey. Please be assured, your responses will remain confidential.

This survey is two pages long, consisting of twelve questions, and should take only 10-15 minutes to complete. Your responses will help to develop effective science education programs for students in Victoria.

Thank you for your assistance.

Matt Douglas
Worcester Polytechnic Institute

WPI WORCESTER POLYTECHNIC INSTITUTE

The following survey consists of a series of twelve questions related to science education programs in Victoria.

The first four questions will help us determine what types of teachers the different types of CSIRO Education programs could best serve. These questions ask you to indicate which responses apply most directly to your teaching experience. In some questions, multiple responses may apply; please indicate **ALL** responses that describe your experience.

The remaining eight questions in the survey pertain directly to your awareness of and experience with science education programs in Victoria. Question 7, if applicable, will ask you to explain any reasons why CSIRO Education programs are not accessible and/or not relevant to your students.

Upon completion, please use the enclosed envelope to return this survey to:

CSIRO Science Education Centre
PO Box 56
Highett VIC 3190

If you would be interested in having a member of our study contact you to discuss these programs further, or if you would like to receive a copy of the results of this survey, which will be available after May 1, 2001, please fill out the following and include this sheet with your response. Should you return it, **this form will remain separate from your responses** following any additional contact:

Name: _____

Phone: _____

School: _____

Email: _____

____ I decline to participate in any further discussions, but would still like to receive a copy of the survey results.

Survey results will be sent through the mail in paper form or by email in a Microsoft Excel spreadsheet. Please indicate which form you would prefer:

_____ Paper

_____ Email

Survey of Victorian Science Education Programs

1. Please place a check next to the type of school at which you teach.

   _____ Government

   _____ Catholic

   _____ Independent

2. What grade level(s) do you teach? (Circle all that apply)

   P 1 2 3 4 5 6 7 8 9 10 11 12

3. In the space below, please write the number of years you have been a full-time teacher.

   _____ years

4. What branch(es) of scientific study do you teach (check all that apply)?

   _____ General Science

   _____ Biology

   _____ Chemistry

   _____ Earth and Space

   _____ Physics

5. Many criteria are involved in selecting extension education programs. Please rank each of the following elements by their level of importance in your selection process. (1-Very Unimportant, 2- Unimportant, 3-Neutral, 4- Important, 5-Very Important, N/A-No answer)

Selection Criteria	Importance Level					
	VU	U	N	I	VI	
Cost of Program	1	2	3	4	5	N/A
Ease of Booking	1	2	3	4	5	N/A
Duration of Program	1	2	3	4	5	N/A
Availability of programs for certain group sise	1	2	3	4	5	N/A
Written support material provided with program	1	2	3	4	5	N/A
Outreach Opportunities	1	2	3	4	5	N/A
Program Presentation	1	2	3	4	5	N/A
Program Content	1	2	3	4	5	N/A
Content's affinity with the Curriculum and Standards Framework	1	2	3	4	5	N/A
Other (please specify):	1	2	3	4	5	N/A

6. Are you aware of the science education programs offered by CSIRO Education, Victoria?

_____ Yes
_____ No

If you answered No to question 6, please skip to question 9.

7. How did you become aware of the available CSIRO Education programs (check all that apply)?

_____ Advertisement in *Contact*
_____ Advertisement in *Connections*
_____ Advertisement in *Victoria School News*
_____ Conference or Seminar
_____ Direct mail
_____ Word of mouth
_____ Other (please specify): _____

8. What are the primary reasons that you elect not to participate in the programs offered by CSIRO Education, Victoria?

_____

_____

_____

_____

_____

_____

_____

9. Have your students participated in any science education programs offered by an organisation other than CSIRO?

_____ Yes
_____ No

If you answered No to question 9, please skip the remaining questions.

10. What organisation(s) offered these programs?

_____

_____

11. What were the names of these programs?

_____

_____

12. How did this program compare to those offered by CSIRO?

_____

_____

_____

Thank you for your time in completing this survey.

Upon completion, please use the enclosed postage-paid envelope to return this survey to:

CSIRO Science Education Centre
PO Box 56
Highett VIC 3190

Follow up Phone Ditty

Hello, this is _____ from CSIRO in Highett. A survey was sent to you as a part of a research project being conducted by myself and two other students of Worcester Polytechnic Institute in the United States.
I was ringing you to see if you have received the survey and have had the opportunity to fill it out.

Responses:

Got it, filled it out

Thank you very much for your input and we look forward to receiving it.

Got it, haven't filled it out

If you would have an opportunity to fill out the survey, it would be greatly appreciated. If need be, we can send you another copy.
You can use the postage-paid envelope included with the survey to return it.
Thank you for your time and we look forward to receiving your survey.

Never got it

I'm sorry to hear that. We would still like you to have the opportunity to fill out a survey. <GOTO: RESEND>

Lost it

It is very important to us that you have a chance to fill out a survey. <GOTO: RESEND>

<RESEND>
We would be happy to send you another survey.
Would you like to receive it by fax, email, or post?

Fax / Email

All right.
Could I please have your fax number / email address?
<If fax> Also, could I have your name to make sure that the fax is directed to you?
Ok, we'll send that right out to you.
Thank you for your time and we look forward to receiving your survey.

Post

<Look up school in FileMaker – it should already be open>
All right. Let me double-check the address I have for you.
<Read address>
Is that correct?
Also, could I have your name to make sure that the letter is directed to you?
Ok, we'll send that out to you later today.
Thank you for your time and we look forward to receiving your survey.

Survey Content Analysis Form & Entry Protocol – Participant

Description: For the following questions present in our survey that require written responses to be given, we will try to quantify those qualitative responses using the methods and strata outlined in this template.

1. Enter valid identification code for respective survey
2. Enter economic quartile classification (E1 = 1, E2 = 2, E3 = 3, E4 = 4)
3. Enter Metro or Country (Metro = 1, Country = 2)
4. Enter school type #(Catholic = 1, Government = 2, Independent = 3)
5. Check off grade level # (P, 1-10, VCE)
6. Enter number of years teaching
7. Check off branches of study taught (General Science, Biology, Chemistry, Earth Science, Physical Science)
8. Check off awareness categories (Contact, Connections, Victoria School News, Conference or Seminar, Direct mail, Word of mouth, Other)
9. Enter science education selection criteria# (1-Very Dissatisfied, 2-Dissatisfied, 3-Neutral, 4-Satisfied, 5-Very Satisfied, 0-N/A-No answer)
10. Check off programs which students have participated (refer to entry screen headers for program title)
11. Enter satisfaction level# for participated programs (1-Very Dissatisfied, 2-Dissatisfied, 3-Neutral, 4-Satisfied, 5-Very Satisfied, 0-N/A-No answer)
12. For question 9-11 use the attached worksheet A to stratify and quantify information.
13. Check off participation in other programs if applicable
14. For question 15 use the attached worksheet B to stratify and quantify information:

Worksheet A

Instructions: For the respective short answer portions of the survey being examined look at the keywords and phrases in order to classify the responses.

Response includes keywords & phrases: cost, money, expense(s), budget, cheap, etc.

Therefore: Cost of Program (check off category in database)

Response includes keywords& phrases: easily booked, available, scheduling easy, staff helpful on phone, etc.

Therefore: Booking & Availability (check off category in database)

Response includes keywords & phrases: fit into schedule, time effective, etc.

Therefore: Duration of Program (check off category in database)

Response includes keywords & phrases: handouts, worksheets, provided follow up lessons, etc.

Therefore: Written Support Materials (check off category in database)

Response includes keywords & phrases: no buses, hard to travel, they come to us, etc.

Therefore: Outreach Opportunities (check off category in database)

Response includes keywords: set up, presenters, engaged, energy, equipment, etc.

Therefore: Program Presentation (check off category in database)

Response includes keywords: CSF, curriculum, standards, Board of Studies, etc.

Therefore: Contents Affinity w/Curriculum (check off category in database)

Response includes keywords: hands-on, interactive, content, etc.

Therefore: Program Structure (check off category in database)

(Note: Responses must fall into these 7 categories, however please use best discretion to distinguish between categories)

Worksheet B

Instructions: For the respective short answer portions of the survey being examined look at the keywords and phrases in order to classify the responses.

Response includes keywords & phrases: better, more effective, higher quality, etc.
Therefore: more effective (enter 1)

Response includes keywords & phrases: equal, same, no difference, etc.
Therefore: same (enter 2)

Response includes keywords & phrases: worse, lower quality, less effective, etc.
Therefore: less effective (enter 3)

more effective presentation=1, similar in nature=2, less effective presentation=3, not comparable=4.

(Note: Responses must fall into these 4 categories, however please use best discretion to distinguish between categories)

*This Protocol and Analysis is only designed for CSIRO participant surveys as compiled and processed by student representatives of Worcester Polytechnic Institute.

Survey Content Analysis Form & Entry Protocol – Non-Participant

Description: For the following questions present in our survey that require written responses to be given, we will try to quantify those qualitative responses using the methods and strata outlined in this template.

1. Enter valid identification code for respective survey
2. Enter economic quartile classification (E1 = 1, E2 = 2, E3 = 3, E4 = 4)
3. Enter Metro or Country (Metro = 1, Country = 2)
4. Enter school type #(Catholic = 1, Government = 2, Independent = 3)
5. Check off grade level # (P, 1-10, VCE)
6. Enter number of years teaching
7. Check off branches of study taught (General Science, Biology, Chemistry, Earth Science, Physical Science)
8. Enter science education selection criteria# (1-Very Dissatisfied, 2-Dissatisfied, 3-Neutral, 4-Satisfied, 5-Very Satisfied, 0-N/A-No answer)
9. Check off awareness of CSIRO programs
10. Check off awareness categories (Contact, Connections, Victoria School News, Conference or Seminar, Direct mail, Word of mouth, Other)
11. For question 8 use the attached worksheet A to stratify and quantify information.
12. Check off participation in other programs if applicable
13. For question 11 use the attached worksheet B to stratify and quantify information.

Worksheet A

Instructions: For the respective short answer portions of the survey being examined look at the keywords and phrases in order to classify the responses.

Response includes keywords & phrases: cost, money, expense(s), budget, cheap, etc.

Therefore: Cost of Program (check off category in database)

Response includes keywords& phrases: easily booked, available, scheduling easy, staff helpful on phone, etc.

Therefore: Booking & Availability (check off category in database)

Response includes keywords & phrases: fit into schedule, time effective, etc.

Therefore: Duration of Program (check off category in database)

Response includes keywords & phrases: handouts, worksheets, provided follow up lessons, etc.

Therefore: Written Support Materials (check off category in database)

Response includes keywords & phrases: no buses, hard to travel, they come to us, etc.

Therefore: Outreach Opportunities (check off category in database)

Response includes keywords: set up, presenters, engaged, energy, equipment, etc.

Therefore: Program Presentation (check off category in database)

Response includes keywords: CSF, curriculum, standards, Board of Studies, etc.

Therefore: Contents Affinity w/Curriculum (check off category in database)

Response includes keywords: hands-on, interactive, content, etc.

Therefore: Program Structure (check off category in database)

(Note: Responses must fall into these 7 categories, however please use best discretion to distinguish between categories)

Worksheet B

Instructions: For the respective short answer portions of the survey being examined look at the keywords and phrases in order to classify the responses.

Response includes keywords & phrases: better, more effective, higher quality, etc.
Therefore: more effective (enter 1)

Response includes keywords & phrases: equal, same, no difference, etc.
Therefore: same (enter 2)

Response includes keywords & phrases: worse, lower quality, less effective, etc.
Therefore: less effective (enter 3)

more effective presentation=1, similar in nature=2, less effective presentation=3, not comparable=4.

(Note: Responses must fall into these 4 categories, however please use best discretion to distinguish between categories)

*This Protocol and Analysis is only designed for CSIRO participant surveys as compiled and processed by student representatives of Worcester Polytechnic Institute.

TALK SLOW.

Hello, my name is _____, I'm calling from Highett, Victoria. I represent Worcester Polytechnic Institute, which is an American university located in the state of Massachusetts, U.S.A. Two other students and I are conducting an important study for CSIRO's Science Education Division here in Highett. It is our understanding that _____ is expecting a CSIRO presenter on _____. Could I please speak with _____?

(NO?) Could I please leave a message? Please tell _____ that _____ called and can be reached at 9252-####.

(YES?)

Hello, my name is _____, I'm calling from Highett, Victoria. I represent Worcester Polytechnic Institute, which is an American university located in the state of Massachusetts, U.S.A. Two other students and I are conducting an important study for CSIRO's Science Education Division here in Highett. CSIRO Education would like to improve its offerings by performing an analysis of its current programs. It is our understanding that you are expecting a CSIRO presenter on _____. We will be accompanying the CSIRO presenter to your school to observe the program. Would it be possible for us to interview you for 15 minutes after the presentation?

Interview Questions and Protocol
(Participant schools)

OBJECTIVES

1. To obtain teacher impressions of the content of CSIRO educational offerings
2. To obtain teacher impressions of the quality of CSIRO educational offerings
3. To obtain teacher impressions of the student interest in CSIRO educational offerings
4. To obtain suggestions for improvement of CSIRO programs

STRUCTURE

1. Individual interview directed as a conversation with a purpose
2. Funnel shaped design format using domain questions followed up with probes
3. Interviewer role: Unsophisticated sympathetic

SCHEDULE

1. **Greeting:** Thank you for scheduling an interview with us. My name is… we are from… we are conducting this study for CSIRO Education.
   Request: Grade level(s) taught, subject(s) taught, years as a full-time teacher.
2. **Statement of purpose:** To gain information about how to better serve teachers and students in CSIRO's science education programs.
3. **Offer confidentiality:** Your responses will help us give CSIRO Education recommendations for improvement, but your name will not be associated with the information offered.
4. **Opening Statement:**

   "Throughout my research and time in Victoria thus far I've found various descriptions that aim to describe the breakdown of the Victorian school system. Could you describe the general structure of the school system present in Victoria?"

   Probes: ? are there differences between the government, Catholic, independent schools?
   ? confirm which type of school the educator teaches for

5. **Questioning:**

   "How did you first become aware of the science education programs available at the CSIRO centre?"

   Probes: ? did you come across any ads about CSIRO Education in journals or teaching publications?
   ? do you think many teachers are aware of CSIRO's educational offerings?
   ? what steps would be useful in taking to get the word out about CSIRO?

   "Please describe the CSIRO science education program(s) that you have attended."

   Probes: ? which CSIRO program(s) did you participate in?

? what are the major reasons you chose to participate in the programs offered by CSIRO Education, Victoria?

? confirm the years booked, and **if they have not participated in 1999, 2000 or 2001, mention**: "according to CSIRO's records, your school has not participated in recent programs, what were the main reasons for discontinued participation?"

"What are your impressions of CSIRO science education program(s) that you have attended?"

Probes: ? ask for comments on the content of the program(s) adequate

? ask for comments on the presentation of the information

? how were the programs received by the students?

"On a scale from 0-100 (one being the coldest and 100 the hottest) what number would you pick to describe your overall satisfaction with your CSIRO experience?"

Probes: ? push for explanation of number chosen if greater or less than 70

? what factors come to mind that influenced your rating?

"After your previous experience(s) with CSIRO Education for what reasons would you be more or less likely to participate again?

"Finally, given your experiences, describe to me the key factors that you would address if you were to aid in the improvement of CSIRO science education programs."

Interview Questions and Protocol
(Non-Participant schools)

OBJECTIVES

5. To obtain information about attractiveness of other programs
6. To obtain teacher impressions of CSIRO education programs (if applicable)
7. To obtain information as to lack of participation in CSIRO programs
8. To obtain suggestions of how to improve extension science education programs (CSIRO in particular, if applicable)

STRUCTURE

4. Individual interview directed as a conversation with a purpose, remember SXT
5. Funnel shaped design format using domain questions followed up with probes
6. Interviewer role: Unsophisticated sympathetic

SCHEDULE

6. **Greeting:** Thank you for scheduling an interview with us. My name is… we are from… we are conducting this study for CSIRO Education.
   Request: Grade level(s) taught, subject(s) taught, years as a full-time teacher.
7. **Statement of purpose:** To gain information about how to better serve teachers and students in extension science education programs
8. **Offer confidentiality:** Your responses will help us give CSIRO Education recommendations for improvement, but your name will not be associated with the information offered.
9. **Opening Statement:**

   "Throughout my research and time in Victoria thus far I've found various descriptions that aim to describe the breakdown of the Victorian school system. Could you describe the general structure of the school system present in Victoria?"

   Probes: ? are there differences between the government, Catholic, independent schools?
   ? confirm which type of school the educator teaches for

10. **Questioning:**

    "Have your students ever participated in any extension science education programs?"

    (IF NO SKIP TO 2nd TO LAST QUESTION)

    Probes: ? given by what organisation?
    ? please describe these programs and your experiences with the organisation
    ? was the content and quality of the program(s) adequate?
    ? how were the programs received by the students?

"On a scale from 1-5 (one being the lowest and 5 the highest) what number would you pick to describe your overall satisfaction with your experiences?"

Probes: ? push for explanation of number chosen if greater or less than 3
? what factors come to mind that influenced your rating?

"Are you aware of the science education programs offered by CSIRO Education, Victoria?

Probes: ? did you come across any ads about CSIRO Education in journals or teaching publications?
? do you think many teachers are aware of CSIRO's educational offerings?
? what steps would be useful in taking to get the word out about CSIRO?

"What are the primary reasons that you do not participate in any of the programs offered by CSIRO?"

Probes: ? get as much info as possible

"Finally, given your experiences, describe to me the key factors that you would address if you were to aid in the development of science education programs."

Thank you so much for your time.

Do you have any suggested referrals of people who may have good ideas or opinions about science education programs?

INTERVIEW #1 PG+

I: Interviewer
R: Respondent
DATE: 3-20-2001
TIME: 9:00

Brief Introduction

I: Through my research in Victoria we've learned about the different types of school, independent, government and Catholic and I was wondering, have you found that there are differences between the schools?
R: In what respect?
I: We thought it would definitely make a difference in whether or not you could book CSIRO, if a school couldn't afford some of the programs.
R: Realistically, I find it quite easy to book the CSIRO. I would like them to do more work going out to some of the schools, because I think it's a big organisation, that benevolent sort of factor that are very important and we don't have a lot of that now, just to inspire children about science. However we find that the children here willingly pay, we subsidise many things, but they willingly pay whatever they need to for specific sessions in school, and we haven't found the CSIRO sessions too expensive. So once you break it up between the whole class, it might be 3,4,5 dollars, but for the quality of the experience, we don't consider that to be too much. But, we can't have them all the time, but one or two quality experiences backed up by good teaching is often enough. Of course if you have lots and lots of money, you could have more, but I am not sure necessarily whether that would really improve the outcomes.
I: You feel like it has just enhanced your education system.
R: Exactly, you've got to have a very firm basis upon which the children can base these experiences or use these experiences as an introductory springboard for the sorts of things you're going to be doing. We tend at this school to have, like many schools, units of work organised in with our KLA (Key Learning Area) host. This term its Studies of Society and the Environment (SOSE), next term it's science, the following term is technology, and the last term is health and phys. ed. Even though we integrate our units of work into other KLA's the host KLA's are where the most emphasis is given. So next term we will be looking to have other organisations, like the CSIRO, we'll be having specific activities that encourage children to learn science-based outcomes in May.
I: How did you first hear of CSIRO's offerings.
R: Through flyers sent to the school, I am the science coordinator at the school and I read all of those pretty thoroughly.
I: Do you remember what journal it was?
R: It was actually a little pamphlet about their activities and then we rang them up and that's how we got interested. And also at the time Eleanor Gregory was in charge and she was fantastic, she was just so tuned into what teachers need, and so resourceful and so at ease with the science curriculum. She actually inspired the staff, we asked her to come out to the school for a PD day for science. She's now working with DEET, but she was fantastic. So I think people inspire you as well as the programs, I mean it's one thing to say this program is fantastic, but if in the delivery, if you don't feel like this person has a good grasp of the needs of primary children, primary

teachers and the science curriculum in general, you don't want to have them back, because they're wasting your time. I mean you don't have time to waste on non-learning activities, I'll be picked up on that, because every activity is a learning activity, but you want them to be extended and inspired and challenged.
I: So do you think that many teachers are aware of CSIRO and their offerings?
R: I know in our school they are and I can't imagine why people aren't aware of that, because they do do a fairly good coverage in terms of advertising what they have to offer. As I said, often you have to be more proactive, teachers are scroungers, they try to get as much as they can from as little as they can because that is the way education has always been in state-run schools and if they, for instance, were offering a session of PD, I think the best advertisements are the personnel who work for them who can come out and talk to staff, even at lunchtime, for fifteen minutes, or offer to take a session with children as a trial session, as a demonstration session of what they've got to offer, there is no teacher that wouldn't take that up. It could be a half an hour. It's time-intensive I know, but I think those types of things are the best advertisements because we've have people here in the past, who we've put a big asterisk next to their names because we know they are the absolute first spot to go to next time we're doing something like that, because their so fantastic and we develop that ongoing relationship with the company, which is what you want because they get to know the school, the children's needs, your needs. You want those sorts of ongoing relationships and then you feel like you have a real partnership with the community. CSIRO is a big organisation.
I: Yes, we have found that they are pretty well known. Can you describe the CSIRO science education programs that you have been involved in?
R: We've been involved in the CREST programs, we've also been involved in one of the activities where they come out here. I know that we booked some of their sessions, actual demonstrations that are hands-on, where the children are manipulating things. That is a great advantage because many schools now haven't got the money, or the time or personnel to organise equipment. You can buy it, you can always find enough money to buy it somehow, but keeping it in good condition and making sure that it is all returned, that is also time-intensive, but it's very difficult for schools to have enough equipment for a whole grade to do activities on, so that's where it is a great advantage to have organisations like CSIRO who can actually come out and bring everything you need, it's all set up, it's used all the time, there's someone in charge of it, they know it's all there, they can change things for the students, and they know it's safe, they know the safety regulations, it gives teachers a great amount of confidence to know that all of that is done. CSIRO has a great reputation so you can have great confidence in the fact that what their doing is safe, well-organised, and going to inspire the children.
I: So did you find that these equipment needs were the main things that inspired you to book the program with CSIRO or was it just needing to cover a certain subject area?
R: It was mainly because we wanted to have someone whose got confidence in an area to teach the children, because many teachers are fabulous with environmental sciences, but with physical and chemical sciences, in particular, teachers are not quite so confident. So to book those types of sessions. It is great for people to come in with their samples and all their equipment, kids like fiddling, they love hands-on stuff, we all know we learn by interacting and touching things, so even earth sciences is another area. With animals and environmental sciences most people can cover that quite adequately. So that is where the CSIRO is fantastic. And also, the CREST

