Teachers' Insights into Informal Science Education Programs

An Interactive Qualifying Project submitted to the faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfilment of the requirements for the
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May 5, 2011

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Abstract

Over the past few decades Australia has experienced a decline in science education. The goal of this project, sponsored by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), was to help increase participation rates of its informal science education programs by determining *why* and *how* teachers use programs. This was achieved by gathering information from Victorian teachers and comparing it to how CSIRO Education, Victoria develops and advertises its programs. The results of this project showed there are opportunities for CSIRO Education to improve its advertisements to reach more teachers.

Acknowledgements

The project team would like to extend its acknowledgements and thanks to the people who made this project possible. In particular, we would like to thank project liaison Chris Krishna-Pillay and all of the staff at the CSIRO Science Education Centre in Highett, Victoria. We would also like to show our appreciation for the direction and support given by project advisors, Richard Vaz and Chrysanthe Demetry. In addition, we would like to recognize the interview and survey respondents, whose participation made it possible to provide CSIRO with recommendations for how to better serve teachers and students in Australian science education.

Executive Summary

Over the past decade, Australia has seen a significant decrease in the percentage of students who voluntarily study science subjects beyond compulsory years of education. In response, the Australian Curriculum, Assessment and Reporting Authority (ACARA) has called for a national focus on finding the most effective ways to get more students interested and excited about science (Australian Curriculum, Assessment and Reporting Authority, 2009). According to educational specialists, one of the most successful methods of engaging students' interests in curricular science learning is through the use of informal education (Goodrum, Hackling, & Rennie, 2001; Tytler, 2006), which is generally defined as any type of education that takes place outside the traditional classroom environment.

There are many providers of informal education in Australia, one of which is the *Commonwealth Scientific and Industrial Research Organisation (CSIRO).* CSIRO is the national government body for science research in Australia. As a division of this organisation, *CSIRO Education* strives to promote science education among Australia's youth. To do this, CSIRO Education offers informal education programs, as well as teacher professional development, to help support science teaching and learning throughout the nation. Currently CSIRO Education, Victoria reaches over 60,000 students annually; however, this is only 7% of Victorian students.

Project Goal and Objectives

The goal of this project was to help the staff at the CSIRO Science Education Centre in Highett, Victoria gain a better understanding of *how* and *why* teachers use informal science education programs. We hoped that this information would provide an opportunity for the organisation to expand its educational outreach to more Australian students and teachers through the implementation of more suitably targeted programs. In order to achieve this goal, we completed three objectives:

1. ***Review CSIRO Education, Victoria's program design and advertisement methods.*** We conducted interviews with staff members and attended CSIRO's programs to gain an understanding of the organisation's current program design and advertisement strategies.
2. ***Identify the criteria influencing teachers' and administrators' decisions to book informal education programs and the ways in which the programs are being used.*** We reviewed CSIRO's database containing past post-program evaluation forms to get a better sense of teachers' attitudes towards CSIRO programs. We also developed and distributed a web-based survey to a sample population of Victorian teachers and administrators to identify teachers' criteria for booking informal education programs and the different ways in which programs are used in teaching practices. Additionally, we interviewed teachers to gain deeper insights to specific responses.
3. ***Develop recommendations on how CSIRO Education, Victoria can better design and target its programs to see higher program participation rates.*** We compared analysed data and identified any gaps between what CSIRO does and what Victoria teachers and administrators want. From this, we made recommendations to help CSIRO Education, Victoria expand its educational outreach.

Findings

After observing seven different programs at twelve schools, and briefly talking to twenty-seven teachers, we conducted eleven in-depth interviews with teachers who had participated in programs with CSIRO, and seven with teachers who had not participated in CSIRO programs within the past ten years. We also collected 140 responses from the online survey (6% response rate), reviewed the results of 1,300 program evaluations, and held interviews with three different CSIRO staff members.

The most influential criteria in respondents' decisions to book informal education programs were curriculum relevance, program price, and student engagement. These were the most commonly mentioned criteria in our survey data, and were also found to be the most influential through interviews with teachers. Although we found that these criteria did not vary significantly between the teachers of different school levels or booking histories, the *reasons why* teachers valued these criteria did vary with school level and school type. Primary teachers tended to value a program's relevance to the curriculum because they are looking to fill gaps between their school's curriculum and their personal knowledge on a specific science subject, while secondary teachers tended to look for programs which provide curriculum related equipment and resources that the school might not have access to. While most teachers tended to consider the price of a program when booking, the influence of that criterion depends mostly on the school type; independent schools tended to see the price of a program as a less influential criterion than other school types. When considering student engagement, most teachers valued hands-on activities and a knowledgeable presenter as a way of keeping students interested in science.

Respondent teachers tend to book programs repetitively because of previous experience and satisfaction with the program. Most teachers who book programs with CSIRO have previously used its programs in the past. Over 80% of CSIRO's annual bookings from 2008 to the present were from schools which had booked a CSIRO program at least once within the five years prior to that booking. In addition, just about every teacher who participated in the programs we attended had either previously participated in a program, or had discovered CSIRO by word-of-mouth from another teacher who had previously participated in a program. Our findings from interviews suggest that teachers tend to trust referrals from other teachers when deciding which programs to book.

How teachers use informal education programs depends on the learning unit and the teacher's preferences. We found no correlation that linked certain demographics to specific ways of using programs in a learning unit. When we asked teachers in interviews how they use programs, many of them indicated that it depended on the learning unit. We did find that, from survey respondents, the most commonly mentioned use of informal education was as a reinforcement of the current learning unit. Although the percentages of respondents using programs in this way were similar between school levels, other uses of informal education differed between primary and secondary respondents. More primary level respondents tended to use programs as introductory immersions into learning units, while more secondary respondents tended to use programs to provide the equipment and resources that students would not otherwise have access to.

The content, engagement, and price of CSIRO Education, Victoria's programs align well with teachers' criteria for booking programs. CSIRO programs are tailored to the Victorian Essential Learning Standards (VELS), and are designed to be suitable for specific year levels. Primary level programs include activities that are geared towards being simple yet engaging for young students. Secondary level programs try to spur interest in science by including more uncommon and hard-to-

find equipment and resources for students to interact with. Past post-program evaluations and interviews with teachers indicated that, for the most part, teachers were satisfied with the program's design, presentation, and cost. The cost of CSIRO's programs is comparable to other similar programs provided by different organisations. From this, we concluded that any realistic change to CSIRO's program design and presentation would not render significant increases in program participation rate or satisfaction.

A significant portion of survey respondents who had not previously participated in a CSIRO program were not completely aware of CSIRO Education, Victoria and its offerings. Nearly half of respondents who had not previously participated in a CSIRO program selected that they were "unaware of CSIRO programs' existence" when asked why they had not booked with the organisation. Additionally, all respondents who selected that CSIRO programs were "not available in their area" were in the same region as at least one other respondent who had participated in a CSIRO program. Whether or not these results were due to misunderstandings of the survey questions, this lack of awareness shows that CSIRO's advertising strategies do not sufficiently reach all Victorian teachers and administrators.

Many respondents who were responsible for booking programs are not targeted by CSIRO Education, Victoria's mail-out advertisements. Roughly half of survey respondents who had previously participated in a CSIRO program and were responsible for booking the program reported that they were not the "science coordinator" or "teacher in charge of science" at their school. However, CSIRO only addresses its mail-out advertisements to these specific positions within schools. Thus, we concluded that CSIRO's advertisements may not be effectively reaching all teachers responsible for booking programs.

Recommendations

From our findings, we concluded that the design of CSIRO programs sufficiently aligns with what teachers want, but that there are some notable gaps in CSIRO Education, Victoria's advertisement strategies. We focused our recommendations primarily to address those gaps.

Continue current approach to program design with small variations. CSIRO designs its programs in a way that sufficiently aligns with *why* and *how* teachers use informal education. We recommend that CSIRO continues to approach its program design in the current manner. Alterations in program design will unlikely increase the numbers of bookings. However, some variations to take into consideration are shortening the introduction, allowing more time for activities, and including more of a wrap-up discussion of the program's *Key Learning Points*.

Address mail-out advertisements to a wider range of teacher positions within schools. We found that many teachers who are responsible for booking programs are not "teachers in charge of science" or "science coordinators;" however, mail-out advertisements are only addressed to teachers in those positions. In order to reach more of the people who are responsible for selecting and booking informal education programs, we recommend that CSIRO Education, Victoria address its annual mail-outs to a wider range of teachers and administrators of different positions within a school. Since the organisation sends more than one mail out per year, there are opportunities to address multiple positions per year. CSIRO can also include more than one brochure within the mail-out, so that brochures can be distributed to multiple teachers within a school. This approach could

result in CSIRO's advertisements reaching more people who are responsible for booking programs, yet unfamiliar with CSIRO Education's entire offerings.

Offer incentives for teachers who successfully refer new bookers to CSIRO programs. Many teachers learn about programs from another teacher. In an effort to increase program participation from more new bookers, we recommend that CSIRO offer discounts to teachers or administrators who successfully refer new bookers to its programs. This will hopefully create an incentive for teachers to learn about CSIRO Education and spread information about the programs around education communities through word-of-mouth. This form of communication, which we found to be one of the most popular ways in which teachers find out about informal education programs, could significantly increase the number of teachers using CSIRO programs.

Offer discounts for teachers from schools that have not booked programs within the past ten years. Many teachers who have not previously participated in CSIRO programs selected that a lack of funding has prevented them from doing so. Offering discounts to new bookers may allow teachers who feel that programs are too expensive to experience CSIRO programs. This may give them an opportunity to better assess the value of the program. Since many teachers who have previously participated in CSIRO programs have been satisfied enough with the program to re-book it, discounts on programs may lead to more repeat bookers.

Use testimonials from teachers more regularly in advertising. Generally, teachers who have participated in CSIRO programs are satisfied. Many teachers learn about these programs from other teachers in their school. They are more likely to trust that the program is worthwhile if another teacher has had a positive experience with the program. We recommend that teacher testimonials be used more heavily throughout advertisements, and generally made more available. This will allow sceptical teachers to see what others think of the program.

Other ways testimonials can be made more available are through social networking websites. Options for the organisation include creating CSIRO Education pages on general social networking websites such as *Facebook* and *Twitter*, as well as education focused networking websites such as *Education Network Australia*. Not only can this form of advertising make teacher testimonials more available to other teachers, it also makes them more visible to parents who are sometimes responsible for funding programs.

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2.3 Teacher Perspectives on Excursions and Incursions	Ariel
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3.2 Identifying Teacher Insights	Ernie* Kurt
3.3 Developing Recommendations for CSIRO	Ernie
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4.4 CSIRO's Advertising: Reaching New Bookers	Ernie* Krysten
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1 Introduction

Science education is vital to maintain high numbers of science-skilled professionals in a nation's workforce (Gates, 2007). In Australia, however, studies have shown that the overall student interest and participation in science has steadily decreased since the early 1990s (Goodrum, Hackling, & Rennie, 2001). In response to this decline, Australia has begun a nationwide effort to reenergise its current science education system, by changing the way science is being taught in primary and secondary level schools (Tytler, 2007). By making more resources available to science teachers and focusing primarily on the engagement of students, Australia hopes to attract the best young minds towards science-based careers, ultimately contributing to the overall wellbeing of the nation.