programs, that we are members of, but didn't do it last year, because we enrolled in it but we have a very busy year, and I wanted to do it properly, so this year, in the beginning of the science term we are actually going to, I am going to start teachers off on using the CREST awards and doing incidental work with children, one of the sessions where children are exploring an aspect of science and giving them awards and making that part of our assembly day. I wanted it to be done properly, rather than to start it and have it dribble out to nothing, I wanted everyone to embrace it fully and understand what it's about and to feel as if they are supportive. I, as a curriculum coordinator, also have to be ready to give a whole lot of my time going in and helping teachers and providing resources for them. I know in the past Eleanor and CSIRO have been very happy to send consultants out, I think that it was only Eleanor, to support that kind of thing happening in schools, but it is different for one person to get out to all the schools to cover that sort of need, so that's probably an area that if they want schools to take up more of a science focus, to embrace some these programs, they maybe need to have a little more of that support.
I: And that would be curriculum support?
R: Yes, or suggesting resources, or there could be a webpage, I don't think they've got one, with support resources and a list of activities, there is always more you can do.
I: They do have a website that describes the program offerings but something that goes into that depth.
R: Personally, Eleanor was very open in helping the staff. She was always flatout, but I never ever rang her and not had her return my call. Even if she wasn't working, since she was part-time, you could hear the kids in the background. That sort of response you really appreciate because teachers are busy as well. It is because you have demands with the children and meetings, when you want to make a phone call, you want it to hit, not just ring and ring and ring. Representatives of CSIRO should be reliable, and I have found them to be that way.
I: As far as your actual impressions of the program, have you been satisfied with program content and presentation?
R: Yes, very very good, and easy to understand. The children's engagement is up to the staff at the school. We can be inspired by CSIRO and the materials they provide, if the teachers are approaching things with enthusiasm, the children will take it up with enthusiasm. It is often that teachers that are hesitant, as I said, in those areas of science that they aren't comfortable with for a number of reasons, from a lack of knowledge, experience or materials, but it is not because CSIRO haven't presented them in a very clear way.
I: So if you were to rate your experience on a scale from 0-100, what would you say your satisfaction level would be?
R: From my past experiences I would say 95% because I have been very pleased with what they have to offer. It's just been perfect.
I: So you would be likely to book them again.
R: Oh yes, we will be, as soon as we get an idea of what people are doing in sciences, of course it depends on the units of work that they are doing.
I: Is there anything else you can think of that you would like to suggest that CSIRO do to improve their offerings?
R: Well I was thinking that sometimes it might be really useful for them to have either resources that teachers could borrow, like the unit boxes that we have in our science room that teachers can borrow for their classroom, and then they have materials for their session. If they are developing these programs say especially the CREST

awards, it might be really useful for them to support teachers and schools that are feeling less capable by having a number unit boxes that teachers can actually go and borrow for at least 2-3 weeks, so the teachers can use the material for whatever unit of work they're doing. They might like to extend that and have extension activities, on the website, how you might extend and develop ideas developed on doing this green or orange card (CREST). They have already got that a little bit on the cards, don't get me wrong, but here it would be more fully explained and maybe even with resources you might use or relevant multimedia, computer programs, up-to-date resources such as film, video, tv programs. All of those things save teachers a lot of time, and if they can tap into them, they will use them. It's all about time efficiency, being able to get the maximum results from the minimum amount of time. People will go and pick up unit boxes, we tended to do that a lot more in the past, now we expect schools to be more self-contained, we've forgotten that not every school has to own everything, we can borrow, but sometimes it's so difficult, so it would be great if CSIRO could do that more, or maybe the organisation could foster more links between primary and secondary schools. That is what I would like to see, more resources. I know a lot of the top of my head because I work in science and I read all the materials, flyers that come in, et cetera, but there are still lots of things that I don't know, and I often think, I know there is something else that would've been fantastic here and I haven't used it. I'm using things I know not things that have just come out. It's people like the CSIRO and the organisations at the cutting edge there, and just for kids to see a real scientist or people working in the field is inspirational, it is for anyone. And having them talk about the things that they do in their everyday life, I'm always trying to get people to come in and talk about these things. We've got a lot of very talented children at this school, but I don't feel that they are extended at all, especially in the area of science, because of the reticence of teachers to take on a lot of the experimentation and exploration with the children because of all those reasons I mentioned.

I: Do you want those kits to be very specific or just covering the general topic and giving directions that you could go if you wanted to.

R: I think it's pretty obvious that if you look at some of those units, that they need certain materials to do it properly and it would be very good just for the kits to have those materials so that the teacher could just get the kit and know that with this card and this kit, that's is what you can do, and you can do it really well without having to worry about anything but once again it would be really good to have more extension resources, because I often think we only do what we have to do and that we are teaching to lowest common denominator and I hate that. It is really great for someone who know start that when a child does this unit of work that it is actually a basis for them to understand this and this and this, that is the advantage of CSIRO of looking from the top down, not all primary teachers have that. They don't see that if kids don't understand this area of movement, then they won't understand that aspect of physics in year 10 and 11. And that sort of thing that CSIRO can develop boxes which actually take the kids further.

I: And is that the link you are talking about…

R: Yes, I am talking about those sort of links where if the kids are being engaged in something and sort of just doing little bits and pieces that don't really extend them, and you're actually giving them worthwhile learning experiences (with a kit) and taking them further, deeper in their understanding, but exposing them to more sophisticated level of thinking while your doing it.

I: Thank you for your time.

INTERVIEW #2 PG+

I: Interviewer
R1: Respondent #1
R2: Respondent #2
DATE: 3-21-2001
TIME: 3:00

Brief Introduction

The interview started late (3:30) because R1 was busy with children's activities, when it id begin she seemed a bit flustered. The discussion took place in R1's art classroom. The interview with R1 was not extensive: soon after discussion began I realised that though she had knowledge of the programs, she had not been directly involved. The assistant principal, R2, was in fact a former CSIRO employee and he had coordinated the efforts to bring CSIRO Education to the school.

So, R1 rushed around trying to find R2 before their 4:00 meeting. R2 seemed annoyed with my presence, and it seemed he wanted to challenge my competence. There was also a slight bitterness about him. Nevertheless, he seemed pleased with what CSIRO offered his school, particularly in the CREST program. At one point he mentioned that they had had a representative come out for a program, this he snickered at. R1 remained in the classroom as I spoke with R2. He had a few suggestions. He mentioned that he was the author of *Scientriffic*, which he seemed very proud of, he thought it was wonderful that he suggested easy to use/make equipment for teaching science concepts. Soon the time left before their 4:00 meeting had dissipated and I was ushered out. R2 left me his card reiterated his previous suggestions after the tape recorder had been shut off.

INTERVIEW #3 PG-

I: Interviewer
R: Respondent
DATE: 3-26-2001
TIME: 2:00

Brief Introduction

I: What subjects do you teach?
R: I am the Assistant Principal at the school, I also take up PE. The rest of the time I am administer of duties, which involves curricular design and welfare and professional development for teachers.
I: How long have you been teaching?
R: I have been teaching now for 14 years and this is my second year in this position.
I: Have you ever been involved in any science extension programs?
R: Ah, all sorts of things, here at this school, with Melbourne University being so close, we've had groups of science students come across and they'll be involved in the school for 6 weeks periods and they'll run science activity type programs for the children, lots of hands-on stuff, that ties into our curriculum, and they provide us with some really good content, they are normally, third or fourth year students and they are pretty well trained and they know their stuff, and they run they program for us and we give them the opportunity to use us as guinea pigs. So they get the experience of coming into a primary school and teaching. Being from a university, they've got much better resources, one of the problems with science teaching is resources. There are a lot of materials that teachers have, using kitchen type things, everything from skewers to ice to flour in science, but some of the other more technical things, it's really hard cause primary schools aren't funded for resources for experimental type work.
I: So they brought in different equipment…
R: They rolled up and they had magnets and they did science and they had rockets going off in the playground, so pretty exciting stuff.
I: Was there any particular program that you can remember they did?
R: They actually ran their own program in correlation with the CSF, I've got copies here, they based it on that and we told them the things that we were doing and they plugged it into that. This year we are going there. We've had other excursion organisations that will come to the school on science days, so the truck rolls up and they've got boxes of stuff. Sometimes it's more science tech, a lot of technology, and in teaching it is sometimes very gray, in primary schools the difference between science and technology, but they do a lot of science activites. And again, it's resource rich. We've run excursions to ScienceWorks and to the museum which is now relocated just across the road from us. And then there's programs where I've just looked at the course myself and looked at the outcomes that we are trying to achieve with the children and they'll build a program. But science is one of the areas, like technology, that hasn't been a strength in our education system, it's been pushed aside. The curriculum keeps growing in literacy and science is pushed aside. Now a lot of countries we're real concerned about that.
I: Is this specific to primary schools?
R: And secondary too, and for the first time ever we've got a course of studies that runs from prep, our first year, right up to VCE, which is the end of our secondary

college. Now there is a science course that takes you right from the first day in primary school right to when you've finished when you are 18 years old. We've never had this before and it's all laid out in these documents. It's not totally prescriptive when you look at it, it gives you outcomes as a framework and then you devise your course around that and there is evidence for each outcome that you are hoping the children will demonstrate.
I: So it dictates the end result and doesn't really matriculate the lesson?
R: No, the teacher has free run because we are moving from a system where it was designed was totally based at the school. And I think it's the trend that's gone around the world I gather, we're moving towards a more centrally based curriculum… which in my mind is better, it allows for a lot more accountability, and also children move state to state so their transient population and they are continuing the same program.
I: Have you ever heard of the science programs offered by CSIRO?
R: Yeah. Now I haven't had much to do with them I must admit.
I: What are some of the major reasons why you choose not to participate in some of the programs?
R: Ah, don't know about it, now that could be a problem of ours, sorting out mail that comes in, they advertise well in Education News, we probably need to pick up more on that. But really the biggest thing is time, we're just trying to fit so much in, teachers always have to fit so much in…
I: Are there any publications or newsletters that CSIRO definitely should advertise in to get the word out about the programs.
R: Well they're advertised in the Education News, which is really good, it's a journal that comes out every fortnight and they do advertise in there, in the Union newspaper would be very good, because a lot of teachers have a really strong union base and certainly in the principal's documents, they've got a Principals' Association, those interested in curricular design would certainly read those materials. Well I have seen their advertisements in Education News. I read that all the time and the advertisement doesn't stand out so they might to have more of a catchy title. The publication itself has been rather bland since it's produced rather cheaply, but that is also changing as the whole system's changing and becoming more corporate-oriented.
I: If you were brought in to help design a science education program by CSIRO. What factors would you tell them to address, whether it would be cost of booking, ease of booking or accessibility to students… what would be the biggest factors?
R: A school like ours, it would be great if someone could come here because of the buses is very high, it costs us a lot to bus kids everywhere, we actually don't have school buses like they do in America sometimes, so a big cost for us is transport. At the same time, at least once a term we have an excursion, so going to somewhere like the CSIRO would be good. The main thing is that the program fits in to what the course content is, so if they're actually aware, and I am sure they would be, of the departmental documents, and they advertised courses that fit into that, then teachers look at it and say, I'm going to plug it in there cause it will complement what I've got planned. Cost would also be a big thing, now it's costing about 5 dollars (per student) when we go on excursion with the (name of group that I cannot discern) environmental group and they run activities too, and kids go to some of the cultural exhibitions, so that's 5 dollars to have a teacher talk to you about a subject, they have to keep the cost down, by the time you get a bus… The fact that CSIRO is central to Melbourne is a good thing, that's pretty easy to get to.

I: In past programs, if you were given a scale 0-100, 0 would be the coldest and 100 would be the hottest temperature, where would you place yourself on that scale based on your satisfaction with the past programs you've participated in (not with CSIRO)?
R: Oh, about 90, I have been really impressed, especially with Melbourne University, what they've done for us, and the people that come in, we've had some good quality programs, really hands-on that's the best thing, really practical work, they bring in material for kids to use, which we can't have access to.
I: Is there anyone we could contact over there if we wanted more information about their programs (at Melbourne University)?
R: There's a man named Roger that coordinates it, I will go get his name and number.
I: Ok, then we're all done, thank you for your time.

INTERVIEW #4 PC+

I: Interviewer
R: Respondent
DATE: 3-22-2001
TIME: 9:00

Brief Introduction

I: What grade levels do you teach?
R: I've taught all grade levels, nearly. This year I'm teaching P-1. I've been a reading specialist (without a classroom) for the past 4 years. I've been in the role of curriculum coordinator, so I am responsible for organising professional development for teachers. Also, I am to be an instigator in curriculum and policy development, new teaching methodologies and keeping abreast on what's happening in education. I'm still doing all that, even though I still have a class.

I've also taught year 5, year 3, and year 2.

I: What subjects do you teach?
R: When you're a primary school teacher, you teach all subjects. Depending on the school, like if you have a large school, they might be able to put some funding into a specialist music teacher, P.E. teacher, science teacher, or art teacher. But, from my experience in Australian primary schools, it's highly unlikely to be a specialist science teacher. Being a very small school, we don't always have a specialist. Sometimes we do, sometimes we don't, depending on what we see as our focus for that year. We've never had a science specialist, so that's always been the job of classroom teachers to teach science and technology.
I: How long have you been teaching?
R: Since 1982
I: So this is a Catholic school?
R: Yes, this is a Catholic primary school. Catholic schools in Australia are funded… I don't know the breakup, but there's a lot of Federal and State funding in the schools. The state pays for the teachers' wages, I think and the buildings and the resources are provided by fees and grants.

We have a lot of English as a second language students. This school has historically provided for foreign newcomers, but a lot of the people who have been at the school for a long time have been first arrivals into the country. Because Collingwood has a lot of high-rise flats, public housing, when people have come, particularly as refugees, they live in the high-rise flats in Collingwood and around the inner city – Carlton, Kensington, North Melbourne, Flemington, even South Yarra. They may move – they get established, get jobs, and move on. We've always had people coming and going constantly at this school.

… [Collingwood has a reputation as a tough, ethnic neighborhood, but she likes working there] …

I: What are the different types of schools?
R: We've got three systemI: we've got the independent schools, which some Catholic schools are, and they're usually the more wealthy schools. Then you have the other schoolI: private schools. Then there's the state education system, which is all the state primary schools in Victoria and the secondary colleges. And then there's the systemic Catholic schools which are all run by the Catholic Education Office (CEO) and all the funding is sent from the CEO to here.

All the teachers are on the same wage level. The money kind of gets siphoned a bit because some schools have got really big populations and their fees are higher and some of that money gets siphoned off them and sent to us. [laugh]
I: So each school kind of looks after each other?
R: Yeah. That's the theory. Also, in the government has an Education Maintenance Allowance (EMA). Anyone who's on a lower income – they get two payments a year at around about $70 a child. That helps to cover the costs of school fees, uniforms, or whatever. That's to everyone in all schools.
I: How did you first hear about CSIRO programs?
R: Well, I'd say mailouts. I go through the mail and file stuff. When we are looking at our science, we go through the files for professional development. I think CSIRO offered the 'Science from Junk' program. So, we had someone come out and we had an in-service on that and then everyone went and did that sort of thing with their studentI: fit it into their topic. Then, say, the next term, because we've got a renewed enthusiasm and given some thought to science and its role, we would then have sat down and developed a policy statement on why we believe science is important. So you do professional development and put it into action in the classroom and at the end of that unit, put it into a policy statement.
I: What were the reasons you brought the program in?
R: It was an enrichment tool. To enrich how we can teach science. In primary school, you don't have scientific equipment. It's not about microscopes and thingI: it's just impossible. Basically, we've got to teach them the basics. There's an unlimited amount of knowledge in the world and at the primary school level, you're not about teaching them just information, because what is knowledge now, may not be true when these children are adults. We are about teaching skills and processes and making them wonder and want to learn more and making connections between all the different KLA's. In my classroom, we are doing 'stories: old and new.' It's kind of a social…throwing in a bit of history like what life was like a long time ago and then that connects to mathematicI: 'there's a cone on top of that castle.' So you try and teach children that everything is interconnected.
I: Does cost play a large factor?
R: Cost plays a really big factor. You get a limited amount of money to spend. Depending on what your focus is for that year, that's what you might spend the bulk of your money on. So when it was science… we didn't actually spend a lot on science, because I think CSIRO also taught us that, at a primary school level, you don't need to have a lot of that kind of equipment. Mostly, the science is about the junk. Chemistry is about detergent, changing substanceI: that kind of thing. That's why that particular class did appeal to us.
I: Is there anything that stood out in that program?
R: It was really good fun. It didn't just offer practical activities that you can do with kids. It also allowed for your own science understanding and knowledge base and understanding to grow as an adult. Sometimes I think I find that very frustrating when professional development is always just about you do this activity with your students. I think that there has got to be something in it for my own growth and understanding.

I've never been a science person, except for some biology in an environmental kind of sense. It's always really good to get a better understanding of physics and chemistry in a way that its not incredibly technical – just a good, solid understanding which you can then impart to students, but it helps you think of other ways and other activities to do yourself. If you don't understand what's going on, then you'll

probably just do that one activity that you saw. I think that's what was good about the CSIRO program – it helped to develop your understanding.
I: How would you rank your satisfaction on a scale of 0-100?
R: I suppose about a 75. That's probably being conservative.
I: Can you think of anything that could have been improved?
R: I think it was really good. They left sample follow up stuff and because I haven't had a class of my own, I haven't tried any of the programs where they come into class. Now that I have a class, I'd like to try it. We call that sort of program an incursion and with the costs of transport these days, that'd be the way to go.
I: What would be the factors that would shape your decision to have your class participate in a program?
R: It would depend on the topic we were doing. There's four terms in a year and in each term we pick a broad topic for the entire term and you try to integrate everything into it. Everything you do in the classroom, you try and make it relate to that topic. With this being an English as a second language school, sticking to one topic helps overcome a language barrier to individual topics. So, you pick three main learning areas each term, with one as the focus KLA. You then make sure to teach the processes of those three KLA's, but the focus is on the major focus topic. The focus topic cannot be repeated on the same studentI: even from year to year.
I: If CSIRO asked you to help design a program, what would you make sure gets included?
R: They should cater to the different levels. Cater to teacher professional development, as well as teaching methodology. They should consider three levels in primary schools, and break topics up into lower primary, middle primary, and upper primary.

They should make sure to address the sciences that are generally hard to address in primary school, like the physics and the chemistry. Primary school teachers are quite good at doing the earth sciences and the biology stuff on our own. The others are usually a bit trickier for primary school teachers to cover.
I: Thank you again for your time.

INTERVIEW #5 PI-

R: Respondent
DATE: 4-5-2001
TIME: 10:15

Phone Interview
(Non-Participant school)

SCHEDULE

1. **Greeting:** Thank you for scheduling an interview with us. My name is… we are from… we are conducting this study for CSIRO Education.
2. **Statement of purpose:** To gain information about how to better serve teachers and students in extension science education programs
3. **Offer confidentiality:** Your responses will help us give CSIRO Education recommendations for improvement, but your name will not be associated with the information offered.
   Request: Grade level(s) taught: 4-6
   Subject(s) taught: Primary Teacher (wide variety of subjects)
   Years as a full-time teacher: 18 years

4. **Opening Statement:**

   "Throughout my research and time in Victoria thus far I've found various descriptions that aim to describe the breakdown of the Victorian school system. Could you describe the general structure of the school system present in Victoria?"

   Probes: ? are there differences between the government, Catholic, independent schools?

   R: Not as constrained by curriculum, and not as much funding as government schools. Strong philosophical background because we are a Christian school and people appreciate that.

   ? confirm which type of school the educator teaches for
   R: Independent

5. **Questioning:**

   "Have your students ever participated in any extension science education programs?"

   R: No, looking to book Lab on Legs from CSIRO.

(IF NO SKIP TO 2nd TO LAST QUESTION)

Probes: ? given by what organisation?

? please describe these programs and your experiences with the organisation

? was the content and quality of the program(s) adequate?

? how were the programs received by the students?

"Are you aware of the science education programs offered by CSIRO Education, Victoria?"

R: Yes

Probes: ? did you come across any ads about CSIRO Education in journals or teaching publications?

? do you think many teachers are aware of CSIRO's educational offerings?

? what steps would be useful in taking to get the word out about CSIRO?

"What are the primary reasons that you do not participate in any of the programs offered by CSIRO?"

R: School size is very small. CSIRO not able to come out to present to a little school. Costs to parents is too large, but well priced programs for the most part. I can see how some of the programs would cost more just by the nature of the topic.

Probes: ? get as much info as possible

"Finally, given your experiences, describe to me the key factors that you would address if you were to aid in the development of science education programs."