One such resource is the *Commonwealth Scientific and Industrial Research Organisation (CSIRO)*, which is the national government body for scientific research in Australia. Today, CSIRO employs over 6,600 staff and maintains more than fifty sites across the nation. To educate the community about CSIRO research and science in general, CSIRO Education has nine Science Education Centres throughout Australia. These centres offer several resources for schools, including informal education[1] programs in the form of incursions and excursions for primary and secondary level students. CSIRO's informal education programs, which reach more than 320,000 students annually, are used to improve science teaching and are designed predominantly to link hands-on activities with concepts being taught in the classroom (CSIRO, 2010).

CSIRO Education programs currently reach approximately 7% of primary and secondary level students and teachers in Victoria, Australia. However, program bookings have generally remained stagnant over the last five years. While some schools book programs repeatedly with CSIRO Education, there are also many schools which have never booked a CSIRO program. CSIRO Education is keen on increasing its program participation rates to a larger number of students and teachers every year, with the intent that some teachers will begin designing classroom learning units with CSIRO programs as key components. In order to do this, the staff at CSIRO Education, Victoria wished to have a better understanding of what teachers *value* most in informal education programs and the *educational purposes* that programs serve.

This project aimed to help the staff at the CSIRO Science Education Centre in Highett, Victoria gain a better understanding of *how* and *why* teachers use science education programs, so the programs could be better targeted towards the needs of Victorian science teachers. Our team accomplished this by conducting interviews with teachers and administering an online survey which provided insight into teachers' decisions for booking informal education programs, and how these programs were being used in classroom teaching practices. We discussed our findings with CSIRO and developed recommendations for program design and advertising improvements, which will potentially allow CSIRO Education, Victoria to be able to reach a larger population of Victorian schools in the future.

[1] Informal education is generally defined as any type of learning that occurs outside of the traditional classroom setting.

2 Background

In this chapter we begin by discussing the decline in science education throughout Australia by addressing the reasons behind the decline and the resulting consequences for Australia's future. We then present how the nation attempts to reverse the decline in science education through the use of informal education and introduce the Commonwealth Scientific and Industrial Research Organisation (CSIRO), a provider of informal education programs. Lastly, we discuss the value of informal education programs, such as incursions and excursions, in the teaching and learning processes in schools. Overall, this chapter presents the factors that must be taken into consideration when looking to increase the participation rates in informal education programs.

2.1 Decline in Australian Science Education

In a 2007 article published in the *Australian Science and Teachers Association Journal*, Grady Venville explained how Australia was currently in "the advanced stages of a crisis in school science that threatens the future of Australia as a technologically advanced nation." Venville, the inaugural Professor of Science Education at the University of Western Australia and an internationally known leader in science education research, was the first to refer to the decrease in Australian science-based interest and participation as a "crisis" (Venville, 2008). In the following sections, we will explain the reasons behind this decline and the consequences associated with it.

2.1.1 The Decrease in Student Interest and Participation

A 2007 study conducted by the *Australian Council for Education Research (ACER)* suggested a development of increasingly negative attitudes towards science in Year 8 students over the past two decades. According to the study, *primary* level science education programs are generally student-centred and activity-based, resulting in high levels of student satisfaction. The dissatisfaction occurs when students move on to *secondary* level schooling where the science being taught, according to many experts, is neither relevant nor engaging, and does not connect with the interests and experiences of the students (Goodrum, Hackling, & Rennie, 2001). The study suggests that traditional chalk-and-talk style of teaching, copying notes, and "cookbook" practical lessons that are often practiced in secondary level formal education offer little excitement and discourage students from being interested in science.

The *Trends in International Mathematics and Science Study (TIMSS),* which was conducted in 2002 and assessed 10,030 Australian Year 4 and Year 8 students from 414 schools, looked into the effect of declining student interest in science. The study showed a reduction in students who reported having "high" levels of self confidence in science from 66% to 49% over the transition from primary to secondary school (Thomson & Fleming, 2004). The same *TIMSS* study showed that students who liked science "to some extent" declined from 87% in Year 4 to 67% in Year 8. The authors attributed these trends to the "diminished personal nature of the teacher-student relationship from middle school to secondary school" and a secondary school curriculum that allows little flexibility for tailoring to individual students' needs (Speering & Rennie, 1996). Glen Aikenhead, an educational expert at the University of Saskatchewan, argues the main reason young students are choosing to turn away from science is due directly to the nation's traditional science curriculum, which was designed specifically to train these students as a preparation for entering a science field (Aikenhead, 2006).

Another education expert at Deakin University, Russell Tytler, argues that the declining interest in science areas is believed to result in a declining number of students who chose to study science subjects in post-compulsory years of schooling (Tytler, 2007). Figure 1 shows the non-compulsory participation rates of Year 12 students in the biology, chemistry and physics in 1978 and 2002 (Australian Council for Education Research, 2007). As shown in the graph, the number of students who chose to study these science subjects decreased significantly over these two decades.

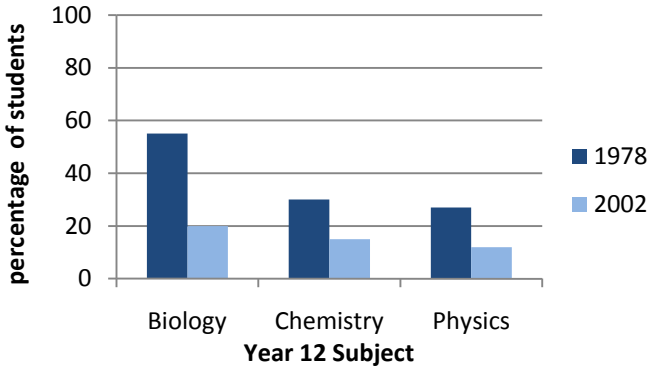

Figure 1: Participation rates of Year 12 biology, chemistry and physics in Australia (Australian Council for Education Research, 2007).

As a result of decreased science interest during secondary school years, the population of tertiary[2] students studying science-related fields has seen a significant falloff. At the 2006 Australian Council for Education Research (ACER) conference, Chief Executive Officer Geoff Masters pointed out that the number of Australian tertiary students studying physical and materials sciences fell nationally by 31% from 1989 to 2002, and that in 2001, only 1% of university graduates in Australia were in physical sciences compared to an *Organisation for Economic Co-Operation and Development (OECD)* international mean of 2.6%. As seen by the decreasing participation rates of students who chose to study science, the current educational system is not effectively drawing a large number of students towards science-based careers. As Tytler points out, a detailed look at this crisis in science education shows there is clear evidence that "the curriculum and classroom practice is failing to excite the interest of many, if not most, young people at a time when science is a driving force behind so many developments and issues in contemporary society" (Tytler, 2007).

2.1.2 Shortage of Qualified Science Teachers

A consequence of this decline in the number of students studying science at universities is the decreasing number of teachers who graduate with science backgrounds. This problem is resulting in a looming shortfall of qualified science teachers for Australian schools (Tytler, 2007). According to Tytler, in 2006, 40% of schools reported having difficulty staffing physics classes and 35% staffing chemistry classes. This problem grew as schools got further away from metropolitan areas. Figure 2.1 shows that in seven out of eight states and territories, at least 50% of schools reported this difficulty (Harris & Farrell, 2007). Another 2006 study showed that schools were between twice and four times more likely to report "very difficult" in filling vacant teaching positions in science if they were located outside what was determined to be the metropolitan region (Lyons, Cooksey, Panizzon, Parnell, & Pegg, 2006).

[2] University level

Exacerbating the problem is the fact that Australian science teachers generally feel undervalued and under-resourced. In 2001, up to half of Australian science teachers wanted a career change out of teaching (Goodrum, Hackling, & Rennie, 2001). In one of the schools studied, two science teachers mapped their abilities to challenge students to explore, question, and reflect, as well as their abilities to support, monitor, and address individual students' needs as "low" compared to teachers in other subject areas (Beeth, Duit, Prenzel, Ostermeier, Tytler, & Wickman, 2003). These problems are directly related to the limited science and professional development resources made available to teachers in Australia, and may help further explain the decreasing science participation and interest throughout the nation (Tytler, 2007). Advocates for science teachers are calling for school systems to provide teachers with the support of ongoing professional development and access to modern facilities, equipment, and other resources to help teach science in ways that promote improved learning (Goodrum, Hackling, & Rennie, 2001).

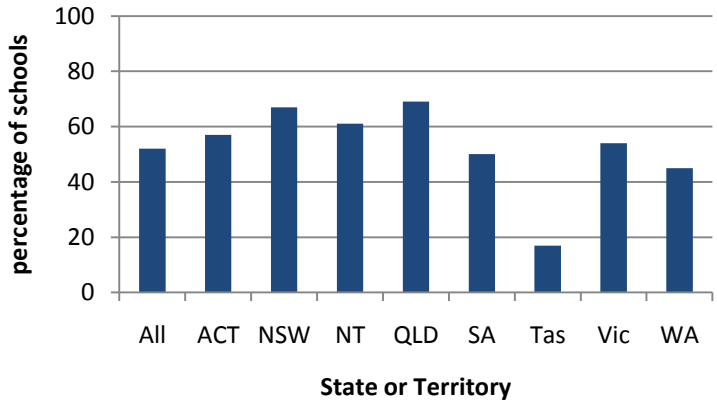

Figure 2.1: Percentages of schools reporting difficulty recruiting science teachers (Harris & Farrell, 2007).

2.1.3 Current Science Curriculum

Each Australian state and territory has defined its own curriculum for use in its schools. In response to the decline in interest in science, however, Australia has launched a nationwide reform of its science educational system over the past decade or so, which has led to the development of the "Australian curriculum" (Dekkers & de Laeter, 2001). This curriculum is guided by the *Melbourne Declaration on Educational Goals for Young Australians*, and was adopted by the council of state and territory education ministers in December of 2008. Described as the Australian curriculum's aim for science education, *The Australian Curriculum, Assessment and Reporting Authority (ACARA)* mentions the importance of the curriculum's ability in engaging students' interests in science by "expanding curiosity and willingness to explore, as well as stimulating students' questions about and speculation on the changing world in which they live" (Australian Curriculum, Assessment and Reporting Authority, 2009). According to Goodrum, the project director of the Australian Academy of Science, curricula centred on the relevant needs, concerns, and personal experiences of students are the most effective resources in raising student participation in science past compulsory years of schooling (Goodrum, Hackling, & Rennie, 2001). In order for this to occur, science education must not be prescriptive and should be based upon the "spark of excitement" that stems from discovery and students' abilities to engage in the discourses of science (Tytler, 2007).

In Victoria, science education is developed through the *Victorian Essential Learning Standards (VELS)*. This recommended guide developed by the Victorian government is separated into different

stages of learning and is used by most Victorian teachers to focus key learning topics throughout different years and subjects of schooling. According to the Victorian Essential Learning Standards, an effective tool to supplement the formal methods of classroom teaching in science subjects is through the use of experimentation and interactive programs. These types of hands-on activities and experiments, which are referred to as important ways of getting students involved in learning, are often most effectively offered by informal education[3] organisations. (Victorian Curriculum and Assessment Authority, 2011).

2.2 Enhancing Science Education in Australia: The Commonwealth Scientific and Industrial Research Organisation (CSIRO)

CSIRO Education, Victoria is a division of CSIRO that offers programs which provide hands-on activities to educate and stimulate students' interest about various science topics. It is supported by the *Department of Education and Early Childhood Development (DEECD)* and the *Catholic Education Office of Melbourne (CEOM)*. The organisation offers thirty different educational programs that cover a wide variety of science topics. Teachers can either bring their students on excursions to one of three on-site laboratories, or use the programs as incursions in their classroom with CSIRO educators (CSIRO, 2010). In this section, we discuss CSIRO Education, its science programs, and what the organisation strives to achieve through the provision of informal education.

2.2.1 CSIRO's Mission and Programs

Current CSIRO education programs, run by the nine education centres throughout Australia, reach over 320,000 students and teachers annually (CSIRO, 2009). The Science Education Centre in Victoria reaches more than 60,000 students annually (Krishna-Pillay, IQP Project Brief, 2011). The goal of these programs is to spread awareness to science teachers, students, and their families of the ways in which science research contributes to the community. According to CSIRO, "today's school students will be the scientists, policy makers and voters of tomorrow, so they need a strong grounding in science to participate." CSIRO encourages students to pursue careers in *science, mathematics, engineering, and technology (SMET)*, and strives to engage, enthuse, and educate students and teachers about science and its applications (CSIRO, 2005).

Most of the programs that CSIRO Education offers are geared towards giving students the opportunity to take part in hands-on activities. Programs range from the basic topics of air and weather for primary students to the more advanced topics of photonics or genetic engineering for secondary students. All programs are available as excursions at the CSIRO Science Education Centre (CSIROSEC) in Highett, Victoria, and most programs can travel to schools as incursions in the classroom. Primary school programs generally attempt to simply get students engaged with hands-on activities, while secondary school programs aim to provide a deeper understanding of concepts with more sophisticated experiments unavailable to schools. The more advanced programs involve hands-on experiments suitable for students completing their *Victorian Certification of Education (VCE)*, the certificate that students receive on the completion of their secondary education (State Government of Victoria, 2011).

All programs offered by CSIRO Education, Victoria are designed to fit into the Victorian science curriculum (CSIRO, 2010). When developing its programs, CSIRO attempts to include multiple skills

[3] Informal education is generally defined as any type of learning that occurs outside of the traditional classroom setting.

described in the Victorian Essentials of Learning Standards. Not only is program content based heavily upon science learning, but it also aims to incorporate other skills such as communication, teamwork, and personal learning. According to one CSIRO staff member, the activities in these programs are designed to be different from standard activities and experiments that teachers already use in the classroom (C. Lewis, CSIRO, personal communication, March 10, 2011). It is the goal of CSIRO educators to provide students with a meaningful learning experience as well as an idea of how "cool" science can be (S. Elliot, CSIRO, personal communication, March 17, 2011). Often, the programs are not necessarily meant to teach students a large amount of material, but are designed to ensure that students who have the potential to further their education in science gain a greater interest in the subject matter (C. Krishna-Pillay, CSIRO, personal communication, March 11, 2011).

2.2.2 CSIRO's Desire for Program Expansion

CSIRO attempts to bring its science education programs to as many students as possible in order to further its mission. A rough estimate, using data from the *Australian Census Bureau (ACB)* and the CSIRO Education annual report, indicates that currently about 7% of Victorian primary and secondary school students experience a CSIRO Education program annually (Australian Bureau of Statistics, 2010).

Previous students from Worcester Polytechnic Institute conducted a study for the Victorian CSIRO Education Centre in 2001 to investigate participation levels in CSIRO's outreach programs. This resulted in recommendations to increase CSIRO program participation. Responses from surveys and interviews with teachers showed the main reason to use CSIRO education programs was to get students excited about science and engage them in learning science concepts. Additionally, a small minority of those surveyed indicated they used the programs to fill knowledge gaps. Several factors that influence the booking of programs were also identified.

Over 90% of the schools surveyed considered cost as one of the most important factors. Other factors included convenience to book programs, length of program within school timetable, availability of incursion programs, and class size in relation to program size. This study also organised their findings from studies and interviews to display CSIRO Education, Victoria's program strengths and weaknesses. The most prevalent strengths were program structure, hands-on nature, curriculum content affinity, program presentation, cost, and outreach capabilities. The weaknesses included teacher awareness of programs, availability and flexibility of programs, excursion program location, and the time required to explain the hands-on activities (Douglas, King, & Meleschi, 2001).

2.3 Teachers' Use of Informal Education

The programs offered by CSIRO are examples of informal education, which use activities that occur outside the classroom setting to educate students. Most informal education programs are developed primarily for school use, but are not developed to be part of an ongoing school curriculum. The goal of informal education is to get students to interact with their peers, their teacher, and the science material (Satterthwait, 2010). Hands-on activities are used to get students working in groups, manipulating various objects, asking questions that focus observations, and collecting data in an attempt to explain natural phenomena. These activities have shown to improve children's science learning and achievement by developing positive attitudes towards science (Satterthwait, 2010). The influence of informal science education has been acknowledged as an effective tool to supplement the formal methods of classroom teaching and learning (Hofstein & Rosenfeld, 1996). However, the impact the program has on students depends on how well the

teacher has built the program into the curriculum, and how they refer back to it afterwards (Scribner-MacLean & Kennedy, 2007).

Although these types of programs can be effective, there are a number of reasons why teachers decide not to pursue the use of informal education. According to a study by Hofstein and Rosenfeld, the price of programs can be too expensive for some schools to afford, causing teachers and administers to overlook such programs. Programs can also be difficult to place inside the curriculum, which causes teachers and administrators to view programs as disruptions. Another reason is that teachers may not feel confident enough to lead informal programs themselves, especially if they lack background knowledge and training in the subject. One study showed that teachers tended to avoid out-of-class experiences because of their unfamiliarity with the philosophy and logistics of the programs (Hofstein & Rosenfeld, 1996). Teachers also have a hard time identifying, isolating, and controlling the relevant variables that impact the program. The same study shows that students are influenced to learn in an informal environment and that limited information exists on the conditions for an effective experience (Hofstein & Rosenfeld, 1996).

Since there are state and national standards for the school curriculum, designing the informal approaches to align with state and national standards can be a challenge for educators, curriculum directors, and informal science centre directors. If teachers do not properly align the program with the curriculum, the experiences for students could leave them with new misconceptions (Duran, Ballone-Duran, Haney, & Beltyukova, 2009). Donna Satterthwait, of the University of Tasmania, claims unproductive programs result from teachers being unfamiliar with how to best integrate a program's resources into classroom settings. She believes, in order for students to truly gain knowledge from programs, teachers need to use more of their classroom time to find out what students know about the program before the program begins. If students have no prior knowledge, teachers have to give lessons beforehand to identify any misunderstandings. This uses more classroom time than some teachers are willing to dedicate to the programs. Successful programs, however, can be used in various ways by teachers to enhance education on specific topics. In Australia, this method is being used to revive science education from its current decline (Satterthwait, 2010).

3 Methodology

The goal of this project was to help expand the outreach of CSIRO Education, Victoria's science programs to a larger number of Victorian students and teachers. The project aimed to help the staff at the CSIRO Science Education Centre in Highett, Victoria gain a better understanding of how decisions to book informal education programs are made, and how those programs are being used in classroom teaching practices. The following list of objectives was set in order to accomplish the goal of this project:

1. Review CSIRO Education, Victoria's science programs, advertising methods, and internal resources.
2. Identify the factors affecting teachers' and administrators' decisions to book informal education programs and the ways in which these types of programs are being used.
3. Develop recommendations for CSIRO Education, Victoria to better target its programs towards the needs of Victorian teachers and administrators.

This chapter describes the approach that was taken to achieve these three objectives.

3.1 Assessing the Current Status of CSIRO Education Programs

We began by reviewing existing information about CSIRO's education programs and learning about current program design and advertising strategies. In this section, we first explain how we investigated post-program evaluation data from teachers, and then spoke with CSIRO staff members to understand how the organisation currently designs, presents, and advertises programs to satisfy teachers.

3.1.1 Review of CSIRO's Post-Program Evaluations

CSIRO Education, Victoria maintains an extensive online database that includes a large percentage of Victorian schools' contact information, records of past and future bookings, and previous program evaluations. Since August of 2005, program evaluations have been distributed to teachers during every incursion and excursion program. The evaluation form (see *Appendix G*) includes a five point rating scale for thirteen different program aspects, an overall program satisfaction score (out of ten), and three long-answer questions. We analysed approximately 1,300 evaluations from 2005-2011 with the following questions in mind:

- What do teachers seem to like most about CSIRO education programs?
- What are teachers' most common suggestions for improvements?
- What are teachers' perspectives regarding the pricing of CSIRO's programs?

Since all of the responses from the program evaluations had already been coded, and response frequencies had already been calculated, obtaining the desired information was straightforward. We calculated the percentages of Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree responses for the questions which were most relevant to our project. The percentages of teachers who responded with each coded response in the open ended evaluation questions were also calculated (see *Appendix H)*.

The return rate for these evaluations was about 10% from 2005-2011. Because this response rate was so low, there was a possibility that those who responded had different views than those who had not responded. Therefore, it is possible that the results from CSIRO's program evaluations may not have been a confident representation of the views of all participating teachers.

3.1.2 Becoming Familiar with CSIRO's Program Design and Advertising

Once we had identified what teachers believed to be the strengths and weaknesses of CSIRO's programs, we held informal interviews with CSIRO staff members to discover how the organisation designed and advertised programs to meet teachers' needs. The interviews with CSIRO staff were intended to address the following research questions:

1. What factors do CSIRO Education, Victoria believe to be most influential to teachers' decisions to book programs?
2. How are programs designed to meet these conditions?
3. What limitations are faced by the organisation when designing program content and presentation?
4. Are there variations in the way different programs are designed?
5. How is program pricing determined?
6. What are CSIRO Education, Victoria's main forms of advertising, and who do these advertisements target?