R: Available for country areas
Hands-on work
Smaller Programs that could travel further into the country

Also, organising a group of smaller schools together so that CSIRO will come out to the country and will have enough kids to run programs. I am pleased with what I know of CSIRO programs so far.

Thank you so much for your time.

INTERVIEW #6 PG+

I: Interviewer
R: Respondent
DATE: 3-16-2001
TIME: 1:30

Brief Introduction

I: In our research in Victoria, we have learned that there are three types of schools, government, Catholic, and independent. This is a government school, correct?
R: This is a government school, it's actually classified as disadvantaged.
I: Do you think there are differences between the types of schools?
R: Oh, absolutely, especially in a school like this. Government schools have funding… private schools get so much more, so much better facilities.
I: So how did you first become interested in CSIRO's science education programs?
R: Well, we had to teach energy as a unit, and we thought, eeek, especially one part is making a model of a circuit and we thought, oh what are we going to do? It's going to be really hard, so we looked up CSIRO and we saw the Energy program and we thought, Yes! Thank you!
I: So you hadn't used them before.
R: No, we just heard about it in the staff room. This is my first year at this school, so I'm the one that started it.
I: Had they hear about CSIRO through word of mouth.
R: You must have sent a mailout, but no one's ever looked at it, so when I became Science Coordinator. I had dealed with the CSIRO when I was in private school and the Double Helix Club years and years ago, so I always loved the CSIRO; my brother is studying science at Melbourne Uni too, so it's always been a part. So I knew that this was going to be good.
I: So you were involved in the Electricity and Magnetism and the Light and Sound programs today, what were your impressions of the programs?
R: The kids loved it, they were enthralled, I've never seen them so in tune.
I: Did you worry about the content of the program agreeing with any of the curriculum requirements?
R: Well, Light and Sound we didn't really have to cover, but I thought we might as well get them to do that stuff that's fun. But the Energy one, it covered most of the science and technology CSF outcomes perfectly. We had to do the circuits, they've done a variety of them, and hands-on experience, which was great, and we'll do follow up on the experiments.
I: And as far as the presentation goes, you were satisfied?
R: Oh the presenter was fantastic; he had the kids in the palm of his hand.
I: SO if you had to rate your experience from 0-100, what would you give for a satisfaction rating?
R: Oh, 95 plus, we loved it, the whole staff room is buzzing. We've been doing the lead up work to this, defining energy, but it's all pretty dry, as much as you want to make it fun in class you can't without the hands-on experience. Especially these kids, they do it and they remember it. After the first session, we had a quiz session, and they knew everything. 90% of them were able to answer all the questions we used to see how much they'd learned.

I: Since CSIRO has asked us to give recommendations to improve their offerings, is there anything you would suggest?
R: Um, do more aspects of science, we'll have you in every term!!! Fantastic! Do everything on the CSF. You do half the teacher's job by covering the CSF, so we can sit back and enjoy someone else teaching what they specialise in, which is much easier since primary is pretty general.
I: Thank you so much for your time, please call us if you have any suggestions!

INTERVIEW #7 PC+

I: Interviewer
R: Respondent
DATE: 3-23-2001
TIME: 2:15

I: How did you first become aware of the science education programs at CSIRO?
R: Ah, I think it was just in a pamphlet that was sent to the school and if other teachers have used it, they might recommend it.
I: Do you think that most teachers are aware of the offerings?
R: I think most teachers are.
I: We were just trying to determine what might be the best way to reach people.
R: Well I suppose it depends, I mean a lot of information comes, I suppose it depends on the person the information gets given to, whether they then send it out to the people at the schools. We have people in charge of each area. If someone is in charge of science and technology, they will then say to us, well there is a big program coming up, so I suppose it depends on the communication in each school.
I: Now you said that you haven't been in the classroom for awhile, does that mean that you no longer teach science, or that you are the coordinator?
R: I am in charge of literacy.
I: But in the past you have observed session.
I: Can you describe for me the CSIRO sessions that you were involved with?
R: I think that we were involved in a program about weather and wind and those sorts of things.
I: And what were your impressions of the program?
R: Ah, I thought it was really good, it was usually on the children's level and it was all very hands-on and well-prepared and was really at a level the children could understand.
I: So the program content was very relevant.
R: Yes.
I: What about the presentation?
R: The person was very good and they presented it and talked at the children's level of understanding.
I: So you saw them excited about the information and engaged.
R: Yes they were very engaged.
I: So if you were to rate your satisfaction level with the CSIRO offerings, from 0-100, what would you number would you choose.
R: Oh, 95… they are always very visual and that's important for this age.
I: Would you say there is anything that could be done to improve the offerings?
R: I suppose that gets people off is the cost.
I: Is it considered a high price?
R: Sometimes budgets do get tight and I don't really know what the cost of it is now.
I: And transportation isn't an issue?
R: CSIRO came out here, which was best for us, because the cost of buses is quite expensive, especially seeing as we're so far out. Um, I don't know if there is any follow up material, but that would be helpful.
I: DO you think there are any topics that are not addressed in the programs, that you think should be addressed for the different grade levels.

R: I can't remember what the topics were, I guess it depends on the school's cycle of doing things, whether they are related to the CSF I suppose, since that is what we use in the schools… in science that has just changed, so maybe you need to look at what is the content of the CSF for Victorian schools, and see if they're correlating.
I: So do you think that it would be likely that you would book CSIRO again?
R: Oh, I think so.
I: Ok, thank you for your time.

INTERVIEW #8 PG-

I: Interviewer
R: Respondent
DATE: 3-27-2001
TIME: 3:45

Brief Introduction

(Tape recorder started late)
R's students are involved in a statewide talent search (grades 5 & 6) in which student projects compete.
She runs a science competition in the school and got 250 entries last year. Prizes are given to winners and participants.
Science is given a high priority in the school.
She has also applied to have the school become a participant in NASA's STARS program to do experiments and communicate with astronauts.

She promotes students to partake in 'passion projects.' In particular, students are involved in cross-age tutoring, their own projects, class science competitions, science talent search

R said that CSIRO programs were good, based on feedback from teachers. She was impressed with the teacher in-service programs.

She believes that teachers could use in-service topics, however science and technology are not a priority this year.

The staff enthusiastic for in-service – good because staff lacked "background and confidence"

Each year programs refined each year – Ford assembly line program for kids.

Programs should be "keyed in to the CSF" and should be hands-on and should have good presenters.

INTERVIEW #9 PG+

I: Interviewer
R: Respondent
DATE: 3-20-2001
TIME: 9:00

Brief Introduction

R: Ah years 5 and 6.
I: now is that a specialised area of science or is that like…
R: No, No, almost all the teachers here, and largely in Australian primary schools, and my roll is assistant principal and I share a class, as well as I guess I am in charge of a year 5-6 area.
I: What sorts of science excursion or incursion programs does your school participate in?
R: Ah, in science, largely, if, I suppose the most popular excursion in ScienceWorks, and the Science Museum, because it's about 4-5km from here. I would imagine every second year I would say, every child in the area would go to Lindenburg Beach. Incursions in the past as well, we've used CSIRO people and a couple other groups as well, but largely, ah the way that our units of work or the way that ours curriculum is structured here is that, we have integrated units of work that are given a particular base if you'd like, so you might have a health based unit, a science based unit, or a technology based unit. So when we do these science-based units, then we look at every possible ways do excursions.
I: What specific programs have you done?
R: Ah, there's the one, I forget the name of it now but they… as long as the scientists come out, scientists come out and work with the kids, they come with experience and whatever. Where as ScienceWorks they generally visit for sorts of exhibitions. I remember one time we took the kids there they had a sports exhibition and ah, also one on all the technology that used when making a film.
I: What were your impressions of the programs?
R: Ah the ScienceWorks stuff is good, they have some good exhibitions, and the incursion are excellent, but the only problem with that is that they tend to be a bit of a service. You know they tend to be one of those things that are hard to follow up, and I think the kids tend to come away thinking… you know not of them as negative experiences, but I think… they can often reinforce that science is a bit of a circus or like magic. But in terms of cost, and accessibility, you got of have all of those people out, and coming through, but what would be a better program is if you had them come in for a 3 or 4 week period and work on something that they seen. But having them all at once on the one day, doing experiments and demonstrations, even though they do it very well, it involves the kids, and the kids are doing stuff, it much better when they can do stuff like testing themselves, it still ends up being like magical and you wonder if that's what you wanted to get out of it.
I: According to the record we saw, CSIRO came in 94"…
R: Yeah that's right, the last one, yeah that could be, I forget the name, but there is a group that comes.
I: Do you remember the name of the CSIRO one?
R: Oh, no, it was for year four, but there's some stuff I can remember, Flat Jackets or Tricks.

I: Are the programs generally used to fill a curricular requirement?
R: Yeah, yeah, they definitely are, we would never have someone come out to the school just done something, because it will be bit of a fun afternoon. We have a fairly highly geared, fairly structured curriculum; we got a two-year rotating system. For example if you were to start something like next term with the 5,6,7,8's and were studying Australian History, you wouldn't have the science guys come in, have those people come in at all. The following terms we try to make sure their doing some chemistry or some physics, but you would never do it out of…
I: In picking a certain excursion or incursion program, what factors do you consider?
R: Well, if it fits into the outcomes we're trying to get with the kids, and that just not the science excursion, actually next term the years 5 and 6 will be at camp doing some recreation stuff of the Australian gold rush in the 1860's, and so we're looking at specific excursion would be high applicable to what we're doing. If you look at other programs that we do, the outcomes that we wanted to achieve with the kids would be met by the excursions, they're not always exactly the same, and that because you can't expect them to pay, the parents to pay for excursions.
I: Are there any logistical issues, time…
R: Ah, time, was a problem, if it's not close by, because buses are very expensive, and we are in Williams Town, it great for a lot of things, but anything across the city is hard for us. Well that factors into time to, I mean if you have to get 2 classes on a bus it gets expensive for transport, unless you've got 5 or 6 year kids it's tricky. So excursions are good, but incursions are, can be a bit better. The kids get everything in the one day, it would be great to spread that out over a period of time, but weather that would get a little expensive over time I don't know. But I guess, ideally if I were to promote those things, and I were to get the cooperation of the schools in the area, you might have say a scientist or extension education person working in our school for every Monday for say a month, and then Tuesday afternoon somewhere close-by, if you could manage it like that. That would be a great system if they could vist every Monday, and do such an such, because then the kids can follow up in a sort of complete way, and it will drop that sort of gimmicky thought.
I: Of the incursions and excursions you've been to recently, how satisfied on a scale from 1-100 would you say you were with the programs?
R: well largely their good, because we try to, well this isn't just science but anything as well, if you got specific outcomes that you want to achieve and are fairly thorough in choosing what you want to achieve, your incursion and excursion they are good, because they largely achieve what you want. I guess I'd say a 90 really. Almost everything we've done for the past 4 or 5 years have been pretty good because we've been fairly specific in what we wanted to achieve, and I guess over a period of time we got better in choosing certain ones, and the bad one dropped off, so yeah. A guy came in off the street to teach golf, some sort of instruction, but had he turned up in the middle of winter during the Australian History thing we would have probably said no, and I don't think the kids would have got much out of it. I think the incursions and excursions are specific that would be good.
I: If CSIRO came in and asked you to help them design a program…
R: Oh yeah that would be good, yeah that would be fine.
I: So what advice would you give them?
R: yeah so what I said before, a high degree of flexibility, we have the CSF, which is a blueprint, so you'd need to do that. Certainly they need to make sure that what they are offering are consistent wit our outcomes. I guess also incursion in science are a

little better when you have staff that are good with the kids, and can work with the teachers, so…
I: Well thanks, I guess I don't have any more questions.

INTERVIEW #10 PI+

I: Interviewer
R: Respondent
DATE: 3-10-2001
TIME: 4:00

Brief Introduction

(Interviewed shortly after program)
I: What grade level(s) do you teach?
R: Grades 3 and 4
I: What subject(s) do you teach?
R: General Science
I: How did you first become of CSIRO programs?
R: Through word of mouth (wife).
I: So you were involved in the Air and Weather program today. What are the major reasons that you booked a CSIRO program?
R: The program was booked as an enrichment tool to finish a part of the class curriculum.
I: Is there anything that could be done to improve the program that you participated in?
R: It was good, but in the start of the program, less talking and introduction should be done. The kids were not engaged at that point. You could maybe add another experiment during that time period. The presentation should be a little more hands-on as to involve more the class.
I: What factors were involved in choosing this program, was cost a factor?
R: Cost was not a factor for him. In fact he thought it was very cheap.
I: Thank you for your time.

INTERVIEW #11 PG+

I: Interviewer
R: Respondent
DATE: 3-21-2001
TIME: 3:45

Brief Introduction

(Tape recorder was not available)
The school has 237 students and brought in CSIRO as a part of a school-wide science day. [From R's later descriptions, it sounded as though the program was Light & Sound, but she wasn't sure. She mentioned also that Years 5 & 6 attended the Lego Robotics program].

R teaches Primary and Year 1's and is science and technology coordinator for the school because she has interest in science, not because she has superior knowledge in science. The coordinator's job is to find equipment (and activities) for science learning in the school.

On the different types of schools in Victoria:
There are the private, moneyed schools and the public ones. This school is a government one. The state schools and some Catholic schools don't have a lot of money to spare, while most independent schools that accept tuition payments have nice facilities and can afford extra activities.

How did she become aware of CSIRO?
She heard of CSIRO primarily through mailouts. She had recently received a large package of CSIRO materials, including information about an Internet service providing science activities each month. In addition to the mailouts, she noted that the quality of the previous program was the primary reason she had called them back for another session. Word of mouth, she noted, is a good means of spreading news about program offerings. She noted also that she had seen advertisements in Education News.

What programs was she involved with?
She couldn't recall the names or tremendous detail about the content. She remembered, however, that there were a number of hands-on activities at a variety of stations during the session. The instructor had a blurb at the beginning and then let the students have at it.

Why did you turn to CSIRO for these programs, impressions?
They have very good organisation. Ava was very organised. She was very accessible, and very helpful in booking programs. She kept R up-to-date on developments in bookings and made the process very smooth. The content of the programs was directly on point. The instructors worked very well with the children and fit right in to the situation. The CSIRO programs made equipment available to the schools that would not normally be a feasible option. CSIRO programs were very reasonably priced. Most programs are upwards of $5 per student and the CSIRO programs were only around $3 per student. She thought these prices were very

reasonable. Excursions to the CSIROSEC were not reasonable because of the added cost of hiring a bus. Parents would be required to pay for part of this type of trip and they only are asked to do this a couple of times per year.

Other programs?
Another program frequently used by the school is ScienceWorks [a division of the Victoria Museum]. These programs, she mentioned, were less organised and less applicable to the curriculum being taught.

Score CSIRO programs 0-100:
She would give the CSIRO programs a 90 or 95 because there's always room for improvement.

How could programs be improved?
CSIRO could provide more of a variety of programs. They book CSIRO every two years, but with more of a selection, they could possibly do it every year.

What were the key factors that made you select CSIRO?
Quality from the last time. Cost.

Suggestions?
Scientrific is written at a level too high (in terms of reading level) for the students it is advertised to be aimed at (7-year-olds). It would be more applicable to year 5 and 6 students. CSIRO could publish a periodical actually directed toward younger students.
Double Helix is advertised to be for 10+ year olds. It is written more for late primary or early secondary students. CSIRO could offer programs that operate concurrently with "science week" activities (this week is Biodiversity). CSIRO program offerings should mirror each strand of the CSF. They could offer more programs aimed at younger students that would just introduce them to science concepts (not necessarily explain them). They just need some "gimmicky" science programs like strangely-shaped bubble making wands. They could call it "Gimmicky Science." In addition, CSIRO could provide means for teachers to develop programs. Leaflets that they could laminate that would outline topics or experiments. These would have diagrams explaining steps to conduct an experiment and could be developed for preps, middle, and secondary students.

Key issues in program participation?
The key issues would be cost and ease of use.

Thank you for your time

INTERVIEW #12 SG+

DATE: 4-15-2001
TIME: 3:00

Brief Introduction

Questions regarding CSIRO's extension science education programs

This teacher declined to talk with us after the program because she needed to immediately get on the bus to travel back to school. We gave her a questionnaire like this one to have her hopefully address our key concerns.

Thank you for helping us with this study. We are students from Worcester Polytechnic Institute contracted by CSIRO Education. Our purpose is to gain information about how to better serve teachers and students in CSIRO's science education programs.

Your responses will help us give CSIRO Education recommendations for improvement, but your name will not be associated with the information offered.

What grade level(s) do you teach?
7-12

What subject(s) do you teach?
Maths, Junior Science, Physics (11,12)

How many years have you been a full-time teacher?
21 years

Do you believe that teachers or classes would sometimes benefit from the utilisation of extension science education programs, why or why not?
Yes

How did you first become aware of CSIRO educational offerings?
From LabTalk advertisement

Did you come across any ads about CSIRO Education in journals or teaching publications?
Yes, see above

Do you think that most teachers are generally aware of CSIRO's educational offerings?
I don't know

What steps would be useful in taking to get the word out about CSIRO?
Maybe literature sent to science coordinator

You attended the Physics program today at the CSIROSEC. Have you participated in any other CSIRO science education programs in the past? If yes, which programs?

Yes, a presenter came to our school and presented a show for Year 7 students, I think FlatCats.

What were your impressions of the programs you participated in (please address your impressions of program content and program presentation)?

The show that came to our school was very entertaining and the students really enjoyed it. This one today (Materials Testing) seems pretty good, but there is a huge amount of instruct before the kids start. Cards with instructions would be good.

On a scale of 0-100 (0 being the lowest and 100 being the highest) how would you rank your satisfaction level?

90

After your previous experience(s) with CSIRO Education, for what reasons would you be more or less likely to participate again?

All hands-on activities, with expert supervision, and directly relevant to the VCE course. Students are highly engaged.

Finally, given your experiences, describe to me the key factors that you would address if you were to aid in the improvement of CSIRO science education programs.

Less verbal instruction- restrict to safety and special cautions, as well as good intro to theory. More large clear laminated instructions at each work stations.

Thank you for your time.

INTERVIEW #13 SG+

I: Interviewer
R: Respondent
DATE: 3-22-2001
TIME: 2:15

Brief Introduction

(Tape recorder not available)

The interview was in the hallway outside a classroom R was overseeing for a portion of the interview.

R teaches chemistry and mathematics to students in all secondary grades except year 7 and has been doing so for 18 years.

Said she has known about CSIRO programs since she was in university.

The programs she has had classes attend were Electronics and Forensic Frenzy. She had positive impressions of them. She commented on how the hands-on nature of the programs was good for the students.

She used the electronics class to meet a specific curricular requirement. The forensics program was for enrichment purposes.

R commented that there was not too much in the realm of chemistry programs. As a chemistry teacher, she would like to have seen that.

She also noted that there are more programs for students in years 7 & 8 or those in VCE, but not as much for students in years 9 & 10.

She liked the electronics program. She was disappointed that the forensics program didn't contain a lot of chemical experiments. There were plenty of good physical experiments, but she mentioned that there were a number of chemical analysis tests that could have been conducted as well (blood test).

She mentioned also that a class in organic chemistry, covering plastics and polymers would interest lots of schools for VCE and other levels.

The key factors in deciding to participate in a program were cost, including the cost transportation. Time is another consideration in having programs – it is beneficial when a program can fit into a single class period. Content is also a key issue.

R would rank her satisfaction with CSIRO as a "strong 80."

CSIRO could improve by adding more variety to the program offerings. Each year they could add one more program.

The key aspects of a good program were making the programs accessible to kids. (The instructors in the programs she has attended were very good and related well to the students). The programs must reflect current technology.

The size of the current programs was very good (20-25 students). There was good set up and the cost wasn't too bad (especially considered to other places, like the zoo, ScienceWorks, or the museum).