We held multiple informal discussions about these topics with CSIRO Manager Chris Krishna-Pillay and CSIRO Deputy Manager Caitlin Lewis. Caitlin Lewis's extensive knowledge about CSIRO Education, Victoria and its operations was used to gain information on the basics of CSIRO's program design and advertisements. The Deputy Manager also directed us to the most knowledgeable staff members for each of our research questions, and was able to provide our team with physical copies of CSIRO's main forms of advertisement. Sean Elliot, one of CSIRO's program presenters who helped design over half of CSIRO Education, Victoria's current programs, provided his insight to what the organisation attempts to accomplish in the design and presentation of programs.

These interviews were semi-structured and conducted by individual team members. A full set of interview questions can be found in *Appendix A*. The data collected from staff interviews was then compared to information collected from Victorian school teachers, and used to assess both the current and prospective status of CSIRO Education, Victoria's science programs.

3.2 Understanding Teachers' Perspectives on Informal Education Programs

As discussed in the background chapter, the type of informal education programs offered by CSIRO Education is a powerful way to supplement structured learning units in primary and secondary schools. However, little is known about which aspects of these programs teachers value most, or how these types of programs are being used in teaching practices. With more information about teachers' perspectives and uses of informal education, CSIRO Education would have an opportunity to better align its programs' design and advertising to what teachers value most about informal education. Thus, the major focus of our project was to gain more insight from teachers and administrators, focused on the following research questions:

1. What criteria do teachers use when choosing informal education programs?
2. What barriers do teachers face when booking informal education programs?
3. What do teachers see as the purpose of informal education programs in their learning units?

We sought this information through the use of various methods. During school visits, which we attended with regularly scheduled CSIRO programs, we approached classroom teachers with a short questionnaire. This questionnaire acted as an introduction of our study to teachers, and was used

mainly as an attempt to schedule additional meetings where more in-depth, semi-structured interviews could be conducted. Interviews at schools which had not booked with CSIRO were also set up via phone call or e-mail. In parallel, we aimed to gather information from a larger number of Victorian teachers through a Web-based survey, which we administered to a sample population of Victorian primary and secondary level school teachers. The following section discusses these methods in more detail.

3.2.1 Web-Based Survey

Teachers from schools which have and have not booked with CSIRO Education, Victoria held the ultimate answers to our project's main research questions. The primary reason for this survey was to gain straightforward responses to the following research questions from a large number and range of Victorian teachers.

1. What are the primary reasons teachers choose to book specific educational programs?
2. How are teachers incorporating informal education programs into their teaching practice?
3. Why do teachers choose not to book with CSIRO Education, Victoria?

We referred to survey design principles and, in particular, tried to develop a survey that would not require more effort for respondents to complete than absolutely necessary (Fowler, 2009). For this reason, we designed a Web-based survey which eliminated the extraneous work required by respondents of traditional mail-out surveys. However, e-mails often tend to be cluttered with spam, and are generally not thought to be as intimate as something physically mailed out and returned. Given our project's time and resource limitations, an online survey was determined to be the most effective means of obtaining the highest possible return rate.

The survey instrument, which can be seen in *Appendix K*, was designed to be completed by any teacher or school staff member in less than five minutes. To begin with, both personal and school specific information, including teaching experience, booking history, type of position, school level, school location, and school type, was collected from all respondents. This information was used to investigate the possible influence of these demographic factors on teachers' decisions to book programs and their uses of programs.

We then asked respondents whether they or their students had previously participated in a CSIRO science education program. Based on their response, they were guided toward a different set of open-ended questions. Previous program participants were asked to list any other forms of informal education they use, their criteria for booking programs, and their uses for programs. These respondents were also asked to specify whether or not they had ever been responsible for physically making a booking with CSIRO, which allowed us to indentify which teacher positions are responsible for making program bookings within school systems.

Non-participants were similarly asked to list their criteria for booking any informal education programs that they currently use. In addition, a multiple choice question was used to identify reasons why non-participating respondents chose not to book programs with CSIRO. Response options for this question were developed with the help of Chris Krishna-Pillay, and included several options that can be seen in *Appendix K*.

We chose to use open response questions to gather survey data regarding our major research questions about teachers' booking criteria and uses of programs. This approach was taken in order to avoid potentially leading responses with predetermined selection lists. Allowing teachers to come

up with their own responses also gave us an opportunity to observe the differences in terminology between respondents. These types of questions did, however, introduce a different coding bias when analysing responses, which is described at the end of this section.

Ideally, having the actual contact e-mail addresses of every science teacher in Victoria would have been the most effective option for deploying the survey. Since this information was not accessible to us, the survey was first sent to list of generic school e-mail addresses obtained from CSIRO's database. These e-mail addresses included both schools that had and had not previously booked programs with CSRIO Education, Victoria. According to our liaison, e-mails sent to these addresses are usually seen first by a principal or assistant, and would have a reasonable chance of being forwarded to the desired party. With this information, we determined that using these email addresses was a reasonable way to reach a large number of Victorian teachers; however, we cannot be sure whether the e-mails were successfully delivered to the intended recipients.

Three days after sending our survey to the general addresses, we attempted to increase the response rate by re-sending the survey to a smaller number of personal e-mail addresses. CSIRO Education, Victoria has individual contact information for a portion of the teachers that have previously used the organisation's programs, as well as some information for teachers that have not previously used its programs. The survey was sent to the personal e-mail addresses for all the teachers in CSIRO's database in two groups, those who had booked a CSIRO program in the past ten years, and those who had not. During this part of the survey administration, each group of personal contact e-mails got a different copy of the survey, based on booking history, so the responses could be kept separate.

The e-mail messages used to introduce our study and provide the link to the survey can be found in *Appendix J*. These e-mails were slightly different for primary and secondary schools in order to address differences in schools' staff structure at the different levels.

A total of 3,221 e-mails were sent out. Of those, 2,418 were emailed to generic school addresses (1,829 of which were primary and 589 of which were secondary), and 803 to personal teacher addresses (439 of which had used a program in the past ten years and 364 of which had not). Out of all of these messages, 864 were returned as "undeliverable," resulting in a total of 2,357 messages that, to the best of our knowledge, reached someone's inbox. Because of time restrictions, we were only able to give respondents eight days to respond before we cut off data collection for analyse purposes.

In return, we received 140 survey responses, yielding a final response rate of approximately 6%. To investigate the legitimacy of this response rate, we referred to survey analysis principles and found that we did not collect enough responses to make representative claims about the entire population of Victorian teachers and administrators. We also found that several factors may have made the data from this survey unreliable.

When response rates are low, the potential for non-response bias is a greater concern. Respondents and non-respondents may have different characteristics that might influence the results. For example, respondents who have positive opinions about CSIRO's programs may have been more likely to complete the survey than others. In our survey design, we did not create any way to detect non-response bias, nor did we have the resources or time to do an analysis for it. Thus, we

considered potential biases when discussing findings from the survey, and attempted to avoid any generalisations of findings to the entire population of Victorian teachers.

In order to reveal findings from our survey data, we used an open coding process to produce statistics for the responses to open-ended questions. This process involved grouping individual responses together under coded titles based on specific keywords within the responses. The coding categories for teachers' decision criteria and use of programs can be found in *Appendix M*. Additional analysis will be presented in section 3.3. This coding process may have introduced bias to our findings, since the coding was determined by our interpretation of the responses. For this process, we could not be sure that all of our interpretations were accurate.

3.2.2 School Visits

While the web survey was designed to obtain responses from a large population of Victorian teachers, it did not provide much depth to the answers we were seeking. Therefore, we sought to contact a small population of Victorian teachers in-person to explore *why* and *how* they use programs in a more detailed manner. One of the greatest challenges of this project was gaining access to teachers given their large work load and various time constraints. For this reason, team members travelled to schools during programs in order to establish face-to-face contact with teachers. This introduction provided a way for our team to explain our project goal to teachers and gain their attention, making the process of scheduling follow-up formal interviews easier.

We visited a total of twelve schools with CSIRO educators. When choosing which programs to attend, we focused on selecting a wide variety of programs in a number of different schools. Visits were planned at government, independent, and catholic schools of both primary and secondary levels in order to account for differences in teachers' perspectives based on school types and student age levels. A detailed schedule of programs attended can be seen in *Appendix B*.

Team members travelled to the schools with CSIRO presenters. During each program, we approached teachers with a short questionnaire, attempting to uncover brief information on the following topics:

1. How did you learn about this program?
2. What criteria did you look for when choosing this program?
3. How well does this program fit the criteria?
4. What would you do without CSIRO Education's programs?

These questions were designed to be specific and easily answerable, so that short teacher responses could be given during the program with as little disruption as possible. Although responses to these questions were helpful, the primary reason for this method was to introduce ourselves to teachers. With the help of an in-person conversation, it became easier for us to gain personal contact information from teachers and set up additional semi-structured interviews. In the days directly following the school visits, the team members who attended each program entered data from responses into a spread sheet organised by school, teacher, and program information. Any contact information that we obtained was used to establish communication with teachers via e-mail or phone. From there, follow-up interviews were scheduled based on teachers' convenience.

We coded the responses to the questionnaires and calculated the frequencies of the response codes. We also looked for trends among different types of schools. The findings from these initial

questionnaires were mainly used as indicators of where to probe for more information and supporting evidence for claims based on interview and survey data.

3.2.3 Interviewing Teachers and Administrators

In order to discover the underlying reasons why teachers find specific aspects of a program more important than others, we designed interview questions meant to spur thoughtful discussions from teachers (see *Appendix D & E*). Through these discussions, teachers brought up ideas and factors that otherwise may have been overlooked. The primary reason for these interviews was to gain information on the reasons behind reoccurring responses from teachers. The interviews were geared towards answering the following research questions:

1. What are the primary reasons teachers book specific programs? Why are these important?
2. How are teachers using programs in their classroom? Why do they choose to use informal education programs in these ways?
3. What prevents teachers from booking certain informal education programs?
4. How can CSIRO education programs be improved?

A benefit of these interviews was that they allowed us to get on a similar level of understanding with teachers. In the Web-based survey we developed for this project, the surveyor was not available to answer any questions that the respondents may have had. A great deal of the survey's effectiveness depends on how well questions are formulated so that the respondents are interpreting the questions in the manner they were intended. In our interviews with teachers, we were able to help teachers fully understand what we intended by our questions, making the data collected by these means more reliable.

In developing our interview script we used information from program evaluations and discussions with CSIRO staff to construct probing questions. These types of questions were designed to get teachers in the right mindset to answer our larger research questions. Since we had an idea of potential responses, we were able to create questions that would lead to further explanation of the reasoning behind their thinking. These probing questions allowed us to build some sort of familiarity and understanding upon the topics which we discussed.

Interviews with teachers we met during school visits were scheduled and usually conducted during the week following the program's presentation. In total, nine interviews were held with teachers who had recently participated in one of CSIRO's programs. Since these visits were limited to booking schools, we did not have a way of establishing in-person contact with teachers who had not booked CSIRO programs.

To reach these types of teachers, potential schools were identified from CSIRO's database and e-mailed. These e-mails were sent out to general school addresses, asking for teachers who were interested in participating in an interview to respond. From those teachers that responded, six phone interviews, and one in-person interview, were set up with non-participating teachers. Our interview questions for this group were based around the same research questions as interviews with participating teachers, while not specifically referencing CSIRO programs. We chose to take this approach so we would be able to directly compare the differences and similarities between responses from those not participating in CSIRO programs with those who are.

Directly after individual interviews were completed, data was entered and organised in a spreadsheet. Key phrases were coded based on demographic characteristics of the interviewees,

and the frequencies of these phrases were compared to the results of the survey. Most of the information gathered from the interviews was used as supporting evidence to add depth to the findings made from our Web-based survey.

3.3 Developing Recommendations for CSIRO

Once data had been collected, we began analysing it to form recommendations to assist CSIRO's program development and advertising. We aimed to identify where CSIRO programs and advertising aligned with teacher needs, and where there were gaps. To formulate our recommendations, we focused on the following questions:

1. Are there any differences between the criteria of teachers who have previously booked with CSIRO and those who have not? Are there any differences in responses to this question based on respondent demographics?
2. Are there any differences in how teachers use programs based on respondent demographics?
3. What are the reasons behind teachers' choices not to book programs with CSIRO? How can CSIRO address this?
4. How can CSIRO better align its methods of advertising to schools with the needs and interests of teachers in mind?
5. Can program structure be altered? Does anything need to be added to or removed from the program presentation?

To answer these questions we calculated the frequency of the coded responses to find the most commonly mentioned criteria for booking and uses of informal education. From those frequencies, the percentages of each coded response were calculated for different demographics of respondents, such as participating and non-participating, and primary and secondary. In order to explore whether different types of teachers had different decision criteria, or used programs differently, we conducted Chi-square tests for significance.

The most commonly mentioned responses were identified, and interview data was used to support these findings. We also attempted to use interviews to identify and explain any responses to questions that were not often mentioned in the survey.

We then looked at the data given from non-booking teachers on why they had chosen not to book programs with CSIRO. With the information gained from Victorian teachers, we were able to compare our findings to what we learned from CSIRO Education about how programs are designed and advertised. This comparison was used to identify areas where CSIRO's efforts misalign with what Victorian teachers value about informal education and how they use programs.

Once we had identified these gaps and alignments, we created a set of preliminary recommendations which were aimed to connect CSIRO's programs and its advertisements more with what we learned from Victorian teachers. To see what CSIRO Education, Victoria thought, we discussed our preliminary recommendations with staff and sought feedback about their feasibility. In these meetings, we discussed the extent to which CSIRO Education can use our recommendations to increase its programs' participation rates and educational outreach across the state of Victoria.

4 Results and Analysis

The results and analysis in the following section reveal the information we gained from CSIRO Education, Victoria and the respondent Victorian teachers and administrators. In this chapter, we present findings about Victorian science teachers' decision criteria for informal education programs, along with their use of the programs. We then compare CSIRO's program content and presentation with teachers' booking criteria and uses of informal education programs in order to get a better understanding of where CSIRO's program design succeeds, and where it can be improved. Lastly, we look in-depth at CSIRO Education, Victoria's advertising strategies to examine how effectively they increase participation from new bookers.

4.1 Victorian Teachers' Criteria for Booking Informal Education Programs

When choosing to utilise informal education programs, teachers use different criteria to measure a program's potential value. This value, which is determined by how well a program meets these criteria, plays a significant role in deciding which informal education programs teachers choose to book. The survey and interview respondents in this study identified between one and six criteria, with an average of three, that influence their decision to book informal education programs. Response frequencies from the survey are shown in Figure 3. The most common decision criteria, from both interviews and surveys, were the program's relevance to the curriculum, the price of the program, and the ability of the program to engage students. In this section, we discuss each of these criteria along with the influence of school type and booking history, and use interview results to add greater insight into teachers' decisions.

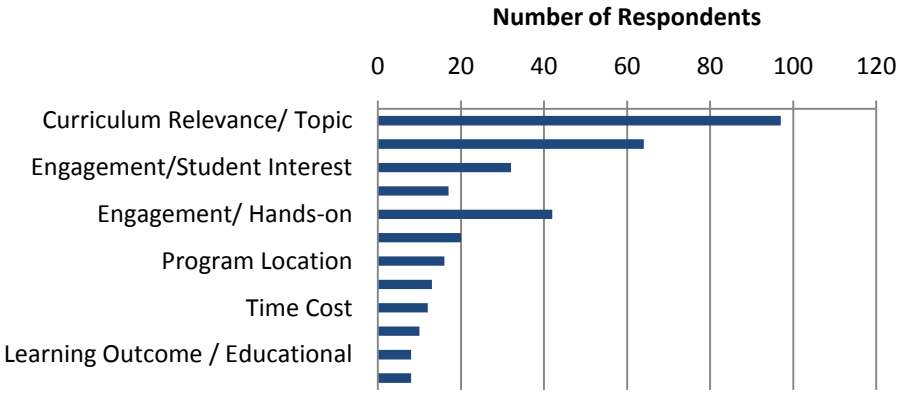

Figure 4.1: Teachers' criteria for booking informal education programs.

4.1.1 Curriculum Relevance

Many respondents (82%) indicated that a program's curriculum relevance was among their decision criteria. This criterion was mentioned more than any other. When coding these responses for analysis, some keywords that were coded to mean *curriculum* were subject, topic, unit, course, theme, program, and VELS (Victorian Essential Learning Standards). Keywords that were coded to represent *relevance* included relationship, fit, complement, link, and support. Any combination of these keywords was coded as "curriculum relevance."

As previously mentioned, respondents listed an average of three criteria when asked to describe their criteria for booking informal education programs. Eighteen respondents, however, only listed one criterion. Out of these eighteen responses, fifteen of those were coded as curriculum relevance.

Thus, of the respondents who only considered one criterion when deciding which program to book, "curriculum relevance" was most often that single criterion. In addition, a majority of the sixteen interview respondents indicated that a program's curriculum relevance was one of their most important criteria. These sixteen interviews included teachers who had and had not participated in CSIRO programs. During interviews, respondents were asked to describe their criteria for booking programs, and then rate each criterion on an importance scale[4]. Nine of the sixteen respondents who were interviewed rated curriculum relevance as 9/10 or 10/10 on this scale.

The importance of curriculum relevance was consistent between teachers who had used CSIRO programs and those who had not. Survey responses showed that 79% of teachers using CSIRO programs mentioned curriculum relevance, compared to 90% of teachers who had not used a CSIRO program. In one interview, a teacher explained that, in their school, teachers and administrators first decide on which areas of the curriculum to focus on, and then look for informal education programs that fit within those areas. This response showed that, in some cases, teachers already know what science topic they want a program to cover before deciding what informal education provider to use. Interviews with teachers also helped us discover that most programs had been selected by teachers due to the similarity between the program's name and the current learning unit's topic.

85% of *primary* school teachers listed curriculum relevance as one of their criteria to book programs. Similarly, 78% of *secondary* school teachers also listed this criterion. From interviews, we discovered that primary level teachers seemed to look for programs which fill gaps between their school's curriculum and their personal knowledge on a specific subject. Through discussions, we learned that some teachers booked programs to cover the area of the curriculum where they personally lacked enough expertise to confidently teach. One primary teacher explained that she or he believed that programs should be developed to provide knowledge and material that inexperienced teachers do not feel confident teaching themselves.

Secondary level schools, on the other hand, usually have science coordinators and classroom science teachers who possess backgrounds in science. This background seemed to give them more confidence in teaching various science topics to their students. Interviews with these teachers revealed that their reasoning for booking programs with relevance to their curricula was aimed to gain access to the equipment, materials, and facilities that their school could not supply. This opportunity allowed teachers to educate students on a curriculum-related subject which they felt they did not have the proper resources to effectively teach.

Although curriculum relevance was most commonly mentioned criterion, not all teachers required curriculum relevance when searching for informal education programs. In fact, one interview showed that some teachers look for the opposite of curriculum relevance. In this interview, a secondary level teacher explained that sometimes teachers attempt to book programs which teach material that is not covered extensively by the curriculum. This approach allows teachers to fit in additional learning experiences that would otherwise not have been taught due to time restrictions.

4.1.2 Price

The price of the program was the second most mentioned aspect in teachers' booking criteria. Fifty-four percent of the survey respondents assessed the monetary cost of a program during the

[4] A scale from 1 to 10 based on importance, one being "not even considered" and ten being the "vital to my decision"

selection process. About half of the interview respondents listed "price," and interviewed teachers gave it ratings from 4/10 to 10/10 on the importance scale. These respondents commented on the value that programs provide compared to their costs. One interviewee, who consistently booked with CSIRO Education, Victoria, stated that how willing teachers are to pay for informal education programs depends on how worthwhile the program is to their classroom teaching practices. Another teacher who had previously used CSIRO programs said that even though the programs were considered expensive, the educational value of the programs was completely worth the price. Whether or not teachers value price highly as a booking criterion, a significant number of the teachers we interviewed still consider how the price of the program will influence the school's budget.

Although all interviewed teachers took price into consideration, some consider price to be less influential on their decision of booking programs. Fifty-five percent of government school respondents and seventy-one percent of Catholic school respondents revealed price as a criterion for choosing which programs to book. In comparison, only 43% of independent school respondents listed price as a criterion. The reason for this difference can be better understood by looking at the breakdown of funding for the different school types (see Figure 4.1). From interviews with teachers, we learned that in most schools either a pre-determined school budget or the parents of students supplied the funding for informal education programs. If parents were expected to pay for each program a school chooses to use, the school needed to consider the typical income for families in that area. Families with lower incomes may be more hesitant to pay for any informal education programs, while wealthier families are more willing to pay additional fees for programs and field trips. To account for the families with lower incomes, an interviewee suggested she or he would consider the exact number of students who could not afford the program, and then find a source that would pay for these particular students. It was important to this teacher that no student is left out, so price was of high importance to that teacher when choosing informal education programs.