INTERVIEW #14 SC+

I: Interviewer
R: Respondent
DATE: 3-19-2001
TIME: 3:35

Brief Introduction

I: Now what grade levels do you teach?
R: I teach 10 to 12
I: Now is that just Science…?
R: Ah, I teach VC as well and I can teach maths but I am not going to.
I: How long have you been a teacher?
R: 15 years
I: But this is your first year here?
R: Yes.
I: So how did you hear about the CSIRO programs, you're the one who booked this one right?
R: We do CSIRO at my old school, we done physics and chemistry all sorts of different CSIRO education, some of which have come in and some of which have gone out. Yeah year 10 do genetics, they do it first term, and it's been standard practice for years that they have this particular in-service here for their genetics unit. But normally it's booked the year before, but because there's a change over in the head of science, which is my job, it wasn't so, so I went and sort of just had to do it.
I: What were the primary reasons you went to CSIRO as opposed to trying to teach it yourself, bringing in someone else?
R: Ah, well CSIRO has a good reputation for doing things here, and they have no school buses here, getting to places is much harder than having people come in, so that would make people coming in sort of a high priority. Just generally speaking no having seen this one I wasn't quite sure, but generally speaking, the reason I would go to CSIRO is because their equipment is better and the set up I think no doubt would be a bit of a undertaking for the average science teacher.
I: How aware do you think are in general about CSIRO's offerings?
R: Do you mean the programs or the fact that they offer things?
I: Well both I mean…
R: Yeah, I think, I mean the science teachers in general are aware of CSIRO and that sort of resource to use but probably you need to be actually got into the individual things before you get a sense of, I mean reading anything on paper you learn certain things, but I think you know people, if your looking at excursions for something like that, rather than going major places like the museum or something like that than you would use CSIRO and that's fine.
I: Of what you saw today what were your impressions of it?
R: <long pause> It looked good, I think it's hard with any of those things like the one that are done in school rather than going to their places, I've always found that it takes half hour to get the kids caught up with what your doing and because it's something, something that they actually won't be doing immediately, and it's very hard when they don't know what the specific goal is, and I think there's that constant tension, and I don't know how you might resolve that. But I think that become a bit of an issue, that set up time is necessary, but it can be… *you know to just come on I want to*

do it! Ah, aside from that, I spoke to the kids after lunch about everything, they all said the same sort of things about how it was, except one girl said she wanted to get the cute guy in the other room, no but there were, ah, I think in a topic like genetics where your taking about DNA stuff, and they can see it in words, but actually having that stuff in front of them to extract, yeah that makes a difference.
I: Do you have any problems with the programs, content or booking or anything along those lines?
R: The main problem is with one I said about just getting it started, content is fine, is it this we are talking about?
I: Yes.
R: Booking, booking is just a very complicated situation over here they were very helpful, they were very polite especially since I think we had to reschedule about 3 times, Just that it would have suited me to have it first two periods of the day and they would have to make it here by like say 7:15, but no, no problems… Oh just when you said content I've seen a physics one that <long pause> yeah I felt that it could have been, they had a roster of like 6 activities, 4 of which were excellent, and the other were not terribly good, and you got restless and these sorts of things.
I: So it wasn't exciting enough?
R: Yeah basically just because it year 12's, it was fairly straight forward, I guess obviously I though they could have done a little more and made it a bit more challenging, but that's just that one. I've had the forensics come, those science people come out and do it, and apart from the set up time with that, other than that it was fantastic, it was wonderful. It was fairly good, but generally speaking I think yeah, I was pleased with that.
I: On a scale from 0-100, 0 being lowest 100 being the highest, what is your range, ah, your overall satisfaction with the CSIRO programs?
R: <long pause> 80?
I: So your reasonably satisfied?
R: Yes, yes.
I: I mean do you think you would be likely to participate in the future? Obviously it depends on the curriculum here, but I mean could you expand possibly to…
R: Yes, we have a Chemistry one coming out here as well, or it might have already come out, but I mean we will evaluate each particular program as it comes.
I: Well thank you very much.
R: No worries.

INTERVIEW #15 SI-

I: Interviewer
R: Respondent
DATE: 3-27-2001
TIME: 10:00

Brief Introduction

R: This is a very big private school.
I: What subjects do you teach?
R: I'm the head of science here. I teach year 11 & 12 biology and this year I'm teaching year 10 environmental science. I can teach across the broad spectrum of science, if I need to.
I: Hoe many years have you taught?
R: 22, 14 here.
I: Have you ever been involved in any science extension programs?
R: I've done some work with Monash University and their education faculty and a program where their postgraduates come teach at the school. We do a fair bit of in-house work with extension students. We've had some involvement with the CSIRO CREST program.
We've had occasion to have visiting scholars come in from Melbourne or Monash and teach in a particular area for a short period of time. That's pretty hit or miss – the information we get from the universities is often too late to make a decision on. I'd like to make more use of it, but to do so we need information in time so that we may plan it into our courses. Often it's too late, or isn't relevant at all.
I: Scale question
R: I'd say very satisfied – 85. The programs we've had in the past have been very good, we just haven't been able to get enough of them.

Another example we haven't used in a while is: Swinburne had a travelling science show that came in and they were real good until they wouldn't carry their equipment up any steps.

What they did was fantastic and I've been exploring ways to getting back to using them.
I: I'm not really familiar with Swinburne. What do they do?
R: They basically go out to schools and run a 'whiz-bang' science show for an hour or two for the kids, demonstrating exciting, grab-'em type activities. Not that the students do the activities – they sit and watch the show and they have some fairly good things. One of them I think was a fairly big electromagnet and whack it with a frying pan and fry an egg on it just because of the heat generated in the magnetism and things like that. Nice little showy things that engages kids in science.

Really, that's what junior science is all about; junior meaning years 7-9 science. It's really about sparking an interest in the kids – it's not about teaching them the academic science.
I: Do you find that teachers are generally qualified to teach beyond the basics in certain areas?
R: No and I've got a really good example of that. Because of the general nature of junior science and the specialist nature of university training, often the two don't meet. It's very hard to find staff who are competent and confident enough to teach across the entire spectrum of science in junior science. Now, I've got a psychology

teacher teaching junior science at the moment, a biology teacher teaching junior science at the moment, who are really struggling with mechanics in year 8 science – basically, forces and things. They're finding it really hard and in fact, this morning one of them set up a time with our physics teacher to get our physics teacher to explain to them what was actually going on. So that answers your question – No, teachers are not confident in those areas and that's an opportunity for someone to provide really good P.D. in specific junior science areas: physics, biology, and chemistry for junior science teachers for the non-chemists,
-physicists, and -biologists.

There's not a lot of that in the marketplace. And if there is a lot of that in the marketplace, I'm not getting to see about it.

I: That prompts the next question: Are you aware of CSIRO education programs?

R: I'm aware that they have them. But, to be perfectly honest, I'm fairly ignorant about what they are, or whether they come to us, or what's involved. I'm being brutally honest about that.

I: Have you seen any advertisements in publications or newsletters?

R: I see odd bits and pieces – I haven't seen anything that really grabbed my attention to the point where I would sit down and read it in great detail. You get the odd flyer, but it doesn't tell you enough about what it's trying to achieve for you to say 'oh, that's worth doing.' You know what I mean?

It might be a problem of mine, as much as it might be a problem of anybody else's. Dangerous ground there to blame CSIRO, but it is a reality that the pressure of time in these jobs is such that if it's not there and upfront for you to see what it means, you ain't got time to sit down and read it.

I've got so much stuff that comes across my desk and it's all clamoring for your attention.

I: I guess just straightforwardly presenting the information of the offerings?

R: Yeah, I think that if CSIRO are (and I know they are) offering teacher in-service material, then that's got to come out that that is what it is. This is professional development material for teachers. Let's differentiate between offering educational programs for schools to go there and do things, or to come into the schools and do things, and professional development for teachers. So, first thing, it's got to differentiate which one of those it's about. Secondly, if it's about professional development for teachers, it's got to say that this it's what we're trying to provide for education for teachers. And why that is so important (there's a hidden agenda here) is that this school is unique in Australia at the moment (that we know of) that we have a total focus toward professional development for staff. We actually devote Monday afternoons from 2 to 5 entirely to staff professional development. One of my jobs as a head of faculty is that all staff have to submit to me an outline of their goals and what professional development they want to do in a year to achieve that. We're not going to be unique in that for too long. Professional development is the big push. I'm looking for opportunities for staff to go to professional development. I'm going to a CSIRO one this afternoon – there's an example of one that I got that was quite specific: it said to me this is what it's value is and I'm off to that at 2:00.

We're looking for people to provide those professional development programs. And we're developing a few of our own.

I: Are there any publications that you would say CSIRO should definitely advertise in?

R: CSIRO should be trying to have a strong presence with the science teachers association [STAV] in *Contact*. STAV does a lot of professional

development stuff themselves, but they can only organize so much and do so much and I just reckon that there is an opportunity for CSIRO to have a strong partnership there. The best way to get to the teachers is through the STAV – or directly.

Their [CSIRO] education service, to my mind, seems very much tied up with providing excursion type education. That's my view – where students go to them for things.

I: If you were to help design a program for students, what factors would you address?

R: I think access is a critical issue, in terms of teachers being able to get to the people and talk to them.

There's no doubt that if you were going to go there to do a program that it'd have to be something unusual. Why are you going to spend the money to get on a bus to go to CSIRO if it's not going to be something unique? Not something you can do in the classroom. That's got to be a driving issue in what they do. Now, finding those sorts of things for junior science can be challenging.

It's also got to take something from the CSF and extend it. It's got to be 'whiz-bang' and it's got to work when the kids get there.

It's also got to be adequately staffed so that the kids are all involved.

I: Would a marketing approach be advantageous?

R: Oh, I think so. That's what I was saying about getting it in front of us.

I: Thank you very much.

…talk about WPI project…

R: I reckon that there should be more of the Swinburne-type science shows. An hour or hour-and-a-half of 'whiz-bang' shows that get kids engaged in science. If CSIRO is doing that, then I am not getting the information about it. I might be not reading it properly, but if they want me to read it properly, they have to put it down…

Maybe, to be divergent – the Internet might be a very good mechanism for developing programs. Another way for schools to access what CSIRO does, is to access it remotely and have a school-based internet site where schools can go to their computer room and visit something going on at CSIRO by Internet and experience it that way.

I: In terms of live video feeds, or interactive programs?

R: Interactive programs. Remote learning through the Internet, interactive programs, like the Virtual Cell. 2-way communication with teachers via email.

I: Thank you for your time.

INTERVIEW #16 SI+

I: Interviewer
R: Respondent
DATE: 3-30-2001
TIME: 9:30

Brief Introduction

I: To start off, what grade levels do you teach?
R: Personally I teach years 9,10,11,12.
I: How long have you been teaching?
R: This is the tenth year since I've started teaching.
I: How did you become aware of CSIRO's program offerings?
R: Well they have steady mailouts all the time, we get the information. I first went there when I started teaching physics in 1996 in a different school, and the other physics teacher organised it and we went out to the Structures and Materials activity. We did it after school and didn't end up getting back until 9 at night, so it was a long day, but that's how I found out originally. I have been going every year since, I've found it to be a very worthwhile activity, and we use the Genetics program as well, though I haven't been to it myself.
I: Can you describe what key factors influenced you to book those particular programs?
R: Well, I can't say much about the Genetics one, but with the Materials and Structures, they provide the venue where students can go and "break things" and use equipment that we don't have. It's a good opportunity to get the kids out of school… I think it's a great activity. My concern with it really, is girls here, trying to get girls into science, the venue is like this old WWII run down place, and most of girls are looking for something a bit more glamorous, you are trying to get them into science… so "if you study science, you can come work here!" [laughter], but that's life. But, I was quite conscious of that when I took them over.
I: So on a scale of 0-100, 0 being the coldest and 100 being the hottest, where would you place yourself to gauge your level of satisfaction with the past CSIRO programs that you have participated in.
R: I'm really completely satisfied, I'd give it a 90. I guess one year we went and the person who was running it, we got them the first time they'd done it and their accent wasn't very clear and things like that, so one year it was just a bit year. But, everyone's got to have their first time, but it wasn't as inspiring. Last year we had Simon Matheson, who I actually studied with at Uni, and he was very good, he knows his stuff.
I: Do you participate in these programs to meet a curricular requirement, or is it for enrichment purposes only?
R: It's pretty close to meeting the curricular requirement cause we need to do prac work. In the old system, I used to use it as part of the work requirements. Last year I used it as the basis of a data analysis assessment they did, this was them getting their data and then they have to analyse it. It is integrated into what they are doing and is part of their assessment.

I: So if CSIRO called you in to develop one of their programs for students, what key factors would you make sure to address in trying to develop a program (whether it be ease of booking or availability or change of venue)?
R: Well I am pretty happy with the program as it is, so… booking is hard cause you have got to get in at the start of the year really or even the previous year, and at that stage you don't know your timetable for later in the year things change, it's hard to pick a good time, so that can be an issue, but that's also a reflection of how good the program is cause everyone wants to do it. The venue, if something could be done, in a way it's good that it's actually going to a real research centre, rather than going to some nice building, so I've got nothing against that. But I'm really trying to work with the girls to get them enthused about doing science as a career, or even going into research and I suppose the ones that are really into science aren't going to care about the building, but a few just look and say… "uh, no".
I: Can you think of anything that could be improved?
R: Nothing's jumped out at me over the years; basically it's been identical for the last 5 years, so nothing's changed. Um, the kids enjoy it and seem to get a lot out of it, especially the whole stress/strain, but with tempering and stuff that's kind of all bonus, that's not on the course, so it's a good experience, when I do their assessment later, I don't include that. It's all great, so I guess it is important that it is closely tied to the course, it's great that it goes beyond, it's always more. I can't think of anything to change.
I: Is cost an issue for you?
R: For physics, we go on that excursion, and we can afford that. I have 12 students and I think it would cost much the same if I had 20, the price was increased, that would be more difficult and we would have to charge the kids.
I: So have you participated in any other programs?
R: We do competitions, the year 11's go down to Queenscliff for the marine biology activities down there, we go there every year. We did a science competition, but the cost for that has gone up so we make the kids pay and make it optional. Since it is expensive, we have cut back on that. In year 7, last we went to the virtual reality theory, we built ancient churches that have been demolished, they have virtual tours of the solar system, and the kids love that and it's brilliant, and I get a better understanding of how that could be used in research. Year 8 Forensic Science from CSIRO comes out here. Year 9 we plan to go to the museum. Year 10 we do the genetics. Year 11 we have something in chemistry, they have an instrumental analysis and use the mass spectrometer and that's really good.
I: Thank you for your time.

INTERVIEW #17 SC-

I: Interviewer
R: Respondent
DATE: 3-29-2001
TIME: 3:45

Brief Introduction

I: What grade levels do you teach?
R: Year 7 to year 12.
I: All areas of science?
R: In Junior science 7, 8 and 9 that's all we do for science, year 10 I taught physics, a unit in motion. Years 11 and 12 I teach chemistry.
I: How many years have you been teaching?
R: 13
I: What sorts of extension science programs do you use?
R: Ok, well I could run through all the excursions that we do, at year 7 they have a zoo excursion, where they learn a little bit about animal classification. They have an incursion where StarLab comes here. Year 8 they go out on an excursion to Series, which is an energy park in East Brunswick and looks at use of energy in the third world, how to cut down the energy consumption in a household, and it looks at alternative sources of energy. It gets students to think about sorts of ways that they use energy now and they then make a series of choices on a worksheet about what sort of life they'd like to lead as adults and then they are confronted with the consequences of those choices if everyone did the same thing, big families, big houses, big cars so on and so on. Year 9 we run a Mary Creek excursion with geography with creeks right down the back here, they collect data on the creek, on-site and they do chemical testing and they look for micro and macro invertebrates and they look at the vegetation along the creek, and they do an environmental assessment of it. Year 10 we used to take them Werribee Zoo but we've decided not to do that anymore, and we're looking into taking them to the museum, but I haven't contacted them yet. Year 11 biology goes to Queenscliff where they look at the mudflat ecosystem there and they go to the marine ecology centre there. Year 12 chemistry has an incursion, there's a company that brings out some instruments of analysis and they use those to test different things qualitatively and quantitatively. Another thing we do at year 7, there is a reptile show that comes. That's about it.
I: What sort of factors influence your decision to choose one program over another?
R: Ok, one CSIRO program that we had looked at in the past was the forensic science program and the reason why we decided not to go to that one was, not just because of cost, but because basically for the forensic science, everything that they were offering we could do ourselves. So we're looking for things that we can't do ourselves and things that offer students novel experiences, places where they wouldn't necessarily go themselves. That's why we used to take year 10's to the Werribee Zoo cause it was a nice inviting day for them, though it didn't really fit in with our science program.
I: How satisfied would you say you are with the programs that you do attend.

R: Pretty good, the Series one was one that has gotten much better over the years. We are looking for money worth to, we don't just ask the kids to spend this money if we think it's a waste of time, it has to be valuable.
I: If you were to rank your satisfaction of the programs that you do attend, on a scale of 0-100, how satisfied would you say you are?
R: Well, some more than others, I'd say with most of them it would be above 80.
I: How did you become aware of the CSIRO programs?
R: Mainly through the flyers that they mail out to schools.
I: Do you see any ads in any publications?
R: About the only ads I've looked at are the ones in *Contact*, I think they have been running ads there. The flyers that they send out are nice and colorful and they'd be hard to miss, and they do keep on sending them out, which is another important thing, if you miss it the first time then you will see it the second time.
I: If CSIRO called you in to help them design a program to meet your needs, what would be some key factors that you would have them address.
R: One problem with the CSIRO is I believe a lot of the things they run are in Highett, is that right?
I: They do have outreach programs.
R: I know they have been running some good programs down in Highett, but that is just too far away for us. If they had programs where they go to schools, yes I would be interested in conferring with them and talking about some possibilities.
I: Are there any issues about what the programs should cover, what topics?
R: Well, I think the Forensic Science one is a good idea, but it is one that a lot of schools can do on their own, so they nee dot be things that could be brought to schools, there used to be a travelling science show that was very entertaining, it was very good. Entertaining demonstrations like that would not be done at a lot of schools; teachers would not have the time or the equipment. So something like that organised along the lines of different things, especially physics demonstrations, cause a lot of junior science teachers aren't that well versed in physics, as a science coordinator I realise that it is the most difficult part of the syllabus to get it covered well. If you had shows that had demonstrations with people who were really knowledgeable in physics that would be great. So that way you'd have a lot of really good ideas filtering down from the tertiary level, the people that write the VCE study design, their knowledge could be filtered down to people like us.
I: Do you have any other suggestions for CSIRO?
R: Well, again, Highett is a long way away from here, so the only shows that would interest us would be the travelling ones, if they came up with ones that were relevant to what I've just been talking about.
I: Thank you very much for your time.

INTERVIEW #18 SG+

I: Interviewer
R: Respondent
DATE: 3-28-2001
TIME: 2:00p

Brief Introduction

I: What grade levels do you teach?
R: I teach all levels from year 7's to year 12's
I: You teach biology right?
R: Well this year I've taught maths, and I'm teaching science and year 11 and 12 biology and I've also taught health.
I: How did you become aware of CSIRO programs.
R: Through the Uni, I knew the CSIRO did programs, and since I started teaching, my aim is to get as many students interested in science, and I think they sent a blue sheet of paper of all the programs, so I rang them up and booked the one that I thought would be the most interesting and related to what the kids were doing.
I: Which one was that?
R: Um, we did the Cool Chemistry one, with Daniel as the presenter, he's really good. I had also seen him as a demonstrator for a Professional PD that we had.
I: So what did you think about the program?
R: Oh, it was fantastic; it was really good. He set up the room and came early and he had all the workstations for the kids. He did demonstrations at the front here. And he had little pieces of paper with experiments and instructions around the room and the kids went from one workstation to another.... It was well organised.
I: Were there any aspects of the program that stood out in your mind as either unusual or exceptional in some way.
R: Well basically, this was two years ago when I did this, so I am trying to remember. The workstations were really good. His demonstrations were really good, kids like demonstrations.
I: So the content was good.
R: Yes, it was good.
I: Did anything, in your mind, need to be improved?
R: One thing... the timing with the school, he had to be here at a certain time so I had to fit it in my timetable, and that was a bit hard. One session went into another session and caused disruption with the kids... maybe if it was more appropriate to the class timing in the school, to do it like that, that would need to be improved. I think the money too, $4.50 the kids didn't think it was worth it, they might want to lower the price a dollar.
I: What were some of the factors that influenced your decision to have CSIRO come in?
R: Well I know they are a good company, and they do some many things for schools with education programs, so I was quite happy to do that. And also the DNA Helix magazine and I know they do so many good things. I'm also planning to call them again to pick another program.
I: Is that to meet a curricular requirement, or just for enrichment purposes?
R: Just enrichment, it can be curriculum but it can be just to get the kids more excited about science, it gives them more hands-on practical things.

I: So on a scale of 0-100, how satisfied would you say you are with the CSIRO programs?
R: Probably 90.
I: If CSIRO called you in to help them design a program what aspects or features would you make sure they included?
R: Um, with some of the instructions, some of them were a bit too wordy for the kids. I did it with year 7's, some of the kids here are not very good with reading skills, so maybe more diagrams.
I: Is there anything else you'd want to make sure they included in the program, things to consider related to teachers?
R: I think maybe he might have needed help, I think one person was not enough, there was a lot he had to organise, he set up so many things, and we had to help him with all the boxes, I used my own time to help him. I got some of the kids to help too, but I think he might need some more help with setting up the room. I could tell he was stressed on that day, there was a lot to bring in, and I think at the time he had a broken wrist too. Even another person, instead of just the teacher going around the workstations, if they had more demonstrators that would have been good. Cause we had two classes in the room, I think there were about 30, so maybe a ratio of 1:10 or 1:5, cause I can't go around and explain everything to all of them at the workstation, so more demonstrators would help.
I: Those are great suggestions, thank you for your time.

INTERVIEW #19 SC+

I: Interviewer
R: Respondent
DATE: 3-20-2001
TIME: 3:30

Brief Introduction

I: What grade levels do you teach?
R: This is a senior college, so we only have year 11 and 12.
I: Do you only teach science?
R: Physics, electronics, and networking, computer networking.
I: Being a senior college, your focus is only on the VCE?
R: Yes, only the VCE. We don't offer anything other than VCE units.
I: How did you first become aware of the offerings by CSIRO?
R: Through the annual physics conference. That's normally held in February at Monash (sp) University. Which ever particular year it was, it was early in the 90's – Amongst all the myriad of handouts you get we got one that contained materials by CSIRO.
I: Did it stand out from the rest, then?
R: What was good about it was they said the experiments were tailored specifically to the VCE. It is a reputable organisation; those at CSIRO don't do things in halves. Plus, they designed specifically for the VCE, so a lot of schools jumped at that.
I: Which programs have you been involved in?
R: Myself, personally, it was the materials testing. I know our biology teachers have also actually been involved in whichever one is VCE biology.
I: What were your impressions of the materials program?
R: The program was good. The handout sheets were a suitable level for year 12. The experiments, in general, were very good. A couple of them were very simple, which some teachers would think, 'oh these are too easy for VCE,' but we had students in physics here had a wide range of ability. The ones that struggled with the more difficult experiments there liked the couple of easy ones, like the one where there's a balance.