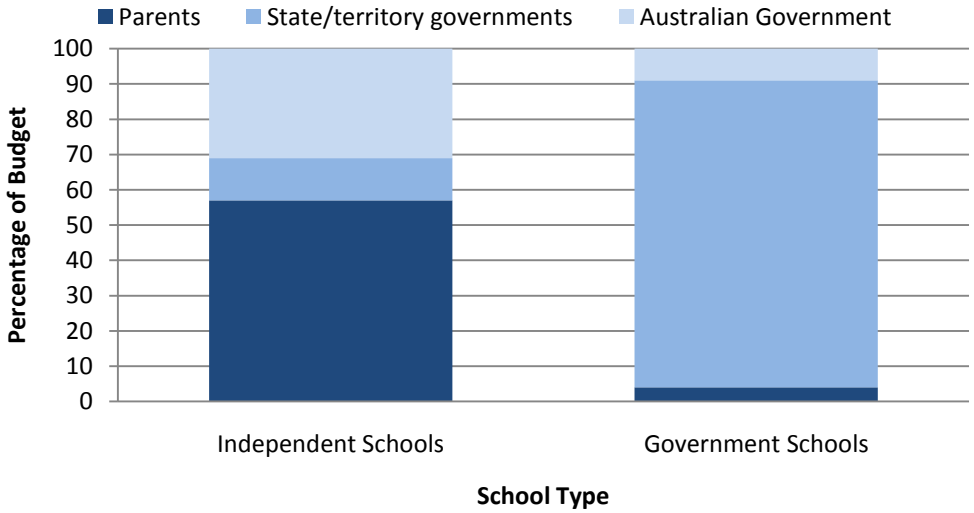

Figure 4.1: Breakdown of funding for independent schools and government schools.

How much a school values science may also influence its budget for informal science education programs. According to one interview with a primary school teacher, in the past their school budget was controlled by someone who was not interested or well educated in science. This led to improper spending of the science portion of the budget on activities that did not result in a

reasonable improvement to science teaching. This could create problems with teachers getting programs they want, especially with many schools having mentioned a limited budget.

4.1.3 Student Engagement

Thirty survey respondents mentioned some term that was coded to mean "engagement" in their criteria for booking informal education programs. When coding responses, we grouped together any responses mentioning student engagement, hands-on activities, and presenter skills under *student engagement*. Our reasoning for including these terms was that hands-on activities and skilled presenters generally are used to "engage" students in programs. Responses which simply mentioned "engaging" did not specify which aspect of engagement these respondents were specifically referring to.

Most teachers we interviewed valued hands-on activities as an effective method for getting students excited and engaged about a topic. Hands-on material received ratings of 10/10 from a third of the interviewees, including those who had used CSIRO programs and those who had not. Twenty percent of primary school teachers mentioned hands-on activities in the survey, while only eight percent of secondary teachers did so. From our team's observations, primary school students are more engaged with the activities in a program than secondary students. One interview, from a secondary school teacher, mentioned that the use of hands-on activities for secondary students was aimed more towards relating the activities to real world situations, rather than getting the students excited. Even though the reasoning behind the use of hands-on activities differed between these two levels, it was clear that they both valued this aspect of programs.

Three teachers from primary levels said they used hands-on materials in their classroom for at least 50% of the time spent on science topics. Another primary school teacher, who rated hands-on material a 10/10, said she or he spends very little time (about 5-10%) on hands-on activities because there were too many other topics to cover in the curriculum. CSIRO programs allowed the teachers to incorporate hands-on activities for their students without giving up too much of their classroom time spent. All secondary teachers who we interviewed said they were using hands-on material outside of a CSIRO program as well, even if they were not making it a priority for booking a program.

Teachers also mentioned that when the presenter was enthusiastic and used interactive discussions along with the hands-on activities, their students became more excited and got more involved in the program. One teacher, who booked CSIRO programs over ten years ago, said that when they held a program in their classroom, they had one presenter that was fantastic and one that was not as engaging. They have not booked a CSIRO program since then because of this. When asked to explain their importance of the presenter's engagement, she or he said that the presenter is one of the biggest criterions in choosing a program, if not the biggest. They needed to make sure a presenter was effective, without the presenter losing the classroom mindset.

4.1.4 Program Reputation and Familiarity

Our discussions with teachers revealed another criterion for booking informal education programs, which was not found to be of high significance in our survey. When attempting to discover why teachers chose to book programs with specific informal education providers, we found that many teachers book programs because either they personally, or another teacher within the same school, had previously used that program before. In most cases, teachers were already satisfied with the particular program's performance, and had chosen to simply re-book the same program yearly

rather than risk the money on an unknown program. Through brief interviews with teachers who had booked CSIRO programs, we found that nearly all teachers we talked to had found out about the programs through word-of-mouth within the school. Additionally, almost all of the twenty CSIRO programs we attended were with schools which had also booked a program previously with CSIRO within the past five years. During in-depth interviews, four out of nine teachers listed reputation as a criterion for booking CSIRO programs, and gave it ratings of 5/10, 8/10, and 10/10 on an importance scale. One interviewee preferred to ring other teachers before booking a program to ask about their experiences with CSIRO programs. Another interviewee said that after being satisfied with a particular CSIRO program, she or he was comfortable recommending that program to other teachers, re-booking that program annually, and willing to try other CSIRO programs. Once teachers became content with a program, they trusted other programs offered by the organisation.

Our survey data, however, showed that only 7% of respondents mentioned anything related to a program's reputation as part of their criteria for booking. We are unsure of the source of this discrepancy, except that perhaps the survey questions may have been understood in a different way.

4.2 How Victorian Teachers Use Informal Education

The second area of investigation we identified for this project was how teachers use CSIRO science education programs. In many ways, the findings from this line of inquiry reinforced teachers' criteria for booking programs, but we also learned more about how teachers integrate programs into learning units. In this section we discuss the details of our findings along with their limitations.

In the online survey, teachers who had previously experienced CSIRO programs were asked how they use CSIRO programs in their teaching practices. Out of the eighty-seven responses to the open-ended question, only forty-six gave useful answers. The remaining respondents either did not respond at all or misunderstood the question. The useful responses were coded into the six categories shown in Table 4.2.

Table 4.2: Survey respondents' answers to the question "How do you use CSIRO programs in your teaching?"

Use	Responses
Reinforcement, enhancement, or support of a learning unit	29
Introduce concepts	12
Provide unavailable equipment resources	11
Provide practical or hands on experience	9
Stimulate or excite students	8
Provide otherwise unavailable knowledge resources	7

In interviews, teachers were asked how they use programs. Because this was preceded by a question about where in a learning unit they use the programs, we obtained somewhat different answers. Program placement and purpose were heavily dependent on the learning unit and the preference of the teacher. Most respondents said they use these programs as an immersion into a learning unit, a supplement to the classical lecture style of teaching, and for additional teaching resources the schools could not provide.

The survey results revealed differences between primary and secondary teachers on use of programs. Figure 5 shows the percentage of primary and secondary teachers who indicated specific uses for CSIRO programs. While there are not enough responses to make any sort of generalisation, most uses listed by teachers were very similar among primary and secondary schools. Programs used to introduce concepts, and programs used to provide equipment resources showed the largest variation between the school levels.

More primary school respondents reported they use programs to introduce concepts, compared to secondary school respondents. From our visits to schools with CSIRO programs, we've found that most science in primary schools has been taught by general teachers with no specific background in science. These primary school teachers may choose to use CSIRO programs because they believe the program presenters have more background on the topic and can present a more accurate picture of the overall subject. Some teachers may actually wish to use programs to learn about the topic themselves.

More secondary survey respondents than primary respondents reported they use programs to fill a gap in school equipment resources. We saw similar evidence in our interviews where a secondary school teacher told us he had been using a particular program for over ten years because it provides students hands-on experience with a tensometer, a rare piece of equipment.

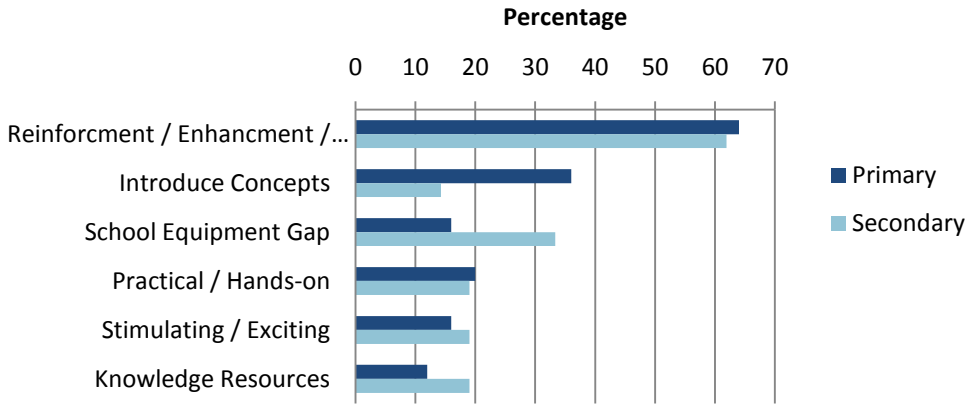

Figure 5: Use of CSIRO programs by survey respondents, grouped by school level.

Teachers who stated they had not used CSIRO programs were only asked in a few interviews about the reasons they use informal education programs; however, it seems that they do use them similarly. Teachers who do not use CSIRO programs stated they either used programs in the beginning of the unit to introduce it, or at the end to wrap the unit up.

4.3 CSIRO's Program Design: Addressing Teachers' Needs

In the previous two sections we presented findings about *how* and *why* Victorian teachers use informal science education programs. We now analyse the extent to which CSIRO's program design process aligns with teachers' needs. The following sections are organised according to teachers' key decision criteria of program content, price, and presentation.

4.3.1 Program Content

As discussed in section 4.1.1, programs' "curriculum relevance" was found, through survey and interview data, to be the most commonly mentioned and important criterion in the booking process.

We explored CSIRO Education, Victoria's programs to see how well CSIRO's program design process meets the needs for relevant curriculum content. In three interviews, CSIRO Education, Victoria's program designers told us that most of the content in their programs comes from what the staff at CSIRO Education, Victoria calls *"Key Learning Points."* When developing a new program, designers start with these fundamental learning blocks. Each program contains a presentation along with multiple hands-on activities which are designed to demonstrate these learning points. To ensure that each program's content aligns with the state curriculum, CSIRO program designers derive these Key Learning Points from *VELS Initiatives* and *Stages of Learning*. Program designers stated that they strive to create programs that allow teachers to cover as many VELS learning requirements as possible. The hands-on activities in each program, however, are restricted by factors such as practicality, safety, durability of equipment, and age appropriateness. It is the combination of all of these aspects that ultimately determines the content of each program.

CSIRO Deputy Manager, Caitlin Lewis, explained that primary and secondary programs are designed with specific differences in mind. Primary programs require less flashy experiments to capture students' interests than secondary programs. For that reason, primary programs are designed with basic experiments which teach young students the fundamentals of science. As we learned through interaction with teachers, these types of programs are often used by primary teachers who lack a strong enough scientific background to confidently teach certain topics. On a handful of occasions, primary school teachers approached CSIRO presenters after programs with either questions about the fundamental learning blocks of activities, or ways in which they could recreate the activities on their own. Mrs. Lewis then explained that secondary level programs, on the other hand, are designed with flashy experiments and rare equipment. These programs are designed to stimulate excitement in science at the secondary level, where students' interest in science generally falls off. This approach to designing programs supplies teachers with resources which are not available to them at their school. In discussions with teachers who had participated in CSIRO's VCE level programs, we found that many times programs were used to cover certain parts of the VELS curriculum where teachers felt they were inadequately equipped to teach. Over half of the secondary level teachers we talked to stated that without CSIRO's programs, they would have difficulty finding resources that were capable of sufficiently replacing the program's content. In both cases, CSIRO's program design process specifically addressed what we had found to be important to teachers who value curriculum relevance in informal education programs.

In our talks with teachers after CSIRO's program presentations, we learned that just about every teacher found that the program's content fit either "well" or "perfectly" with their school's curriculum. Out of the thirty-nine respondents, only one selected that their reason for not using CSIRO was because the content in CSIRO programs was not relevant to their curriculum. This indicates that teachers are not choosing to not use CSIRO programs for the lack of curriculum relevance. In agreement with these findings, 81% of 1,284 CSIRO post-program evaluation respondents selected that they "strongly agreed" that the program's content was well related to their school's curriculum and learning unit. Additionally, another 16% stated they "agreed" the program's content was well related.

4.3.2 Price

Program price was also mentioned by over half of the survey respondents when describing their criteria for booking informal education programs. To see where CSIRO stands, we compared its

program pricing to that of its main competitors. In interviews and surveys, we asked teachers to list any other forms of informal education they use (the results are shown in Figure 6). The most commonly mentioned forms of informal education included programs from the science museum ScienceWorks and university outreach programs. Many teachers also listed classroom visits to the Melbourne Zoo and the Melbourne Museum. For comparison, we chose to look at ScienceWorks and Monash University's outreach programs, whose educational programs we determined to be closely related to those offered by CSIRO Education.

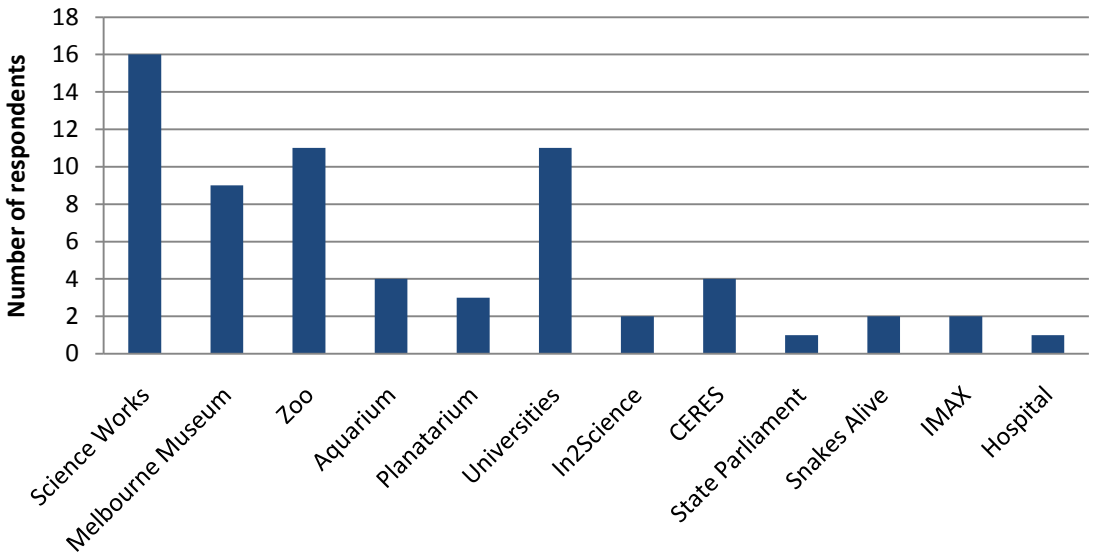

Figure 6: Other forms of Informal Education providers listed by survey respondents.

Monash University's Science Centre offers similarly structured programs as CSIRO Education, with incursion and excursion options for programs in chemistry, the human body, the environment, earth science, physics, and math. These programs are advertised to be "hands-on," "conducted by qualified scientists," and "tailored to the Victorian Essential Learning Standards" (Monash Science Centre, homepage). The price of each program is $175 per hour, with minimum two hour bookings. Monash Science also charges an additional booking fee of $20, and allows a maximum of thirty students per program. This amounts to a total of $370 for two hours of programs or, with a full class of thirty students, roughly $13 per student.

ScienceWorks' education programs are offered at a museum-type educational centre and do not offer incursion options. Instead, ScienceWorks charges a small booking fee ($11) for teachers who want to conduct self-guided tours of their educational facilities at their own pace. ScienceWorks also provides staff guided tours, which incur an extra fee usually under $5 per student. The maximum number of students per group varies largely depending on the program of exhibit, but in general, this form of informal education is less expensive than others. When considering price, however, teachers choosing to book these programs must also consider the cost of transportation, which makes programs more expensive depending on the school's distance from ScienceWorks' education centre. Since museum-type educational programs, such as those offered by ScienceWorks, the Melbourne Zoo, the Melbourne Museum, and the Aquarium are often cheaper than others, more teachers generally chose to use these types of programs with their classrooms (see Figure 6).

CSIRO's program pricing is comparable to that of Monash Science. CSIRO Education, Victoria's incursion programs charge metropolitan schools anywhere from $150-$250 per program. Regional schools require additional fees due to travel expenses and can get as high as $365 for specific VCE level programs. Prices for excursion programs held at the *CSIRO Science Education Centre (CSIROSEC)*, however, are less expensive. Since about 90% of CSIRO's bookings come from incursion programs, which last ninety minutes and allow a maximum of thirty students, the average price ranges from approximately $5-8 per student for metropolitan schools. Rates for regional incursions can get as high as $13 per student.

To explore the extent to which CSIRO's pricing might prevent teachers from booking their programs, we used our survey to ask respondents who had not participated in a CSIRO program about their reasons for not choosing to book with the organisation. Thirty-two percent of survey respondents selected that a "lack of funding" prevented them from booking programs. In three of seven interviews with these non-booking teachers, interviewees explained that CSIRO's pricing was a barrier preventing them from booking its programs. One teacher even described a high desire to book CSIRO programs, but explained that the price was simply too expensive for the school to afford.

Price was not just an issue for schools that had not previously used programs. In an interview with one CSIRO-participating respondent, the teacher explained "We haven't [been] able to use anything like this for many years due to the finances of the school and the socio-economic background of our students." In another post-program interview, a teacher from a "low" *Socioeconomic Status (SES)* school described having problems getting a full program's worth of students to pay for the programs.

Price is a factor in any teacher's decision to book informal education programs. However, CSIRO's program evaluations showed that 88% of the 1,198 respondents either "agreed" or "strongly agreed" that the CSIRO program's cost was appropriate. Combined with interviews, this information allowed us to conclude that teachers who have experienced CSIRO programs in the past generally believe that the program's educational value is worth the price. With that being said, CSIRO's pricing is generally on the upper end for informal education programs in its area, which is clearly limiting its bookings.

4.3.3 Program Presentation

Although each program CSIRO Education, Victoria offers must be tailored in a specific way, all program presentations follow the same general format. From observing programs objectively and talking to CSIRO staff, we became familiar with this format. Presentations begin with a brief introduction and explanation of what "CSIRO" is and does, no longer than three minutes. The CSIRO educator then has a question, depending on year level and program subject, which is used to spur an interactive discussion with students on the topic of the particular program. From there, educators introduce and explain the activities which are previously set up around the room for students' experimentation. Students then work in groups of two or three to complete as many activities in the amount of time allotted. Students are given freedom to move to any open activity, but are expected not to have more than one group at each activity at one time. After the activities, the educator explains the *Key Learning Points* behind a few selected experiments in "wrap-up" type discussions.

According to data from 1,287 of CSIRO's post-program evaluations, 86% of respondents strongly agreed that the program succeeded in encouraging their students' participation. Additionally, open

response questions in these evaluations, which provided room for respondents to explain their favourite and least favourite features of the program, identified that the presenter's enthusiasm along with the use of interactive discussions and hands-on activities generally resulted in more excitement and engagement from students. Although just about all of the twenty teachers who we spoke to during CSIRO program presentations explained their satisfaction of the engagement with students, a handful of teachers offered their thoughts on ways in which the presentation could be improved to increase student engagement.

In four separate interviews, teachers stated that CSIRO programs would benefit from spending less time on introductory and explanatory discussions. These respondents valued the hands-on aspect of the programs above all else, and believed more time could have been spent on the activities if the discussions did not last as long. Along the same lines, one respondent teacher expressed a wish for students to be told when to move from activity to activity. As we were told by this respondent, some students were unable to complete all of the activities because students often spent too much time on certain experiments. Another respondent teacher recommended that students be given more responsibility to figure out how to do the programs on their own, rather than have a detailed introduction on how to complete each activity.

4.4 CSIRO's Advertising: Reaching New Bookers

Survey and interview results were also used to analyse the effectiveness of CSIRO Education, Victoria's advertising methods. Respondents who indicated they had previously participated in a CSIRO program were asked to indicate whether they were ever responsible for physically booking the program. Respondents who had not previously participated in a CSIRO program were asked to select their reasons for not doing so from a provided list in order to investigate how many responded with being "unaware of CSIRO programs' existence." This section explains what we learned about CSIRO's main advertising technique and how effectively its content is designed and targeted to increase CSIRO's participation from new bookers.

Although CSIRO's website and teacher conferences serve to promote the organisation, CSIRO Education, Victoria's main form of advertising comes from annual mail-outs to schools. These mail-outs contain an advertising brochure along with an explanatory letter. The Office Manager at CSIROSEC explained that these mail-outs are sent from CSIROSEC once per term, amounting in a total of four mail-outs addressed specifically to the "teacher in charge of science" or "science coordinator." Two of the four mail-outs are sent to re-booking schools within the Melbourne metropolitan region, where CSIRO Education, Victoria sees most of its program participation. The other two mail-outs are meant to reach potentially *new* bookers, and are sent out to every school in Victoria regardless of booking history or location. As seen in *Appendix L*, CSIRO's advertising brochures are broken down by school level. Each pamphlet lists the programs that CSIRO Education, Victoria offers, along with brief descriptions of each program's content. The brochure also includes the year level(s) each program is targeted towards, the program's price, time length, and whether or not it is available as an incursion or excursion. On the back of the brochure is a short-list of teacher testimonials followed by the organisation's contact and booking information.

4.4.1 Brochure Content

As its main form of advertising, the content in CSIRO Education, Victoria's brochure aligns with what we found to be the most influential criteria in teachers' decisions to book informal education programs. Data from our survey showed that, apart from price, the criteria found to be most

important to teachers were curriculum relevance and student engagement. In CSIRO's brochure, descriptions of programs stress the hands-on and interactive nature of the programs' presentations. Additionally, teacher feedback on the brochure states that "95% of teachers find that CSIRO programs relate well to their curriculum" and that "the hands-on activities offered are the best way for students to engage and learn science."