The person running the session was very good. Greeted the teachers, made us feel welcome, showed us some tea and coffee. In general, it seemed as though they were used to dealing with students at that age. It's a bit more awkward for that, but that's where it's really my responsibility as a teacher to, [while] he or she is trying to lecture, maintain quiet. They did a little of that, and their manner was very good.
I: Did you sign up for the program to meet a specific gap in the curriculum here?
R: Yes. Materials testing has not been something that has traditionally been a part of physics courses. Prior to the VCE, it was considered an engineering topic, rather than pure physics, so when it was introduced in the VCE, schools like ourselves didn't have any equipment like that. So, the practical activities we were doing were ones that involved springs or rubber bands, and not even testing them to their limits because the weights that we had weren't large, heavy ones. So we were doing practice – we were sort of okay, but doing experiments where you load materials until they fail, for example, we weren't able to do that. So, all of a sudden, there was a

glaring need that was being met by CSIRO. So we jumped at it, and so did a lot of other schools. As I said, the experiments were very good.
I: According to CSIRO's records, the school hasn't participated since [year]…
R: [chuckling] You want to know the reason?
I: Sure.
R: What was happening was, for the last three years, when we would run our CSIRO activity, which of course is just toward the end of teaching the materials and structures topic, there is a very heavy SAC period, it was then called a CAT period – the assessment tests were CAT's – they are now called SAC's. It happened to fall during a time when there were lots of these assessment tests and in '97 that occurred as well and I made compulsory excursion, because I valued the experience. In the last three years, I've made it optional – [they have math, chemistry, and biology tests] and they are going to have to miss these and come in on another day to do it. [In those circumstances, I had to make it voluntary]. I have two year 12 classes each year, which is about 54 students and I was getting the order of 6 or 7. Now, if they knew how good a program it was and had tasted it say in year 11, I think that I would get at least half of the students and that would be enough. I think you need 20 to do the program, but because I was getting 6 or 7 and the last year I went we had booked it early in the year for 20 odd students and only had 3 or 4 how up. It was embarrassing, I mean we paid, it wasn't that aspect of it. Now here's this guy got his whole afternoon… not wasted but it's for the sake of 4 students and because the numbers are similar, I haven't gone. So it's all got to do with time of the year that I'm teaching. Now I have looked into the possibly doing a different unit at that time of the year but the way the second half of the year is structured, our major assessment task is a motion crack, not a materials and testing one, I've really got to do it at that time of the year. So I'll do the same this year, I'll say that this is a terrific afternoon excursion, this is what we'll be doing, so it's voluntary, and I've got an idea if the dates are the same for the assessment tests and those are the subjects, then we won't be doing it.
I: Did you only have a certain time that you could schedule it, the program doesn't run all year then?
R: The scheduling would be for second semester materials testing, probably, where that's where the topic falls in their curriculum. What I was finding though, was that it was so popular, that I was booking 12 months in advance. I'd finish [with the program] and almost the next day I'd have the lab tech calling to schedule for next year. And that's the difficulty, so even if I could warm the kids up to it and then say 2 weeks before the event say look, we'd like to go, there's no way you can book in 2 weeks. So, you see my difficulty. I don't, from my experiences over the last couple of years, I think I might have only 6-10 kids, I'm really not sure, but because we have to book so far in advance, I sort of say no I won't book, because I was embarrassed that one year when it was just me, the lab tech, and three or four kids. So, I'd to go but I don't quite know how to solve the problem.
I: Has travelling to CSIROSEC been a difficulty?
R: It's been alright because we go on the school bus, and the lab tech drives a car and we go to McDonald's and plus you spend the whole day, we make a day of it. The kids don't mind at all, as long as you mention food. [laughter]
I: Were there any aspects of the program that you thought could be improved in any way?
R: As I said, the materials are good, I like the range of simple and harder experiments, there's one experiment in particular where the guy from CSIRO he basically does that

and the visiting teachers will assist the students for some of the others. I suppose there's one aspect that wasn't ideal, because it meant that he or she couldn't lend their expertise to some of the other experiments so for those, I know physics to a certain extent, but the engineering aspects of why this particular piece of chalk characteristics change at this temperature, I wouldn't know, I just know the basics of it. But he was on the main machine, textile strength of steel and he or she stayed there and I basically was the expert on the rest. So that is one area that is just unfortunate that he or she needed to be on that piece of machinery. For us the only hassle was that we have large classes here and I always take the limit of 20, and the room is meant for 20. They were allowing that and I think that's to cater to as many schools as possible but it really is a squeeze. I brought 20 back once again because I thought that the program was so valuable I just apologise to students before we went in the room. I said look, it's tight, sorry about that, but if you need to go out for a breather or a drink, then that's fine… I was just upset that the biology area is so much bigger, or that was general science as well in the other room behind, all the biology students seemed to have the world, and these physics students were stuck in the little room. I am sure there is no bias intended [laughter].
I: Would you consider going to a program that covered anything other than the materials?
R: Yeah, I'm sure I would [tone of voice relays that he may not have thought of this before] off the top of my head, I don't know what sort of thing they would offer. That's the real engineering topic for year 12 physics, so that was an obvious one for someone like CSIRO, gravity is an area where's it's hard to get activities, but that's more theoretical area, there may be activities in the motion, with equipment that we don't have. We do have some computer interfacing experiments. Those type of things, if they had ones with good interface materials, that'd be good, just off the top of my head I'm not quite sure.
I: Yeah, I think they offer another one in general physical science for VCE level, and they do have an educational website, just for your information.
I: So on a scale of 0-100 how satisfied are you?
R: 0-100, oh 85.
I: So would you consider using CSIRO again?
R: Oh, I would. The main trouble we've had is booking in advance, if I've got to make up my mind that far in advance, my answer is no based on the fact that it'll probably clash with our dates. Our dates aren't firm until the middle of March. If it's a popular service, it's a bit like the zoo, if you want to book into the zoo or the Melbourne aquarium, you've really got to book ahead months and months. It is just so popular with the schools, so I accept that. One thing I could probably do was if they offered an alternative in physics that would be an activity I would be interested in for a different time of the year. I would certainly look into that. It is just this one particular month that I have a problem.
I: Any other comments?
R: No, it's nice to meet you.
I: Thanks for your time.

INTERVIEW #20 SI-

I: Interviewer
R1: Respondent 1
R2: Respondent 2
DATE: 4-3-2001
TIME: 9:15

Brief Introduction

I: Just to begin, what grade levels do you teach?
R1: I teach 7, 9, 11, and 12.
R2: I am the laboratory technician, so I teach right across the grades.
I: What subjects do you teach?
R1: I teach general science and biology.
I: Since we've been in Australia, we have learned about the three different types of schools: government, Catholic, and independent. What type of school is this?
R1: This is a private independent school.
I: Do you find there are differences between the types of schools?
R1: Probably the government schools get more money then we do.
I: Do your students participate in any extension science education programs, you mentioned the Swinburne Travelling Science Show…
R1: Yeah, they enter what's called the Australian Science Competition is that what you mean by extension programs?
I: Yes, if they work to achieve certain science outcomes.
R1: We don't have programs to extend gifted science students in our school, but we extend them in competitions like the Science Talent Search and the Australian Science Competition, they are tests that are put out by external bodies.
I: Now do they attend any outside extension programs, such as going to the museum…?
R1: Yes, they do all sorts of excursions?
I: Is there one that is outstanding in your mind?
R2: Well the senior students sometimes go to the University to do genetics, looking at DNA, and the characteristics of DNA. The juniors go to the zoo, and places like the Healesville Sanctuary. Some just make visits to hospitals, looking at different diseases, doing that as part of the CSF.
I: What factors are involved in choosing which programs they attend?
R1: It is mostly curriculum based.
I: If you were to rate your overall satisfaction level with the extension science education programs that you are involved in from 0-100, what rating would you choose?
R1: It's pretty hard to gauge, if you classify those activities that we just discussed as extension activities, then the success of the programs is probably 50-50, some kids like them some don't. The excursion part most kids love, the sit-down written testing part, most kids don't like.
I: And they are tested like this for which programs, as part of the talent search?
R1: Yes, like this year, every student grades 7 and 10 is participating in the Australian Science Competition, whether they are the most brilliant students, or the worst

students, I am making them participate. So, some kids are reluctant, but they are still going to do it.
I: What sorts of things are involved in that?
R1: Well basically it is a multiple-choice test on all the disciplines of science, it tests comprehension of different concepts of science, students read through some information, and pick the correct answer. The really good students get high distinction, top 1% of the state. I suppose it is recognition of what level they're at in Australia, and Southeast Asia as well.
I: Are you aware of any of the science education programs offered by the CSIRO?
R2: I had asked for that information, but they haven't sent it out, could you follow that up. I know it's on the website, but I want it in booklet form. I know there is a full range of primary to secondary activities at the centre and onsite.
I: We are trying to determine how effective CSIRO's marketing is…
R2: I know that the CSIRO does in-services at LabCon, which is the laboratory technicians' branch of professional development organisations that educators are involved in.
I: How aware do you think most teachers are of CSIRO science education programs?
R1: I always thought that the CSIRO was a research unit; I never knew that there was an educational unit attached to it. I know there is an educational unit attached to the zoo and other places, but I never thought the CSIRO offered extension educational programs. That's why when you rang me up I said sure, because I'd like to know what's available, because we have a big hole to fill in the primary section of the school, so I was kind of hoping that you would have some materials and education for the primary school.
I: Well we don't actually have materials with us, but we can request them for you.
I: So the main reason that you haven't participated has just been that you were not aware of the programs?
R2: Well I have known that it existed, but I think the teachers are less aware.
I: So if the CSIRO was to ask you to help you develop a science education program, what factors would be the most important in the development.
R1: Obviously you'd look at the CSF and make sure that it falls in line with the CSF, because that is the bible as far as what we are going to teach. And then you would try to offer something that wasn't already there, something that would extend the students, make sure there is a lot of practical and hands-on work.
R2: Yes, enough to challenge the very gifted students, and at the same time enough to teach the less gifted students the basic concepts, so a wide range of experiments would be good.
R1: I suppose making the program more accessible by having some sort of technological basis to it, by linking it to computers, for example like right in the books we are using this year come with a CD-ROM. So the students are extended, not in the classroom, they actually go to the computer and put the CD in and interact in like a living class.
I: Would you want that included as follow up material?
R1: It could be for follow up or it could be an integral part of teaching of the content. These books appeal to the kids that are not textbook learners. SO this sort of program would have to think about that, it would have to be based on the CSF, and work for a wide range of students, and have a practical component, and have an interactive component.
I: And would cost be an issue.
R1: Cost is always an issue.

I: See what CSIRO does is give an actual presentation, they bring the materials so the school does not need to have the equipment, so the cost is per student.
R1: I think that would be fine, the kids would be willing to pay, if it was a reasonable cost. I told you that Swinburne Institute of Technology comes out with their science show and the kids didn't mind the cost at all.
I: Tell me about he Swinburne show.
R2: They did a lot of 'whiz-bang,' very novel, entertaining things. They are presenters as well as educators, so they can really interact with students pretty well. And they'll have the students come up and hold something and be like a magician like the star of the show… very interesting, technological stuff.
I: So it was more enrichment trying to get the students excited about science.
R1: Yeah more motivational than anything else, you can only do so much in 45 minutes, so you tend to show the visual things that really would appeal to the students.
R2: They didn't go through it in a curricular form with the CSF, they just integrated into one spectacular show, and they'd add humor and get the kids really involved. Most of the times I've seen it, it's been very successful.
I: And was that done with the entire school?
R1: You are restricted in space with a lot of schools. I think the shows covered the same topics for the different grades.
I: So the program being accessible to a certain group size would be important.
R1: You'd like to think in year 7 and 10 that all the students will be involved in something of that sort. In my last school we organised so the Swinburne team was there the whole day. So obviously it was disruptive, since the students missed their regular classes, but they got 90 minutes of science.
I: Ok, well thank you for your time.
[Tape recorder was shut off so the remaining statements are paraphrased.]
R2: See if you can request the primary information for us again, because in primary schools, the teachers' general knowledge base in science is really limited, so that would be really useful. If the teachers do not understand the material, then they can't teach it.
I: So professional development would be useful as well.
R2: Yes professional development would be really important.

INTERVIEW #21 SI+

DATE: 3-20-2001
TIME: 9:00

Brief Introduction

Questions regarding CSIRO's extension science education programs

These [two] teachers declined to talk with us after the program because they needed to immediately get on the bus to travel back to school. We gave them a questionnaire like this one to have them hopefully address our key concerns.

Thank you for helping us with this study. We are students from Worcester Polytechnic Institute contracted by CSIRO Education. Our purpose is to gain information about how to better serve teachers and students in CSIRO's science education programs.

Your responses will help us give CSIRO Education recommendations for improvement, but your name will not be associated with the information offered.

What grade level(s) do you teach?
8,9,10

What subject(s) do you teach?
General Science

How many years have you been a full-time teacher?
21 years – but with lots of time off in the middle!

Do you believe that teachers or classes would sometimes benefit from the utilisation of extension science education programs?
From literature at school and from laboratory manager.

Did you come any ads about CSIRO Education in journals or teaching publications?
No

Do you think that most teachers are generally aware of CSIRO's educational offerings?
No

What steps would be useful in taking to get the word out about CSIRO?
Notifying lab staff – through "Lab Lines" newsletter of STAVLTB.
Individual teacher email.

You attended the Forensic Frenzy program today at the CSIROSEC. Have you participated in any other CSIRO science education programs in the past? If yes, which programs?
Teacher 1 – No

Teacher 2 – Yes – DNA

What were your impressions of the programs you participated in (please address your impressions of program content and program presentation)?

Excellent.

Especially presentation.

On a scale of 0-100…

87.5

After your previous experience(s) with CSIRO Education, for what reasons would you be more or less likely to participate again?

An excursion for the students to have hands-on practical experience and a theatrical presentation to enforce classroom teaching.

Finally, given your experiences, describe to me the key factors that you would address if you were to aid in the improvement of CSIRO science education programs.

Nothing comes to mind.

Thank you for your time

INTERVIEW #22 SC+

I: Interviewer
R: Respondent
DATE: 3-19-2001
TIME: 1:15p

Brief Introduction

I: First to start off, what grade levels do you usually teach?
R: do I usually teach…ahh…this year I have 7,8,9 thru 10 and the 2 vce top classes, so that's all of them except year 11.
I: And that's like science or Math?
R: Here Only Science.
I: Only Science…
R: But I can to the Maths.
I: So how long have you been teaching?
R: An eternity…<laughing> 20 years
I: Wow… but that's an accomplishment… congratulations.
R: Thankyou.
I: So basically we are here today because we are trying to gain some information to help CSIRO's Science and Educational division improve some of their programs for the students.
R: All right…
I: So we are trying to get feedback from some of the teachers who have been involved in some of the programs, so I am going to ask you a couple of questions.
R: See we normally take the 12's, we take them all to Hampton down there to do genetics…yes so, I've seen them in the school and at, at the other, you know the other cite.
I: Yeah so first I guess before we go any further we would like to extend a policy of confidentiality, we won't use your name for anything you don't want us to.
R:All right, uhm hum.
I: I always say that to start out with because, *we don't wanna get anybody upset…<laugh>.*
I: I guess you are a little familiar with CSIRO programs in the past, have you participated in any other programs in past years?
R: Ahh… the only other ones that I have actually done very much with is the year 12 genetics, with the program that they run for that. I haven't done anything else, ahh…except this one last year.
I: Oh, This same program?
R: This same program.
I: So how did first become aware of CSIRO, rather, the programs that they offer?
R: Well it's in the… I suppose thru the association, the science teacher association.
I: so what did they have publications or newsletters they you could look at?
R: Yeah and they have advertisements. And it's word of mouth too, we knew that the genetics for the year 12 was quite useful way of doing the other half, the requirements that we have to meet, and the course work.
I: The CSF requirements?
R: Ah no, the Board of Studies requirements, so beyond the CSF, for the year 11 and 12.

I: oh so they have another set of requirements also.
R: Well we do a Victorian Certificate of Education, and for that aptitude you have to meet requirements for that.
I: And this type of school I guess is Catholic school?
R: Yes
I: So, other types are… like in Victoria the other types are?
R: This is ah Catholic school, there are others, we have public schools, the state runs those, and then you have independent schools, we are an independent school, but they are different types of independent schools, which means we are independent of the education department, but we still have to meet their requirements in terms of the curriculum we teach, that sort of thing. And then there are different types of public schools.
I: So the science programs that you have participated in, were you able to book them yourself, or were you just attending?
R: Oh, the one's that I take the year 12's on another year 12 biology teacher booked them, yeah, each year get booked by the science coordinator booked for all year 10's at the same time.
I: So what are some of the typical reasons why teachers choose to bring CSIRO in to do different presentations like gene technology…
R: Well for the genetics, mainly because they can present that sort of information, we don't have the micropipettes, the kits, we don't have that sort of equipment in terms of money…
I: So equipment?
R: Equipment yeah, and their expertise. It's a different face, it's someone talking about what's happening now, and also I think too, particularly for the girls to be aware that there is such an organisation doing something scientific of that sort. But certainly the equipment like for the genetics that we do for the year 12, it is much easy for us to do it here, do it for a day or a half day, then to set up laboratories here.
I: So the content level is adequate?
R: Oh yeah, certainly for the year 12's, you know, and the ah year 10's, I think today they, their a bit of it because they came back from camp, they've been at camp for a week, so their a little bit out of it, but I think probably, there is some girls in my class that were really getting into it. Now I would think content wise it was fine, the level was fine, but we'll talk about it tomorrow and do some follow up stuff. So I think the level of it was quite good.
I: How was the presentation of information, I guess opposed to you doing it yourself, having them come in the classroom setting trying to teach a genetic lesson?
R: Definitely much better <laugh>.
I: So the programs are pretty well received by the students?
R: I think so, yes, although there are some kids in my class that it wasn't going to connect with, they've made those sorts of choices already, I think you have to stand on your head or hang from the rafters to get them to respond. But I think the presentation was fine today, it was quite good, and I think he was quite dynamic, and that comes from the presenter. Like last year I had somebody else, you would not have any idea, they did not have anywhere near that sort of personality, so in terms of getting the message across, he was quite dynamic.
I: Kris does bring a lot of energy to the presentation.
R: Yes, and he was very good that way.
I: So I guess for you it does depend a lot on the presenter?
R: Yeah, but the level of what they were doing was fine.

I: So I guess if you were to have a scale from 0 to 100, 0 being the coldest and 100 the hottest, where would you place yourself of that scale according to you level of satisfaction with the program?
R: Oh an 80, yeah 80 something like that. We were fortunate today because we had 7 kids away, when there's more kids in the room, it's harder for the presenter to communicate with them that much more. Because you have some gaps, where you know there's not that much happening, like when they all came out to do their, filling of the wells or something like that, it gives the others in the rest of the group a bit of an opportunity to sit back.
I: Well do you think the teachers play, or should play a supporting role in that situation?
R: I think they should, yes.
Jess: That was the time that I noticed they were the most distracted, it was like every little thing up front was individual.
R: Yeah it hard for them to remain interested at that point, and I don't know what we can do about it, yeah but that would have been about the only down time for the kids really, because you know there wasn't very much happening at that time, and I think probably the only other thing would have been, at the very outset, I don't think that they connected what they were doing, they didn't realise this is what you are doing to the blood cells, probably that, if they had connected that step through, I don't know how you overcome that except by asking questions about that maybe you could.
I: Well I guess I should sum up and let you get to your food, I don't want to take up too much of your time.
R: Oh thank you <laugh>.
I: Yeah, I guess just given your experiences, for us we want to hear different factors that teachers and educators think we could tell the presenters or tell CSIRO about to improve their programs for students or for teachers, whether it be ease of booking a program, or presentation, the level of energy that a presenter might bring to each program…
R: Well the level of energy was not a problem, I though he was very very good, and he was right with the kids that was not a problem, it was just that little bit of time where…ahh, had we had 7 more kids in the class, you might have seen it get a lil less receptive at that particular point in the class.
I: So I guess just trying to design programs?
R: Well, yeah, how you redesign the activity to be a little more inclusive of a lot more of the kids.
I: That's about it, I thank you very much.

INTERVIEW #23 SG-

R: Respondent
DATE: 4-5-2001
TIME: 1:34

Brief Introduction

Phone Interview Questions and Protocol
(Non-Participant school)

SCHEDULE

1. **Greeting:** Thank you for scheduling an interview with us. My name is… we are from… we are conducting this study for CSIRO Education.
2. **Statement of purpose:** To gain information about how to better serve teachers and students in extension science education programs
3. **Offer confidentiality:** Your responses will help us give CSIRO Education recommendations for improvement, but your name will not be associated with the information offered.

   Request: Grade level(s) taught: 7-12
   Subject(s) taught: Math & Science
   Years as a full-time teacher: 22-25 (lost count)

4. **Opening Statement:**

   "Throughout my research and time in Victoria thus far I've found various descriptions that aim to describe the breakdown of the Victorian school system. Could you describe the general structure of the school system present in Victoria?"

   Probes: ? are there differences between the government, Catholic, independent schools?

   R: Not much, this is a P-12 school

   ? confirm which type of school the educator teaches for

   R: Government

5. **Questioning:**

   "Have your students ever participated in any extension science education programs?"
   R: No, school too far away, we welcome people who will go far.

   (IF NO SKIP TO 2nd TO LAST QUESTION)

   Probes: ? given by what organisation?

? please describe these programs and your experiences with the organisation

? was the content and quality of the program(s) adequate?

? how were the programs received by the students?

"Are you aware of the science education programs offered by CSIRO Education, Victoria?"

R: No

"What are the primary reasons that you do not participate in any of the programs offered by CSIRO?"

R: We are 550km from Melbourne

Probes: ? get as much info as possible

"Finally, given your experiences, describe to me the key factors that you would address if you were to aid in the development of science education programs."

R: Cost, current research/issues, industrial experience into classroom, equipment and background knowledge
Also, would like to see genetics programs, can teach themselves because their "background info becomes outdated so fast".

Thank you so much for your time.

INTERVIEW #24 SG-

R: Respondent
DATE: 4-5-2001
TIME: 10:55

Phone Interview Questions and Protocol
(Non-Participant school)

SCHEDULE

1. **Greeting:** Thank you for scheduling an interview with us. My name is… we are from… we are conducting this study for CSIRO Education.
2. **Statement of purpose:** To gain information about how to better serve teachers and students in extension science education programs
3. **Offer confidentiality:** Your responses will help us give CSIRO Education recommendations for improvement, but your name will not be associated with the information offered.
   Request: Grade level(s) taught: 11 & 12
   Subject(s) taught: Psychology & Biology
   Years as a full-time teacher: 4-5

4. **Opening Statement:**

   "Throughout my research and time in Victoria thus far I've found various descriptions that aim to describe the breakdown of the Victorian school system. Could you describe the general structure of the school system present in Victoria?"

   Probes: ? are there differences between the government, Catholic, independent schools?

   R: Government schools have more restriction with curriculum, Independent schools more expensive and "resourced" as are Catholic schools.

   ? confirm which type of school the educator teaches for

   R: Government P-12

5. **Questioning:**

   "Have your students ever participated in any extension science education programs?"

   R: No, last year I was looking for genetics program for years 11 and 12

   (IF NO SKIP TO 2nd TO LAST QUESTION)

   Probes: ? given by what organisation?

? please describe these programs and your experiences with the organisation

? was the content and quality of the program(s) adequate?

? how were the programs received by the students?

"Are you aware of the science education programs offered by CSIRO Education, Victoria?"

R: No

Probes: ? did you come across any ads about CSIRO Education in journals or teaching publications?

? do you think many teachers are aware of CSIRO's educational offerings?

? what steps would be useful in taking to get the word out about CSIRO?

"What are the primary reasons that you do not participate in any of the programs offered by CSIRO?"

R: Not enough background in programs, transportation and program costs, more so transport than program costs, time issues during term, i.e. very busy, wants to get more information, wants program on genetic advances, or eradicating pests. A resource sheet might help to allow me to communicate to CSIRO what I would like to see.

Probes: ? get as much info as possible

"Finally, given your experiences, describe to me the key factors that you would address if you were to aid in the development of science education programs."

R: Low economic area, kids and parents don't like to pay for education and think it should be free. Also, transportation costs,
Also, would like to be able to bring small classes to programs without high costs.

Thank you so much for your time.

Interview Results

KEY

Numbers identify specific schools
P-Primary, S-Secondary
G-Government, C-Catholic, I-Independent,
+ Participant, - Non-participant

AWARENESS OF CSIRO PROGRAMS

Experience

- Known about CSIRO programs from previous experience (University, previous school either as teacher or student) 13SG+, 14SC+, 6PG+, 18SG+
- Aware of CSIRO programs through in-services at LabCon, laboratory technicians' branch of professional development organisation 20SI-
- Professional development "Science from Junk" program, put that into action in the classroom, became enthused about science and developed policy statement on its importance 4PC+
- Impressed with teacher in-services 8PG-
- Offer a trial session with children, even a half-hour, there is no teacher that would not take that up, creates an ongoing relationship with school community 1PG+
- Be proactive, offer a P.D. session where personnel will come to school, even at lunchtime and explain offerings 1PG+

Mailouts

- Through mail outs 4PC+, 7PC+, 6PG+, 17SC-, 16SI+, 11PG+, 1PG+, 18SG+
- Nice and colorful mailouts 17SC-, 18SG+
- Continually send out flyers, this is good in case teachers miss it the first time 17SC-
- Mail outs must tell you enough about what it's trying to achieve, material must be clear, otherwise with the pressure of time, teacher will not read it 15SI-
- Advertise via email (teachers have not yet gotten mounds and mounds of junkmail in Australia, so email marketing might still be effective) 15SI-, 21SI+

Advertisements

- Aware of programs from LabTalk advertisement 12SG+
- Has seen advertisement in Contact 17SC-, 22SC+
- Has seen advertisements in Education News 11PG+, 3PG-
- Learned of CSIRO offerings through flyers picked up at annual physics conference at Monash University, flyer appealed to teacher because it specifically said the experiments were tailored for VCE 19SC+
- Has seen advertisements, but have not grabbed attention 15SI-, 3PG-
- Notify lab staff, through Lab Lines newsletter of STAVLTB 21SI+
- Advertise in the Union newspaper, teachers have a strong union base 3PG-
- Advertise in the principal's documents from the Principal's Association 3PG-
- CSIRO should try to have a strong presence in STAV's Contact 15SI-

Word of mouth

- Know of CSIRO by word of mouth 22SC+, 10PI+
- Heard about Internet service providing science activities each month 11PG+
- Word of mouth is a good way to spread news about program offerings 11PG+

Not aware

- Was not aware of CSIRO offerings at all 24SG-, 20SI-
- Not aware of outreach programs 17SC-, 3PG-, 24SG-, 23SG-
- Though teacher is aware of program he is involved in, he knows of no others, so he hasn't thought of booking for more than one subject 19SC+

REASONS FOR PARTICIPATION IN / POSITIVE IMPRESSIONS OF PARTICIPATION IN CSIRO PROGRAMS

Content

- Meets curricular requirements 13SG+, 16SI+, 6PG+, 19SC+, 22SC+, 12SG+, 9PG+
- Good for enrichment purposes 13SG+, 4PC+, 18SG+, 10PI+
- Staff at school lacks background 6PG+, 1PG+, 4PC+, 22SC+
- Allowed science understanding and knowledge base to grow even as an adult; when teachers have a good understanding it helps them impart knowledge to students 4PC+
- School lacks equipment (better equipment brought by CSIRO) 4PC+, 19SC+, 16SI+, 6PG+, 14SC+, 11PG+, 22SC+, 1PG+

Structure

- Hands-on nature of programs 13SG+, 14SC+, 6PG+, 7PC+, 16SI+, PG+, 12SG+, 1PG+
- Good set up 13SG+, 14SC+, 18SG+, 1PG+

Structure and presentation

- Kids were engaged 6PG+, 7PC+, 22SC+, 12SG+, 19SC+
- Good fun 4PC+, 12SG+, 16SI+

Presentation

- Good educators, exciting, related well to students 13SG+, 7PC+, 6PG+, 11PG+, 18SG+, 19SC+, 16SI+, 22SC+, 12SG+, 21SI+
- Good demonstrations, very visual 7PC+, 18SG+
- Handouts were good, suitable for grade level 19SC+
- Workstations were good 18SG+
- Follow up material 4PC+

Logistics

- Reasonable cost compared to other programs 13SG+, 11PG+, 1PG+, 10PI+
- Size of program was good (20-25 students) 13SG+, 22SC+
- Outreach capability (no school buses) 4PC+, 14SC+, 11PG+, 7PC+
- Accessible booking 11PG+, 1PG+
- Very polite, helpful and organised booking coordinator 14SC+, 11PG+, 1PG+

Practically

- Gives teachers confidence that the educators know what's safe, what the safety regulations are 1PG+
- Good reputation 19SC+, 14SC+, 1PG+, 18SG+

- Good for kids to see scientific organisation at work 1PG+, 22SC+, 6PG+
- Likes Double Helix 18SG+
- 90% of students were able to answer all questions on follow up quizzes, indicating that they'd learned a lot 6PG+

Specific programs

- Forensics program was excellent 21SI+, 14SC+
- Light & Sound used as fun, since it there are no CSF requirements in that area 6PG+
- Electricity & Magnetism covers science and technology CSF outcomes perfectly, gave them experience with circuits 6PG+
- Materials testing had a good range of experiments for students of all skills 19SC+
- Materials and Structures programs provided venue for kids to go break things, stress/strain especially good 16SI+

REASONS FOR NON-PARTICIPATION IN CSIRO PROGRAMS

Logistics

- Not a lot of money spent on science 4PC+
- Costs are too large 5PI-
- Believe they are too distant to pay for transportation 17SC-, 3PG-, 24SG-, 23SG-
- School size is too small for CSIRO to travel to 5PI-
- Program did not fit into school's timetable for curriculum 19SC+

Content

- Forensic Science program offered things that teachers were capable of themselves, not a novel experience 17SC-
- Looking for genetics program 24SG-, 23SG-

SUGGESTIONS FOR IMPROVEMENT OF CSIRO PROGRAMS

More programs

- Do more programs just to inspire children to do science, for free 1PG+
- Add more variety to offerings, more programs 13SG+, 11PG+
- Do all aspects of science on the CSF, more programs 6PG+
- In primary schools, focus on covering sciences that are hard to teach, like physics and chemistry, rather than earth sciences and biology, which most primary school teachers are good at teaching 4PC+, 1PG+
- Offer more programs aimed at younger students to introduce them to science concepts, like gimmicky science programs with strangely-shaped bubble-making wands, call it "Gimmicky Science" 11PG+
- The focus on junior science (years 7-9) should be sparking an interest in the kids, not about teaching them the academic science 15SI-
- More programs for students in year 9&10 13SG+
- More chemistry programs 13SG+
- A program in organic chemistry, covering plastics and polymers would interest lots of schools for VCE 13SG+
- Offer gravity activities 19SC+

- Physics demonstrations would be particularly relevant, many junior science teachers are not well-versed in physics 17SC-
- Offer computer interfacing experiments/materials 19SC+
- Develop interactive programs for students at CSIRO website for use on schools' computers, like the Virtual Cell 15SI-
- Offer program on eradicating pests 24SG

Change in specific programs

- Chemical analysis should be used in Forensics program, physical experiments are good, but chemical experiments (a blood test) could be conducted as well 13SG+
- Some of the instructions for the experiments in Cool Chemistry were too wordy for the kids, the program was done with year 7's and some of the kids did not have good reading skills, more diagrams would be helpful 18SG+
- Physics program had 4 excellent activities, 2 not so good, students got restless, not challenging enough 14SC+
- Materials testing program included too much instruction in the beginning, laminated instructions at each workstation would be better, verbal instructions should be restricted to introduction to theory, safety and special precautions 12SG+
- Downtime in Gene Technology where kids do individual work, filling wells in the front of class, is not inclusive enough of other students, they get distracted 22SC+
- At the outset of Gene Technology program, students did not connect with what they were doing, did not realise that this is what you'd do to a blood cell, overcome this by asking questions 22SC+, 14SC+

Change in current program content

- More like Swinburne Science Show, to get kids engaged in science 15SI-
- CSIRO could offer programs that operate concurrently with science week activities (ex. one week could be Biodiversity) 11PG+
- Offer programs that correlate with the KLA host's done each term 1PG+

Change in current program structure

- More hands-on presentation, as to involved more of the class 10PI+
- Lower set up/explanation time with kids to reduce the tension of the kids just wanting to get started with the exciting hands-on work, otherwise they forget the specific goal because they are anticipating/anxious 14SC+, 10PI+

Change in current program presentation

- More demonstrators would be helpful, at a 1:10 or 1:5 ratio of CSIRO educators to students, because the teacher was unable to help all the kids at all of the workstations 18SG+, 19SC+
- First time presenters are not as inspiring and should not present at first time participant schools 16SI+

Change in current program logistics

- Program length should fit into a single class period or a double class period, appropriate for the timing at the school 13SG+, 18SG+
- Because there is so much equipment to set up, the presenter needs more help, in this case the teacher helped, but it took from her time 18SG+
- Change venue, building is old and run down, teacher was looking to get girls excited about science as a career and research, and thinks that venue was discouraging 16SI+

- Physics room is too small 19SC+
- Booking is difficult so far ahead of time, teachers often do not know their time tables yet 16SI+, 19SC+, 14SC+
- Cost is high 7PC+, 18SG+
- Organise groups of smaller country schools, so CSIRO can travel out and run a program 5PI-

Change in current publications

- *Scientrific* is written at a level too high (in terms of reading level) for students it is advertised to be aimed at (7 year olds, year 2), it would be more applicable to year 5 and 6 students 11PG+
- Double Helix is advertised to be for 10+ year olds, it is written in a manner for late primary or early secondary students 11PG+

Additional teaching support

- Send consultants out or create a website that suggests resources and activities 1PG+
- Create unit boxes of resources with instructions/experiments on included cards, particularly for CREST programs. Support teachers and schools that are feeling less capable, the teachers could borrow the unit boxes for at least 2-3 weeks. There could also be a website suggesting extension activities, describing how to extend and develop ideas on the cards. The website could suggest additional resources that could be used such as relevant multimedia, computer programs, up-to-date resources such as film, video, tv programs. This will save teachers a great deal of time. The kits should follow curricular outline. 1PG+
- Provide suggestions for how to create easy to use/make equipment for teachers to teach science concepts with 2PG+
- Provide means for teachers to develop programs for preps, middle, and secondary students, with leaflets that would outline topics or experiments, with diagrams explaining steps to conduct an experiment 11PG+
- Offer interactive component, CD-Rom, used as part of follow up or as part of teaching content, especially for kids that are not textbook learners 20SI-

OTHER SCIENCE EDUCATION PROGRAMS SCHOOLS PARTICIPATION AND IMPRESSIONS

General info

- Have not been able to get enough programs 15SI-
- Organisation will actually build program specific for school's needs 3PG-

Other programs

- Monash University, postgraduates come teach at school 15SI-
- Melbourne University, visiting scholars/students, provide science activities in correlation with CSF 15SI-, 3PG-, 20SI-
- Information received from the universities is sent too late 15SI-
- Museum 16SI+, 3PG+, 3PG-, 9PG+
- Statewide science talent search 8PG-, 20SI- (most kids do not like written work)
- Australian Science Competition, kids years 7 and 10 take multiple choice test on all disciplines of science 20SI- (most kids do not like written work)

- Scienceworks (a division of Victorian Museum) 3PG-, (good exhibits, but hard to follow up, reinforced that science is a bit of a circus) 9PG+ (were less organised and less applicable to curriculum taught) 11PG+
- Swinburne Travelling Science Show would not carry equipment upstairs, stopped coming to school, 'whiz-bang' science show demonstrating exciting, grab-'em type activities, kids sit and watch show 15SI-, 20SI-
- Zoo learned about animal classification 17SC-, 20SI-
- Healesville Sanctuary 20SI-
- Reptile show 17SC-
- Queenscliff for marine biology activities 16SI+
- Mary Creek learning about geography, collect data on creek, do chemical testing, look for invertebrates, look at vegetation, environmental assessment 17SC-
- Queenscliff, mudflat ecosystem 17SC-
- NASA's STARS programs to do experiments and communicate with astronauts 8PG-
- Starlab 17SC-
- Series, the energy park where students learn about the use of energy in the third world, hold to cut energy consumption, alternative sources of energy, and they make a series of choices on a worksheet about what sort of life they'd like to lead as adults, and then they are confronted with the consequences of those choices 17SC-
- Virtual Reality, tours and activities, kids love that 16SI+
- Chemistry program, company brings out instruments of analysis and they use those to test different things qualitatively and quantitatively 17SC-
- Ford assembly line program 8PG-
- Hospitals, to look at different diseases 20SI-
- Lindenburg Beach 9PG+

FACTORS IN GOOD SCIENCE EDUCATION PROGRAM DEVELOPMENT

Content

- Must take CSF and extend it 15SI-, 8PG-, 11PG+, 20SI-, 9PG+
- Because Australia is moving towards a more centrally based curriculum, it is important for a science education program to reflect the progression of the course of studies that runs from prep right up to VCE, and the links between those levels 3PG-
- Education should be linked level to level, so at one stage kids understand this area of movement, they will understand that aspect of physics in year 10 and 11 1PG+
- Must be unique, not something that can be done in classroom 17SC-, 15SI-, 20SI-
- Accessibility for kids (easily understood) 13SG+, 20SI-
- Must reflect current science technology 13SG+, 23SG-
- Cater to different levels, in primary schools topics should be broken into lower primary, middle primary, and upper primary 4PC+

Structure

- Should be hands-on 6PG+, 3PG-, 5PI-, 20SI-

Presentation

- Should have good presenter 8PG-, 9PG+
- Presenters must have good grasp of the needs of students, teachers, and science curriculum in general at a particular school 1PG+
- Must be adequately staffed so all kids are involved 15SI-
- Must be 'whiz-bang,' exciting 15SI-, 17SC-, 20SI-
- Wide range of experiments for gifted/non-gifted students 20SI-

Logistics

- Accessibility for teachers (easy to arrange) 15SI-
- A better program would come in once a week for 3 or 4 weeks, rather than one day doing experiments and demonstrations because it ends up seeming to magical, not real, hard to follow 9PG+

Additional teaching support

- Cater to teaching methodology 4PC+
- People that write the VCE study design and people who are really knowledgeable in areas of science should filter knowledge (down from tertiary level) to teachers through education programs 17SC-
- Cater to professional development 4PC+
- Primary school teachers are not as confident in all areas 1PG+
- Hard to find teachers confident enough to teach across the entire spectrum of sciences (taught for junior science), would like to see P.D. in specific junior science areas: physics, biology, chemistry for teachers not trained in those areas 15SI-
- Total focus on professional development, will not be unique in this for long, CSIRO should provide programs for P.D. 15SI-, 20SI-
- Hole in primary school curriculum, teachers general knowledge base in science is limited, program should make up for this 20SI-

GENERAL FACTORS REGARDING PARTICIPATION IN EXTENSION EDUCATION PROGRAMS

Content

- Content 13SG+, 3PG-, 20SI-
- Accessibility 11PG+
- Providing technical resources, primary schools, for example, are not funded for resources for experimental type work 3PG-, 1PG+, 23SG-
- Staff lacks knowledge base 15SI-, 20SI-, 8PG-, 1PG+
- Showing children the interconnection between the different KLA's 4PC+
- Teaching skills and processes since knowledge may change by the time they are adults 4PC+
- Depends on topic, and focus for term 4PC+, 8PG-, 1PG+, 24SG-, 11PG+, 9PG+
- Dependent on knowing specific outcomes, so teachers can know what program will achieve 9PG+

Structure

- Should be hands-on 8PG-, 21SI+

Logistics

- Cost 13SG+, 4PC+, 11PG+, 3PG-, 24SG-, 23SG-, 20SI-

- Cost of transportation/Outreach capability 13SG+, 4PC+, 17SC-, PG+, 3PG-, 24SG-, 5PI-, 23SG-, 9PG+
- Flexibility 9PG+
- Quality of a previous program 11PG+

SATISFACTION RANKING WITH CSIRO'S PROGRAMS
80 (13SG+), 75 (4PC+), 80 (14SC+), 100 (6PG+), 90 (16SI+), 95 (7PC+), 95 (11PG+), 90 (18SG+), 85 (19SC+), 87.5 (21SI+), 95 (1PG+), 80 (22SC+), 90 (12SG+)

SATISFACTION RANKING WITH OTHER SCIENCE EDUCATION PROGRAMS
85 (15SI-), 80 (17SC-), 90 (3PG-), 50 (20SI-), 90 has not participated since '94 (9PG+)

Focus Group Protocol
Group: CSIROSEC Educators
April 10th, 12th

OBJECTIVES

1. To obtain a description of a successful extension science education program
2. To obtain an idea of how the CSIRO programs compare to this description
3. To obtain suggestions for improvement of CSIRO programs
4. To gain an understanding of what might inhibit the successful development and conduction of CSIRO programs

STRUCTURE

5. "Group interview" directed as a conversation with a purpose
6. Funnel shaped design format using domain questions followed up with probes
7. Interviewer role: Unsophisticated sympathetic

SCHEDULE

8. **Greeting:** Thank you for participating in this focus group. [Introduce ourselves] We are from Worcester Polytechnic Institute, an American university.
9. **Statement of purpose:** We are gathering information about your science education programs in order to provide the CSIRO Education with recommendations on how to improve participation levels.
10. **Opening Statement:**

To begin, can we have some introductions around the group?

From our interviews and surveys, we've been offered information about what teachers think is most important in developing and conducting extension science education programs. Please describe what you consider to be the most important factors of an ideal program.

>Probe: Factors that they can control such as
>Probe: How do you engage the students?
>Probe: What do you think of the so-called 'whiz-bang' science shows?

11. **Questioning:**

In discussing what you consider to be an ideal program, how well do the programs that you run match up to this ideal?

>Probe: Content
Presentation
Program Structure
>Probe: What makes some programs more successful than others?
>Probe: How do you think your programs compare to other programs?

Describe the aspects of your offerings that you feel need improvement.

How could these aspects be improved?

Are there any factors that inhibit the improvement of your offerings?

>Probe: Cost
Lack of new ideas
Not aware of teachers' expectations

>Probe: What goes into the development of a program?

Focus Group #1 Field Notes

Note Takers: Shangari B. Meleschi & Matt Douglas
Date: 10/4/01
Time: 3:35pm
Subjects to Observe: Rebecca, Simon U., Mary, Meg (M), Chris (C), Rosemary (R)

Start of Focus Group
Time-
3:35pm (question A)

Rebecca: have to be enthusiastic
R-fun
M-keeps students' attention
C-something that teachers can't see themselves doing – in terms of equipment or understanding
M-cover general concepts
C-things that teachers want them to teach, but that means different opinions of some teachers exists.
Simon: surprising. "I don't think it's our job to teach"
Mary: have to show students relevant to real life and real world. "Does CSF relevant come across in the flyers"?

3:40pm

Rebecca: (active listening)
Simon: we use summer to make programs CSF II friendly. Programs good for making an intro or review to a class topic.
Mary: (active listening)
M-their programs that didn't explicitly saw they were CSF friendly nobody noticed.
C-they changed the names to make them sound more relevant
M-try and make people be one with the science
C-one hour is not enough to teach a single topic
M&C-people want CSIRO to teach whole topics
M-teaching requires repetition
C-programs are good for starting-off points for topics to be addressed in a classroom
R-teachers don't always understand what the goals of the programs are
C-teachers don't always read the materials they send them. people who read materials don't always understand them.
M- a goal is to tap into the kids' psyche
C-cover topics teachers lack confidence in
C- try to link in things from CSIRO
M – competitors such as science fairs, presenters, questacon allow teachers to just baby-sit students
C-Swinburne had lots of fun stuff, but average presenters.
Content, price, and presenters are key to success
M-presenters are seen as experts
C-people not prepared for young folks

3:43pm

Rebecca: (active listening)
Simon: teachers fail to read all materials. Teachers expect "Yoda scientist". Teacher expectations often don't match what CSIRO has to offer.
Mary: (active listening)
3:45pm

Rebecca: (active listening)
Simon: Air & Weather liquid nitrogen is good, something that I got my monies worth for, teachers also pay for convenience.
Mary: Forensic program is appealing because it is well linked to flyer and title word "Who Dunn it"?

3:48pm

Rebecca: (active listening)
Simon: Used to work for ScienceWorks, and had to use objects from museum collection (constraints). I find CSIRO programs to be more flexible than others.
Mary: (active listening)

3:50pm (question C)

Rebecca: I don't know.
Simon: A lot of people don't appreciate what CSIRO does. Teachers are disappointed with the image of presenters.
Mary: (active listening)

3:55pm

Rebecca: There's such a range of anticipation from teachers.
Simon: Teachers book programs without a whole lot of knowledge of the program.
C-teachers' anticipations are not a marketing issue. They're an information issue.
M-PR folks need to help teachers understand
Mary: Must outline time, savings, no travel time, etc.
C- a key is keeping offerings diverse – in-services, VCE workshops…
M – we should keep track of what teachers want
C- can't ask them what they 'really want' – must be careful with the price

4:00pm

Rebecca: (active listening)
R-there are transportation and logistical issues for teachers
Simon: Must plug outreach opportunities. Trying to target people who haven't had us.
C – we come to you and it's as good as if we didn't
- may be seen as a budget science show
- some teachers have no idea about the diversity and quality of what CSIRO does
Mary: It all depends on the science coordinator who gets the information.

M – the communication in schools is not very good. Some teachers never see stuff. A marketing exec. is not feasible.

C – some programs get dropped over time
- increasing diversity may not require new staff

M – flexibility is a key to success – reading audiences, changing shows, time & resources
C – eval forms help tweak shows.
4:05pm

Rebecca: (active listening)
Simon: Few staff that are well versed in what we do. Cars offer a bit more flexibility in booking for teachers.
Mary: (active listening)
C – staff, cars, and gear affect the flexibility of programs
- only one vehicle can transport chemicals
- David looks at most eval forms

R – they call schools if they have negative comments
4:10pm

(Question E)
C – money inhibits improvement. Development requires a lot of staff hours. Equipment can be very expensive
Rebecca: (active listening)
Simon: Funds do inhibit improvements. Text books for ideas. Don't really cater for prep children, idea is floating around.
Mary: Do we get a high percentage back? (Presenter evaluations)

R – kindergarten teachers want more stuff – students at that age have short attention spans

C – when he worked in Sydney they did a series of sessions for a wealthier school in forensics. Week 1: intro and paper experiments to be completed; week 2: hands-on experiments; week 3: follow up discussions; week 4: mock court case

4:15pm (*separate conversations*)

4:17pm
C – sending out kits is another idea
Rebecca: (active listening)
Simon: Asked a lot if equipment is sent out? Even if you give them resources, they like to have them for support and ease.
C – In-services must provide experiments that are repeatable and spelled out.
- should offer in-services on separate topics
- should offer teacher notes with programs

R – can offer full teacher notes for a nominal cost
Mary: Cookbook style in-service oh how to set up a given program good but then they will only book you once a year. $5 is not that much.

4:20pm

Rebecca: (active listening)
Simon: Teachers act like they are paying for everything
Mary: excursion budget per child in not that much, $8 per kid.
4:25pm (*Tape stopped because of conversations direction*)

C – staff PD is also good, though time is an issue
- conferences are a good marketing method
- hold sessions for teachers
- send staff to other organisations instead of doing sessions all the time

Rebecca: (active listening)
Simon: I want to go out and see competitors programs
Mary: (active listening)

4:28pm

Rebecca: (active listening)
Simon: Looking at other programs lets us evaluate our standards.
Mary: (active listening)

4:30 (*CSIRO presenter comes into the room and disturbs last bits of conversation*)

End of Focus Group

Focus Group #2 Field Notes

Note Takers: Jessica King & Matt Douglas
Date: 12/4/01
Time: 2:50pm
Subjects to Observe: Michael, David (DT), Jacinta, Christina, Ava, Mary, Daniel

Start of Focus Group
Time-
2:50 introduction (question A)

Jacinta: Fun
Ava: Educational
Michael: Sells well, hands-on
Christina: Shouldn't go more than 20 minutes without activity
A: Different activities to wow them
Daniel: CSF-linked; easy to organise and bring to school; promote CSIRO, so the program design must work within constraints; hands-on
J: Programs should have a variety of things – for different learning levels
Daniel: and different styles of learners

2:57
Daniel: Programs should extend things already discussed in class; try to make students see why they do certain types of experiments
M: Program should complement, and provide something that teachers cannot do themselves
C: Schools can't afford equipment, so it is easier to bring in the CSIRO
M: Best programs have a point to them, problem-solving

(question A3)
C: 'Whiz-bang' is terrific for watching, but you can't follow it up, and it is not something kids can do themselves, like the "seat of nails" trick, use a little of it for excitement, but I remember watching on TV shows that would have chemical experiments with chemicals that kids could never use, so it was not accessible
DT: Kids can be pressing buttons and just not even thinking
Daniel: 'whiz-bang' shows are very exciting, but there should be an educational basis
C: Whiz-bang makes a great starter and finisher, you need some of it
…
often you need 'whiz-bang' to get students interested in the program

(question B)
3:00
A: Pretty well
C: Pretty well
Daniel: programs have their strengths and weaknesses
J: they're always works in progress
Daniel: Programs are modified often times by changes in content requirements

A: CSIRO programs link well to the CSF and teachers often call for looking for a program that is relevant to what is being covered at the school, they are usually pleased from past experiences.
M: One thing we don't always do so well is providing support material
DT: We have just started providing support material for all the programs, to give more support to the teacher. We hope news of that will spread by word of mouth. You want the kids to have a good time, but you also want to convince the teacher that the kids are having a good time. Right now we give out support material, but do not promote it.
M: It might turn into an expectation, and we are not ready for that, we are still getting feedback.
Daniel: we'd promote our teachers' notes once we've got them for more programs

(question B2)
Daniel: programs that are most popular are the ones teachers have trouble teaching on their own.

(question B3)
A: Teachers call and say that Swinburne hadn't explained enough (relates back to teacher notes too)
DT: We compare pretty well, we keep focused, like we don't do environmental things, Gould League does that, we don't work with animals, that is the zoo and we don't do much with plants, since the Botanical Gardens covers that. We are not a science museum, we don't have big displays. I think we are good for hands-on practical science.
C: At Showquest the Science Circus they have has this great hands-on thing, but it doesn't travel with the show.
Daniel: In marketing, many teachers aren't confident at certain levels
J: The incursions are valuable for schools; it's a great benefit
C: Yeah because at the Observatory schools couldn't afford a bus and paying for the kids.
Daniel: Teachers appreciate the way (CSIRO) people present themselves
C: We don't all come in wearing lab coats and glasses and using big words
A: I am not sure about other programs, but I know that most schools like us because our staff is knowledgeable and friendly, delighted with the info that education officers provide about the programs over the phone, with great staff- that ravels by word of mouth.

3:13
(question C)
DT: I think the cost might need to be lowered
M: We are limited in the equipment that we can provide and maintain, fit in the car and carry
Daniel: We could do a lot more with P-2; programs start out as designed for 3-4 and made harder for 5-6 & easier for P-2 (weakness with primary programs)
M: That reflects most of our educators training, which is more high school trained (more secondary teachers work there)
DT: No one has primary school training, more specific science backgrounds, which is more secondary

J: (Prep) students "struggle just getting through the day," so programs can't throw anything too tricky at them or they'd have trouble
C: They are very excitable
M: Have to be able to touch it
Daniel: 'whiz-bang' shows can seem like magic to them
C: They may not consciously remember what they've been shown, but they will make connections
DT: My nephew in the country talked about the session for days, my brother said, we do make a big impression

3:19
(question E2)
DT: Money
M: Depend on demand, when teachers called and requested energy programs, first we tried to incorporate it into the programs we had, but eventually we made a new program
Daniel: Programs are developed and changed to follow the CSF
DT: We've picked up programs from what other states do as well
(when do you scrap a program)
M: Sometimes the list is just made longer or programs that are not booked often are combined
C: Eventually there may be no one left to do the program
DT: We should look into paring the list down
3:20
A: We should have marketed the wool program for (some national) week
DT: We should market it for federation week

(asked about using holiday science days for tests of real potential programs)
DT: No we don't test, we just rely on the expertise of the presenter
A: We use evaluation sheets to determine how it went, whether it was what they expected

3:25 (mismatches in what is offered and what teachers expect)
DT: Occasionally
Daniel: are rare because public relations folks chat with the teachers to see if programs were what they expected, and Ava sends a fax telling them what to expect
A: And now if they have access to the web, all aspects and costs are on the web
Daniel: Only mismatch when they don't read the flyer

(asked if this is a marketing problem)
M We could improve on what we send
A: We are flat out with money and time
Daniel: Flyers have trouble getting to the right people; email is more direct; they now request email from teachers who book programs and attend conferences. Send emails to lab techs, they will book.
DT: Basically we can improve the best by making sure there are teachers notes, and written backup, by watching each other present, the presenters are good, but it would help for us all to pick up ideas for self-improvement, we could lower costs by making things more web-based- teachers notes and bookings would allow us to be more accessible

A: Couldn't we use the database to get emails?
DT: There is a gatekeeper, it wouldn't be allowed
A: That could be trouble, but we can try to get emails at conferences
Daniel: Couldn't we ask for emails when we book?
J: Right now, I know of parents in our holiday programs that did not know what we do. Parents would take information to schools who think the programs are a good idea; possibly could collect parents' email.
Daniel: Holiday programs are good programs
C: I am on an email list, this teacher mails out an experiment once a week, they are easy, not for CSIROSEC, but it promotes his science show
DT: I would be interested in that, can you send one to me?
C: Yes

End of Focus Group

CSIRO Secondary Science Program

Innovative and Creative Science Programs

Great classes at great prices! Most classes travel to your school! No need to organise transport for your students!

Prices quoted are GST Inclusive

Cool Chemical Science (Years 7&8)

Students work on a series of innovative experiments using unusual chemicals and materials. Mostly hands-on. Duration: 1hr. Cost: $5.50 per student at your school or $4.70 per student at the centre, max 30 students.

Science Procedures and Processes (Years 7&8)

A hands on session that examines the scientific approach in detail. Look at different experiment designs, measure & collect data and analyse results. Duration: 1.5 hrs. Cost: $5.50 per student at your school, or $4.70 per student at the centre with a max of 30 students.

Oz Science (Yrs 8-10)

New for Term 4!

Oz Science is a hands-on science unit that highlights significant Australian scientific research over the past century. Held at the CSIRO Science Education Centre, this 90 minute session helps students in years 8 to 10 become familiar with the work of some

Forensics and Food Technology (Years 9-12)

(Tridium on Trial) – Term 4

Through sloppy hygiene practices, a Deli magnate stands accused of manslaughter. Through practical investigation of the evidence, find out the truth. Duration: 1.5 hrs. Cost: $4.70 per student at the centre with a max of 30 students.

Electronics (Years 9&10)

Let your students enter the world of electronics. Build circuits for light sensors, fire alarms, bike flashers, sirens and even other devices. Use components such as resistors, capacitors, diodes (LEDs), transistors and integrated circuits (ICs), as outlined in the new CSF Physical Science strand 'Energy and its Uses'. Duration: 1.5 hrs Cost: $5.50 per student at your school, or $4.70 per student at the centre with a max of 30 students.

Flat Cats and Mind Games (Years 7-10)
Science to make you think!
What you see is not always what you expect or believe. With unusual and dramatic demonstrations, this show encourages fresh thinking about science and technology. Duration: 1 hr. Cost: $3.00 per student at your school with a max of 60 students, or $3.50 per student at the centre with a max 30 students.

Forensic Frenzy (Years 7-10)
Solve a crime by analysing the evidence left at the scene of the crime! Your students will gain an exciting and practical insight into the world of Forensic Science. Duration: 1.5 hrs. Cost: $5.50 per student at your school, or $4.70 per student at the centre with a max of 30 students.

Gene Technology (Years 9&10)
Introduce your students to current techniques used in the rapidly developing area of Genetic Engineering.
Students will perform a DNA extraction and a gel electrophoresis experiment. Duration: 1.5 hrs. Cost: $6.00 per student at your school, or $5.50 per student at the centre with a max of 30 students.

NOTE: Minimum booking requirements per class apply. Minimum booking requirement per visit of $300 (metro) and $420 (country) applies. Country schools, extra costs per student in sessions apply.
Contact the CSIRO Science Education Centre for details. Phone 9252 6387 or 9252 6410 Fax 9252 6256.
Internet address: www.csiro.au/melbcsirosec JCSAV T2 01

CSIRO Primary Science Program

CSIRO hands-on Science classes and Science and Technology shows can come to your school with experiments and demonstration: year levels. We have exciting and CSF relevant programs for all year levels. Some programs are also available at our centre in High lower costs than shown below. Class sizes at the centre may also vary from those shown below.

Programs available for Years P - 4

Prices quoted are GST Inclusive

Air and Weather Show
Science in Action Show
For Years P-2: Both 30 min duration, max 60 students, cost $2.20 per student at your school
For Years 3&4: Both 1 hr duration, max 60 students, cost: $3.00 per student at your school
Electricity and Magnetism Show with hands on activities
Light and Sound Show with hands on activities
Force and Movement Show with hands on activities NEW!
Energy and Its Uses Show with hands on activities
All 1 hr duration, max 60 students, cost: $3.00 per student at your school
Reaction and Change A hands on session
1 hr duration at your school, max 30 students, cost $3.50 per student
Lego Technic Workshop A hands on session.
For Years 3&4 only: Duration 1.5 hr, max 30 students, cost: $5.50 per student at your school

Programs available for Years 5 & 6

Biological Science
Science Behind the Baa!
Exploring Science
All hands on sessions. All 1 hr duration at your school, max 30 students, cost $3.50 per student.
Electricity and Magnetism Show with hands on activities
Light and Sound Show with hands on activities
Force and Movement Show with hands on activities NEW! NEW!
Energy and Its Uses Show with hands on activities
All 1 hr duration, max 60 students, cost: $3.00 per student at your school.

Cool Chemical Science

Students work on a series of innovative experiments using unusual chemicals and materials. All hands on. Duratio

cost: $5.50 per student at your school, max 30 students.

Lego Technic Workshop Duration 1.5 hr, max 30 students, cost: $5.50 per student at your school
Lego Robotics Workshop
A hands on session. Engage and amaze your students when they explore technology with programmable robots.
Duration: 1.5 hrs, cost $5.50 per student at your school with a max of 30 students.
Forensic Frenzy (Year 6 only) Duration 1.5 hrs, max 30 students, cost: $5.50 per student at your school.
Science Procedures and Processes for Year 6 only.

A hands on session that examines the scientific approach in detail. Look at different experiment designs, measure & collec

and analyse results.

Duration: 1.5 hrs, cost $5.50 per student at your school.

NOTE: Minimum booking requirements per class apply. Minimum booking requirement per visit of $300 (metro) and $420 (country) applies. Country schools, extra costs per student in sessions apply.
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Internet address: www.csiro.au/melbcsirosec JCSAV T2 2001

8 STATISTICAL LOCAL AREAS, Ranked by Median Weekly Household Income

Rank	Statistical Local Area	$
1	Manningham (C) - East	1 070
2	Nillumbik (S) - South	1 019
3	Nillumbik (S) - South-West	980
4	Knox (C) - South	946
5	Monash (C) - Waverley East	930
6	Boroondara (C) - Kew	927
7	Bayside (C) - Brighton	917
8	Boroondara (C) - Camberwell S.	916
9	Nillumbik (S) Bal	898
10	Manningham (C) - West	883
11	Boroondara (C) - Camberwell N.	877
12	Melton (S) - East	866
13	Stonnington (C) - Malvern	855
14	Hume (C) - Craigieburn	842
15	Casey (C) - Berwick	841
16	Wyndham (C) - North-West	839
17	Hume (C) - Sunbury	835
18	Banyule (C) - North	814
19	Wyndham (C) - Werribee	797
20	Whittlesea (C) - North	787
21	Frankston (C) - East	784
22	Macedon Ranges (S) Bal	783
23	Whitehorse (C) - Nunawading E.	781
24	Knox (C) - North	780
25	Maroondah (C) - Croydon	773
26	Brimbank (C) - Keilor	767
27	Greater Geelong (C) - Pt C	764
28	Boroondara (C) - Hawthorn	762
29	La Trobe (S) Bal	758
30	Yarra Ranges (S) - South-West	757
31	Macedon Ranges (S) - Romsey	756
32	Melbourne (C) - Inner	750
33	Wyndham (C) Bal	750
34	Bayside (C) - South	748
35	Port Phillip (C) - West	747
36	Casey (C) - Hallam	744
37	Stonnington (C) - Prahran	743
38	Monash (C) - Waverley West	743
39	Casey (C) - South	736
40	Moonee Valley (C) - West	734
41	Casey (C) - Cranbourne	730
42	Whittlesea (C) - South	729
43	Cardinia (S) - North	721
44	Melton (S) Bal	720
45	Gr. Bendigo (C) - S'saye	718
46	Whitehorse (C) - Nunawading W.	712
47	Whitehorse (C) - Box Hill	708
48	Banyule (C) - Heidelberg	702
49	Maroondah (C) - Ringwood	698
50	Melbourne (C) - Remainder	698
51	Yarra (C) - North	692
52	Glen Eira (C) - South	685
53	Moorabool (S) - Bacchus Marsh	677
54	Mitchell (S) - South	677
55	Cardinia (S) - Pakenham	670
56	Mornington P'sula (S) - West	664
57	Mornington P'sula (S) - East	662
58	Kingston (C) - North	661
59	Glen Eira (C) - Caulfield	651
60	Hobsons Bay (C) - Williamstown	651
61	Hobsons Bay (C) - Altona	651
62	Hume (C) - Broadmeadows	648
63	Moonee Valley (C) - Essendon	645
64	Yarra (C) - Richmond	644
65	Surf Coast (S) - East	640
66	South Barwon - Inner	638
67	Gr. Shepparton (C) - Pt B East	638
68	Wodonga (RC)	627
69	Kingston (C) - South	625
70	Monash (C) - South-West	623
71	La Trobe (S) - Traralgon	622
72	Golden Plains (S) - South-East	620
73	Wangaratta (RC) - North	618
74	Newtown	615
75	Port Phillip (C) - St Kilda	609
76	Towong (S) - Pt A	608
77	Horsham (RC) Bal	606
78	Gr. Dandenong (C) Bal	604
79	Cardinia (S) - South	603
80	Bellarine - Inner	596
81	Yarra Ranges (S) - North	593
82	Brimbank (C) - Sunshine	590
83	Ballarat (C) - North	589
84	Wangaratta (RC) - South	588
85	Darebin (C) - Northcote	585
86	Wellington (S) - Avon	584
87	Glenelg (S) - Heywood	582
88	Frankston (C) - West	581
89	Mitchell (S) - North	581
90	Gr. Bendigo (C) - Inner North	579
91	Moreland (C) - Brunswick	577
92	Indigo (S) - Pt B	577
93	Murrindindi (S) - West	577
94	Corangamite (S) - South	576
95	Moreland (C) - Coburg	575
96	Ballarat (C) - Inner North	574
97	Indigo (S) - Pt A	573
98	Moorabool (S) - Ballan	572
99	Golden Plains (S) - North-West	570
100	Gr. Dandenong (C) - Dandenong	569
101	Ballarat (C) - South	569
102	Baw Baw (S) - Pt A	569
103	Moorabool (S) - West	568
104	Gr. Bendigo (C) - Inner West	567
105	Wellington (S) - Sale	563
106	Colac-Otway (S) - North	559
107	Yarra Ranges (S) - Central	558
108	Gr. Shepparton (C) - Pt A	550
109	Moyne (S) - South	549
110	Baw Baw (S) - Pt B West	548
111	Gr. Bendigo (C) - Inner East	548
112	Delatite (S) - North	548
113	Macedon Ranges (S) - Kyneton	546
114	Gr. Shepparton (C) - Pt B West	545
115	Glenelg (S) - Portland	545
116	Moreland (C) - North	543
117	Corio - Inner	542
118	Campaspe (S) - Kyabram	540
119	Campaspe (S) - Rochester	539
120	Baw Baw (S) - Pt B East	538

8 STATISTICAL LOCAL AREAS, Ranked by Median Weekly Household Income *continued*

Rank	Statistical Local Area	$
121	Mildura (RC) - Pt B	534
122	Greater Geelong (C) - Pt B	532
123	Swan Hill (RC) - Robinvale	527
124	South Gippsland (S) - Central	527
125	Alpine (S) - West	527
126	Darebin (C) - Preston	525
127	Wangaratta (RC) - Central	519
128	Moyne (S) - North-West	518
129	Warrnambool (C)	516
130	E. Gippsland (S) - South-West	513
131	N. Grampians (S) - Stawell	511
132	Campaspe (S) - Echuca	506
133	S. Grampians (S) Bal	504
134	South Gippsland (S) - West	502
135	Wellington (S) - Maffra	498
136	Geelong	496
137	Mildura (RC) - Pt A	496
138	Surf Coast (S) - West	496
139	Maribyrnong (C)	495
140	Swan Hill (RC) - Central	495
141	Queenscliffe (B)	493
142	Moira (S) - West	492
143	Ararat (RC)	491
144	Horsham (RC) - Central	489
145	La Trobe (S) - Morwell	486
146	Wellington (S) - Rosedale	480
147	S. Grampians (S) - Hamilton	480
148	Gr. Bendigo (C) - Pt B	480
149	Ballarat (C) - Central	479
150	Yarriambiack (S) - South	478
151	Geelong West	476
152	Delatite (S) - South	475
153	Swan Hill (RC) Bal	474
154	Moyne (S) - North-East	473
155	Delatite (S) - Benalla	473
156	Moira (S) - East	470
157	Colac-Otway (S) - Colac	469
158	Gannawarra (S)	469
159	Loddon (S) - North	468
160	Gr. Bendigo (C) - Central	466
161	Hepburn (S) - West	466
162	Yarra Ranges (S) - Pt B	464
163	Yarriambiack (S) - North	463
164	Alpine (S) - East	463
165	Wellington (S) - Alberton	463
166	Buloke (S) - North	462
167	Campaspe (S) - South	462
168	Murrindindi (S) - East	462
169	Corangamite (S) - North	460
170	Mount Alexander (S) Bal	457
171	South Gippsland (S) - East	456
172	Colac-Otway (S) - South	455
173	Towong (S) - Pt B	454
174	Gr. Bendigo (C) - Eaglehawk	451
175	Hindmarsh (S)	449
176	Buloke (S) - South	448
177	E. Gippsland (S) Bal	446
178	Glenelg (S) - North	443
179	La Trobe (S) - Moe	439
180	N. Grampians (S) - St Arnaud	438
181	West Wimmera (S)	436
182	Pyrenees (S) - South	430
183	E. Gippsland (S) - Bairnsdale	430
184	S. Grampians (S) - Wannon	425
185	Strathbogie (S)	423
186	E. Gippsland (S) - Orbost	416
187	Hepburn (S) - East	415
188	C. Goldfields (S) Bal	414
189	Bass Coast (S) Bal	411
190	Mornington Pnsula (S) - South	410
191	Mount Alexander (S) - C'maine	409
192	C. Goldfields (S) - M'borough	406
193	Bass Coast (S) - Phillip Is.	391
194	Pyrenees (S) - North	385
195	Loddon (S) - South	373
196	French Island	259
197	Bass Strait Islands	—
198	Yallourn Works Area	—
199	Lady Julia Percy Island	—

Name/Organisation: Swinburne Traveling Science Show (Swinburne University of Technology)
Location: based at Swinburne University
Offerings-
Program Types:

- Analytical Chemistry, Applied Genetics for VCE Chemistry and Biology for years 7-10 that include demonstrations to explore physical science topics. Students can explore UV-Visible Spectrophotometric analysis to determine the iron content of wine, or use gel electrophoresis of DNA restriction fragments, and the transformation of plasmid DNA in bacteria.
- Light and Sound, Electricity and Magnetism for year 7-8 are exploratory workshops to motivate junior science students. Practical experiences would include investigating simple electric motors and generators, and comparing and designing series and parallel circuits and measuring current flow in various circuits.
- Forensic Science, Acid-Base Chemistry, Electricity and Magnetism for years 10+ is designed to highlight a range of science study and careers. Program techniques to be explored include ink stain chromatography, microscopic examination of powders and fibres, and chemical tests on powders and fibres.

Outreach: Yes
Cost: $75-350 per session (25 student max per session), $50 booking deposit, $100 cancellation fee (if with less than 5 working days notice)
Structure: lecture based with hands-on components interspersed throughout.
Curriculum:
Advertising Methods: Direct mail, flyers, word of mouth, etc…
Web References @: http://www.swin.edu.au/science
Phone #: (03) 9214 8503 Fax#: (03) 9214 5003

Name/Organisation: Melbourne University
Location: Work with Carlton Gardens Primary School
Offerings- In undergraduate teaching students in their third year get a micro-teaching experience where children come to the University, fourth year students spend an extended period of time in school itself working with teachers on science and technology
Program Types:

- Empowering children for their world
- Teaching children how science applies to life
- Professional development programs

Outreach: (to Carlton Gardens)
Cost: none
Structure: Hands-on
Curriculum: Relating science to technology to society
Advertising Methods:
Web References @: http://www.unimelb.edu.au
Phone #: Roger Cross (03) 8344 8550

Name/Organisation: Melbourne Museum
Location: Carlton Gardens, Carlton, GPO Box 666E, Melbourne 3001
Offerings-
Program Types:

- Forest Gallery-interpretation of Victoria's forest environment
- Mind and Body Gallery- interactive exhibitions that explore replacement body parts, and then discuss genetically modified foods, geared towards Human Systems for Level 4 Biological Science
- Bunjilaka- the Aboriginal Centre- Listen to stories, view art and admire cultural objects at Bunjilaka and examine the history of Australia's Indigenous people. Recommended for Art, English and SOSE programs,
- Australia Gallery- see how Melbourne has evolved over time. Ideal for studying the processes of history or planning issues.
- Children's Museum- a world created especially for 8 year olds, with size, colour, movement and form themes, the kids explore plant, animal, mineral and human growth.
- Science, Life & Evolution Galleries- gigantic dinosaur exhibits and exhibits ideal for evolution particularly pertaining to flora and fauna. Programs for all CSF strands and levels offered.
- Technology- Digital technologies, computers and communication are all featured in the Technology exhibition. Recommended for all ages.

Outreach: Yes
Cost: $3.50 per student (20-student minimum per show)

- Structure: Museum Outreach sessions are led by a skilled presenter
- Each presentation includes a selection of specimens, objects, replicas and photographs.
- Items presented can be handled
- There are 6 topics to choose from
- Each session is one hour in duration

Curriculum: Support key areas in: The Arts, English, Health and Physical Education, LOTE, Science, Studies of Society and Environment, and Technology.
Advertising Methods: Flyers, booklets, mailings,…
Web References @:http://Melbourne.museum.vic.gov.au
Phone #: 03 8341 7729

Name/Organisation: Melbourne Zoo
Location: P.O Box 74, Parkville VIC 3052
Offerings-
Program Types:

- Education Officers can tailor **Prep** to **VCE** programs to suit your student and curriculum needs across all key learning areas with emphasis on Science and SOSE.

Outreach: Available only through V-Tel teleconferencing machines that provide programming to schools with the appropriate hardware and software.
Cost: $5.50-9.40 (per person based by type of admission and program)
Structure:
Curriculum: Key Learning Areas to support the CSF II and VCE Study Designs.
Advertising Methods: Web advertisement, direct mailings to schools and educational organisations.
Web References @: http://www.zoo.org.au/Education
Phone #: (03) 9285 9355 Fax#: (03) 9285 9340

Name/Organisation: ScienceWorks
Location: 2 Booker Street, Spotswood 3015
Offerings-
Program Types:

- Whodunit? – the hard facts on Forensic Science are presented in an exhibition (i.e. fingerprints, DNA, identkits, maggots to establish time of death, hair matching and the structure of hair samples, footprints, blood groups, chromatography, soil analysis, fibre matching, handwriting analysis) for years 4-10.
- VCE Excellence Exhibition- Technology, Graphic Communication and Media for years 7-12.
- Future Harvest- explores the future of food and farming in Victoria using stories from farmers from across Victoria. The program is interactive and gives students the opportunity to investigate issues of innovation and sustainability for years 4-12.
- Stayin' Alive- students find out about the senses, how we obtain information about our environment and how we use technology to survive in extreme environments for years 3-10.
- Sports Works- explores the science and technology of sport through the themes of fitness, movement and skills for years 1-12.
- Special Effects – (The Sequel)- An interactive exhibition on techniques and technology used to create the illusions and fantasies of film and television for years 1-12.
- Also have teacher professional development programs.

Outreach: Flyers
Cost: An exhibition booking costs $4.10 per student, A planetarium show costs $7.20 per student, Only $30.00 per student for sleep over program (other program costs are additional).
Structure:
Curriculum:
Advertising Methods:
Web References @: http://scienceworks.museum.vic.gov.au
Phone #: (03) 9392 4800 Fax#: (03) 9391 0100

Name/Organisation: La Trobe University
Location: La Trobe University
Offerings-
Program Types:

- Year 10 & 11 Technology Programme (Engineering)- the department of Electronic Engineering at La Trobe University offering half-day workshops to expose students to various current technologies in the electrical engineering field. Designed to develop students understanding and awareness of how electronics are used to improve society, the sessions relate to the electronics component of the science curriculum. These workshops include hands-on sessions building various electronic components (i.e. LED flasher circuit, AM/FM radio bug, etc.) which student get to keep, and offer a choice of interactive demonstrations on various aspects of electrical engineering (i.e. a biomedical engineering lab tour, talk on the developments telecommunications, demonstration of a traffic light controller, "show and tell" session on the evolution of computer hardware).
- Girls in Technology Programme (Engineering)- the department of Electronic Engineering at La Trobe University offering mirror program to the year 10 & 1 technology program with the twist of adding a panel session with current female students explaining what it's like studying Electronic Engineering, typical career outcomes for graduates, and a course information session.
- VCE Physics Workshops (Electronics)- the department of Electronic Engineering at La Trobe University offering half-day workshops for groups of VCE Physics students in Unit 3 Sound, Electronic Systems & Electric Power. Two separate workshops offered, The CRO (Cathode Ray Oscilloscope) and The Digital Logic Gates. Both workshops offer hands-on experiences and task sheet to accompany them.

Outreach:
Cost: $5/ student, some programs are free.
Structure: lecture based with hands-on components interspersed throughout.
Curriculum:
Advertising Methods: Flyers
Web References @:
Phone #: 9479 1923 (Ms. Angela Maplestone- booking contact)

Appendix S – Current CSIRO Program Evaluation Form

EVALUATION SHEET

Your comments are valued and will help us to keep developing programs that are relevant to the needs of teachers. Your assistance by filling in this form is greatly appreciated.

Please fax or mail the completed form to:

The Manager
CSIRO Science Education Centre.
PO Box 56, Highett, Vic 3190
Fax: (03) 9252 6256

Fax: (03) 9252 6256

SCHOOL: _____ **DATE OF PROGRAM:** _____

CLASS TEACHER (optional): _____

PROGRAM: _____ **NAME OF PRESENTER:** _____

1. *Please tick the appropriate box:*

	strongly agree	agree	neutral	disagree	strongly disagree
Program was worthwhile					
I would use this program again					
The program was informative					
The program was entertaining					
The program related well to the CSF					
Class content appropriate for this age group					
Explanations appropriate for this age group					
Activities appropriate for this age group					
Presentation encouraged student participation					

2. *Complete*

This class would be better if . . ..

I would like to see another class/ show being offered in the following science area:

Any other comments . . ..

Appendix T – Suggested CSIRO Program Evaluation Form

EVALUATION SHEET

Your comments are valued and will help us continue to develop programs that are relevant to the needs of teachers. Your assistance by filling in this evaluation sheet is greatly appreciated.

Please fax or mail the completed evaluation sheet to:

The Manager
CSIRO Science Education Centre
PO Box 56, Highett, Vic 3190
Fax: (03) 9252 6256

SCHOOL NAME: _____

CLASS TEACHER (optional): _____ EMAIL: _____

GRADE LEVEL(S) TAUGHT: P 1 2 3 4 5 6 7 8 9 10 11 12

SUBJECT(S) TAUGHT (Please tick the appropriate boxes):

? General Science ? Chemistry ? Physics

? Earth and Space ? Biology ? Other:_____

PROGRAM: _____ DATE OF PROGRAM: _____

NAME OF PRESENTER: _____

1. *Please tick the appropriate box :*

	strongly agree	agree	neutral	disagree	strongly disagree
The program was entertaining					
The presentation encouraged student participation					
The program related well to the CSF					
Class format and activities were appropriate for this age group					
Class information and explanations were appropriate for this age group					
Prior to the class I had a good knowledge of the materials and related subjects					
Class support materials were useful (if applicable)					
Program cost was appropriate					
This program was easy to book					
This program was easy/convenient to host					
I would use this program again					

2. Complete :

This class would be better if . . .

I would like to see another class/show being offered in the following science area:

Additional comments . . .

Do you know of anyone else who would be interested in our programs?

Name: _____

Contact Information: _____

The science educators that were surveyed in this project had a variety of backgrounds. This section seeks to develop a stereotypical teacher from data gathered on them and their preferences in the collected surveys in order to give CSIRO Education an idea of the concerns of teachers of all backgrounds.

U.1 Secondary Country Non-Participants

Based on the survey responses (19 responses), the average regional secondary coordinator from a school that has not previously participated in a CSIRO Education program has 13 years of teaching experience. These teachers usually cover most secondary year levels, with students at an average year level of 9. Most of these teachers have expertise in more than one branch of scientific study, but biology was the most common topic (11/19), with chemistry and physics tied for second (7/19). The average teacher, therefore, might have experience in biology and either chemistry or physics.

Regional secondary non-participants are most concerned about cost when selecting a science education program (4.7 out of 5.0). The presentation (4.5) and content (4.6) of the program are the next most important factors, with curriculum affinity (4.1) and outreach opportunities (4.1) next.

These concerns were generally mirrored in their reasons for not participating in CSIRO programs. A lack of outreach was the most recurrent response (11/19) among these educators. The exact reason for this response, however, cannot be determined. Teachers could be referring to specific programs they were interested that could only be held at the CSIROSEC, or they could simply have been unaware that CSIRO Education offers outreach programs. The cost of the programs was the second most common reason (8/19) for not booking CSIRO. Difficulties scheduling

or booking a program was another problem for some of these teachers (5/19). Stressing a low cost and the fact that CSIRO will travel to the school for most programs will be beneficial when approaching these educators.

U.2 Secondary Metropolitan Non-Participants

The responses (12) to the survey from metropolitan secondary science coordinators from a school that has not previously participated in a CSIRO Education program showed that these educators, on average, have 19 years of teaching experience. These teachers usually cover most secondary year levels, with students at an average year level of 10. Most of these teachers have expertise in more than one branch of scientific study, but biology was the most common topic (10/12), with chemistry a distant second (4/12). The average teacher, therefore, might have experience in biology and possibly one other topic.

Metropolitan secondary non-participants are most concerned about a program's content when selecting a science education program (4.5 out of 5.0). The presentation and cost of the program were tied as the second most important factors (4.3), with curriculum affinity (4.1) and the availability of written support materials (4.1) next.

No individual reasons for their non-participation in CSIRO programs stood out resoundingly. A lack of affinity with the school's curriculum was the most recurrent response (4/12) among these educators. Difficulties scheduling or booking a program (3/12) and cost (2/12) were also concerns for some of these teachers. In approaching these educators, it will be beneficial to have helpful staff stressing the quality of the programs, their correlation with the CSF, and the reasonable prices.

U.3 Primary Country Non-Participants

The responses (14) to the survey from regional primary science coordinators from a school that has not previously participated in a CSIRO Education program showed that these educators, on average, have 16 years of teaching experience. These teachers usually cover most primary year levels, with students at an average year level of 3. Some of these teachers have expertise in most branches of scientific study, but most only specified knowledge in general science. Earth science was the most common specific topic mentioned (9/14), with biology, chemistry, and physics mentioned far less often (5, 4, and 4, respectively). The average teacher, therefore, would have general science knowledge, with some experience in the earth sciences.

Country primary non-participants are most concerned about the structure of a program when selecting a science education program. More specifically, the content and its affinity with the CSF were the highest-rated criteria (4.7). The presentation of the program and the availability of written support materials were tied as the next most important factors (4.6), with cost (4.5) and availability (4.3) also quite important.

These concerns were generally not mirrored by these teachers' reasons for not participating in CSIRO programs. The cost of the program (6/14) and a lack of outreach (5/14) were the most recurrent responses among these educators. The expressed concern over outreach is most likely a result of the teachers being unaware of the outreach opportunities offered by CSIRO Education. Stressing a low cost and the fact that CSIRO will travel to the school for most programs will be beneficial when approaching these educators. One must also make sure they are able to grasp the structure of the programs and their correlation to the Curriculum and Standards Framework.

U.4 Primary Metropolitan Non-Participants

There were not many responses (4) from metropolitan science coordinators from a primary school that has not previously participated in a CSIRO Education program. Caution should be exercised when reviewing the extrapolated results of these responses. The survey results showed that the average metropolitan primary coordinator has 18 years of teaching experience. These teachers usually cover most upper primary year levels, with students at an average year level of 4. All of the respondents have expertise in the earth science branch of scientific science, while other branches were mentioned only once. The average teacher, therefore, would have general science knowledge, with experience in the earth sciences.

Metropolitan primary non-participants were most concerned several criteria when selecting a science education program. In particular, the content and its affinity with the CSF, the cost, and the availability of a program were the highest-rated criteria (4.5). The duration of the program was next most important factor (4.3).

These concerns were reflected in the teachers' reasons for not participating in CSIRO programs. The cost of the program (3/4) and availability (2/4) were the most common responses among these educators. As with other primary school teachers, stressing a low cost and the fact that CSIRO will travel to the school for most programs will be beneficial when approaching these educators. In addition, it will be important to convey an understanding of the structure of the programs and their correlation to the Curriculum and Standards Framework.

U.5 Secondary Country Participants

Based on the survey responses (13), the average regional secondary coordinator from a school that has previously participated in a CSIRO Education program has 15 years of teaching experience. These teachers usually cover most secondary year levels, with students at an average year level of 10. Most of these teachers have expertise in more than one branch of scientific study, but chemistry was the most common topic (9/13), with biology a close second (7/13). The average teacher, therefore, might have experience in either biology or chemistry.

Regional secondary participants are most concerned about presentation (4.5) and cost (4.5) when selecting a science education program. The content (4.4) and availability (4.2) were also important considerations.

The teachers' major reasons for participating in CSIRO programs reflected these concerns. The structure of the programs, including the hands-on activities, was the most recurrent response (8/13) among teachers. The exciting and engaging CSIRO presentation also impressed many educators (7/13). The correlation of programs with the CSF (4/13) was also an important reason for participation. These teachers simply need to be reassured of the quality of the programs they book – as long as prices remain low and booking difficulties can be avoided.

U.6 Secondary Metropolitan Participants

There were not many responses (6) from metropolitan science teachers and coordinators from secondary schools that had previously participated in a CSIRO Education program. Again, caution should be exercised when reviewing the extrapolated results of these responses. The average regional secondary coordinator from a school that has previously participated in a CSIRO Education program has 20

years of teaching experience. These teachers usually cover most secondary year levels, with students at an average year level of 10. Most of these teachers have expertise in one particular branch of scientific study and physics was the most common topic mentioned (4/6). The average coordinator, therefore, would specialise in one particular subject, which would likely be physics.

Metropolitan secondary participants are most concerned about the content of the programs (5.0). The correlation between programs and the CSF (4.9) and the presentation (4.7) were very important considerations as well. The availability of written support materials (4.5), availability (4.2) and cost (4.2) were also mentioned.

The major reasons of these coordinators for participating were lead by the program structure (4/6). The content and curriculum affinity were also mentioned more than once (2/6). When addressing these educators, the effective program structure and quality presentation should be stressed. Maintaining competitive prices and keeping programs available is important as well, but the addition of more substantial support materials would likely please this group.

U.7 Primary Country Participants

Based on the survey responses (13), the average regional primary science coordinator from a school that has previously participated in a CSIRO Education program has 22 years of teaching experience. These teachers usually cover all primary year levels, or concentrate in only one or two. The average year level is 3. Most of these teachers have just general science expertise, but the most common specialisation was the earth sciences (4/13). The average teacher would have general scientific knowledge, possibly with some more advanced training in some of the specific fields.

Regional primary participants are most concerned about cost (4.8) and content (4.8) when selecting a science education program. The presentation (4.6) and the content's correlation with the CSF (4.5) were important. So too were availability (4.5) and ease of booking (4.3).

The teachers' major reasons for participating in CSIRO programs reflected these concerns. The presentation was the most recurrent response (5/13) among teachers. Booking and availability was second (4/13) and cost, outreach opportunities, CSF correlation, and program structure all tied for third (3/13). These teachers simply need to be reassured of the quality of the programs they book, including the content's affinity with the CSF – as long as prices remain low and booking difficulties can be avoided.

U.8 Primary Metropolitan Participants

Based on the survey responses (13), the average metropolitan primary science coordinator from a school that has previously participated in a CSIRO Education program has 20 years of teaching experience. These teachers usually concentrate in only a few year levels, though these vary. The average year level is 3. Most of these teachers have just general science expertise, but some had specialisation in earth sciences (5/13) or biology (3/13). The average teacher, therefore, would have general scientific knowledge, possibly with some more advanced training in earth science or biology.

Metropolitan primary participants are most concerned about a program's content (4.8) when selecting a science education program. The presentation (4.6) and the content's correlation with the CSF (4.6) were also important. Cost was ranked fourth (4.3).

The teachers' major reasons for participating in CSIRO programs reflected these considerations. The quality presentation was the most recurrent reason (7/13) among respondents. Cost and program structure were the next most recurrent reasons (4/13). These teachers simply need to be reassured of the quality of the programs they book, including the content's affinity with the CSF, at a reasonable price.