Considering what we learned about the uses primary and secondary level teachers have for informal education programs (see section 4.2), we looked to see how well the brochure's content addressed these differences. Since survey and interview findings indicated that secondary teachers often use programs as a way to gain access to equipment resources that aren't provided by the school, we investigated the secondary level brochure to see how well its content aligned. Looking at the secondary level brochure (*Appendix L)*, we found that almost all of the program descriptions do not incorporate any type of description about the equipment being used in each program.

4.4.2 Target Audience

Since our project focuses on increasing the current participation rate of CSIRO's programs, the ultimate test of the success of its advertising was to determine the extent to which the organisation's current advertising techniques reach new bookers. In this area of investigation, we determined clear opportunities for CSIRO Education, Victoria to extend its advertising to specific audiences in order to see increased participation in their programs.

Through the exploration of CSIRO's database, we discovered that of the 477 total bookings over the past year (from May 31, 2010 to May 31, 2011), 409 of those bookings (86%) were with schools that had previously participated in a CSIRO program within the past five years. From 2008-2011, this percentage stayed approximately consistent, showing that the organisation has only about 15% of its bookings (over the past four years) from "new-bookers." Thus, we concluded that CSIRO has been unable to increase participation of new bookers.

A large majority of CSIRO's annual program participation comes from consistently re-booking schools. In interviews, almost all teachers from re-booking schools told us that they had found out about CSIRO Education, Victoria and its programs through word-of-mouth within the school system, and that the school's familiarity with the organisation, combined with CSIRO's reputation, made teachers feel comfortable re-booking. Although this shows that CSIRO's programs have satisfied a majority of their participants enough to re-book within the next five years, we aimed to investigate how the organisation could increase the number of *new* bookers. This accomplishment would increase CSIRO's outreach to a wider range of schools throughout Victoria, and would be the most effective means of increasing participation rates.

We first investigated who, within schools, was actually the person responsible for physically making the bookings with informal education programs. According to survey data from ninety-seven teachers who had previously participated in CSIRO programs, over 60% of the "general teachers" at primary schools and over 65% of the "science teachers" at secondary schools were the ones actually responsible for making the booking with CSIRO. Compared to the percentage of "teachers in charge of science" and "science coordinators" who were responsible for making bookings, these percentages were roughly the same.

This finding was given further meaning when we discovered from teacher interviews that in most cases, the person responsible for booking a program was generally the person who decided which

programs to book. During some visits to schools, a few teachers present at the CSIRO presentation told us that they were not even informed of the program being scheduled until that morning. According to these teachers, another teacher, lab tech, librarian, principal, or vice principal had been the one responsible for selecting and booking multiple sessions, one of which each teacher attended with their individual class. When looking at data from both interviews and the survey, we concluded that in a significant portion of schools, it was not simply the job of the "teacher in charge of science" or "science coordinator" to choose and book programs. Rather, this process was the responsibility of an administrator with a different title, or the shared responsibility of many general teachers to book programs how they wish.

Of thirty-nine respondents from non-booking schools, seventeen respondents (44%) selected that their reason for not booking with CSIRO was because they were "unaware of CSIRO's existence." This finding reveals that CSIRO's mail-out advertisements are not effectively reaching teachers that they were sent to. When we looked further into the respondents, we found that there was no significant difference between respondents based on school location or level. What we did find was that almost half (47%) of non-booking respondents who were "unaware of CSIRO's existence" possessed less than five years of teaching experience. However, there are several limitation factors that influence the reliability of this finding.

For this survey question, multiple-choice answers were provided. In one case, a respondent selected "unaware of CSIRO's existence," "not available in my location," and "content not relevant" for why they had not booked with CSIRO Education, Victoria. This showed us that there was some misunderstanding in the way the question was posed. This misunderstanding, along with a low return rate, limits the weight we can place on this finding.

We concluded that although CSIRO Education, Victoria is sending at least two mail-outs per year to every school in the state, the mail-out advertisements are either being hung-up within the school administration or not effectively intriguing teachers who have not previously booked with CSIRO Education, Victoria enough to stay in their memories.

This finding was also restricted to several limitations. This misunderstanding, along with a low return rate, made us sceptical about claiming these findings.

5 Conclusions and Recommendations

We begin this chapter by summarising our findings on the most influential criteria for booking programs, how teachers use programs, how well programs are aligned with the needs of teachers, and why some teachers are choosing not to book programs with CSIRO. We then provide recommendations to address any changes or improvements that can be made in CSIRO's program design and advertising strategies.

5.1 Summary of Findings

The most influential criteria in respondents' decisions to book informal education programs were curriculum relevance, program price, and student engagement. These were the most commonly mentioned criteria in our survey data, and were also found to be the most influential through interviews with teachers. Although we found that these criteria did not vary significantly between the teachers of different school levels or booking histories, the *reasons why* teachers valued these criteria did vary with school level and school type. Primary teachers tended to value a program's relevance to the curriculum because they are looking to fill gaps between their school's curriculum and their personal knowledge on a specific science subject, while secondary teachers tended to look for programs which provide curriculum related equipment and resources that the school might not have access to. While most teachers tended to consider the price of a program when booking, the influence of that criterion depends mostly on the school type; independent schools tended to see the price of a program as a less influential criterion than other school types. When considering student engagement, most teachers valued hands-on activities and a knowledgeable presenter as a way of keeping students interested in science.

Respondent teachers tend to book programs repetitively because of previous experience and satisfaction with the program. Most teachers who book programs with CSIRO have previously used its programs in the past. Over 80% of CSIRO's annual bookings from 2008 to the present were from schools which had booked a CSIRO program at least once within the five years prior to that booking. In addition, just about every teacher who participated in the programs we attended had either previously participated in a program, or had discovered CSIRO by word-of-mouth from another teacher who had previously participated in a program. Our findings from interviews suggest that teachers tend to trust referrals from other teachers when deciding which programs to book.

How teachers use informal education programs depends on the learning unit and the teacher's preferences. We found no correlation that linked certain demographics to specific ways of using programs in a learning unit. When we asked teachers in interviews how they use programs, many of them indicated that it depended on the learning unit. We did find that, from survey respondents, the most commonly mentioned use of informal education was as a reinforcement of the current learning unit. Although the percentages of respondents using programs in this way were similar between school levels, other uses of informal education differed between primary and secondary respondents. More primary level respondents tended to use programs as introductory immersions into learning units, while more secondary respondents tended to use programs to provide the equipment and resources that students would not otherwise have access to.

The content, engagement, and price of CSIRO Education, Victoria's programs align well with teachers' criteria for booking programs. CSIRO programs are tailored to the Victorian Essential Learning Standards (VELS), and are designed to be suitable for specific year levels. Primary level

programs include activities that are geared towards being simple yet engaging for young students. Secondary level programs try to spur interest in science by including more uncommon and hard-to-find equipment and resources for students to interact with. Past post-program evaluations and interviews with teachers indicated that, for the most part, teachers were satisfied with the program's design, presentation, and cost. The cost of CSIRO's programs is comparable to other similar programs provided by different organisations. From this, we concluded that any realistic change to CSIRO's program design and presentation would not render significant increases in program participation rate or satisfaction.

A significant portion of survey respondents who had not previously participated in a CSIRO program were not completely aware of CSIRO Education, Victoria and its offerings. Nearly half of respondents who had not previously participated in a CSIRO program selected that they were "unaware of CSIRO programs' existence" when asked why they had not booked with the organisation. Additionally, all respondents who selected that CSIRO programs were "not available in their area" were in the same region as at least one other respondent who had participated in a CSIRO program. Whether or not these results were due to misunderstandings of the survey questions, this lack of awareness shows that CSIRO's advertising strategies do not sufficiently reach all Victorian teachers and administrators.

Many respondents who were responsible for booking programs are not targeted by CSIRO Education, Victoria's mail-out advertisements. Roughly half of survey respondents who had previously participated in a CSIRO program and were responsible for booking the program reported that they were not the "science coordinator" or "teacher in charge of science" at their school. However, CSIRO only addresses its mail-out advertisements to these specific positions within schools. Thus, we concluded that CSIRO's advertisements may not be effectively reaching all teachers responsible for booking programs.

5.2 Recommendations

From our findings we concluded that CSIRO's program design aligns well with *why* and *how* teachers use informal education programs, but there are some noticeable gaps in CSIRO's advertisement strategy. In order to help CSIRO Education, Victoria expand its educational outreach, we have developed five recommendations which focus primarily on addressing the areas in which CSIRO can improve their advertising strategies.

Continue current approach to program design with small variations. CSIRO designs their programs in a way that sufficiently aligns with what we found to be the three most commonly mentioned and most influential criteria for booking programs. We recommend that CSIRO continue to approach their program design strategies in the current manner. A small variation that can be taken into consideration include shortening the introduction to allow students to have more time with the hands on activities. The introduction can be shortened by providing less explanation on how to do each activity, and holding students responsible for figuring out how to do these activities more on their own. More time could also be spent on the wrap up discussion that explains the *Key Learning Points* of the activities.

Address mail-out advertisements to a wider range of teacher positions within schools. We found that many teachers who are responsible for booking programs are not "teachers in charge of science" or "science coordinators;" however, CSIRO's mail-out advertisements are only addressed to

teachers in those positions. In order to reach more of the people who are responsible for selecting and booking informal education programs, we recommend that CSIRO Education, Victoria address its annual mail outs to a wider range of teachers and administrators of different positions within a school. Since the organisation sends more than one mail-out per year, there are opportunities to address multiple staff positions annually. CSIRO can also include more than one brochure within the mail-out, so that brochures can be distributed to multiple teachers within a school. This approach could result in CSIRO's advertisements reaching more people who are responsible for booking programs, yet unfamiliar with CSIRO Education's entire offerings.

Offer incentives for teachers who successfully refer new bookers to CSIRO programs. Many teachers learn about programs from another teacher. In an effort to expand program participation and obtain more new bookers, we recommend that CSIRO offer discounts to teachers or administrators who successfully refer new bookers to its programs. This will hopefully create an incentive for teachers to learn about CSIRO Education and spread information about the programs around educational communities through word-of-mouth. This form of communication, which we found to be one of the most popular ways in which teachers find out about informal education programs, could significantly increase the number of teachers using CSIRO programs.

Offer discounts for teachers from schools that have not booked programs within the past ten years. Many survey respondents stated that a lack of funding prevented them from booking programs with CSIRO. A significant portion of respondents who had not previously participated in CSIRO programs were also unaware of the organisation's programs. In order for CSIRO Education to effectively expand its outreach throughout Victoria, the organisation should put more focus on attracting new bookers. In order to attract more first time bookers to CSIRO's programs, we recommend that CSIRO offer a first-time discount for teachers who have not participated in programs within the past ten years. This may allow teachers who feel programs are too expensive to experience programs and better assess their value. Since many teachers who have previously participated in CSIRO programs have been satisfied enough with the program to rebook it, allowing teachers to have discounts on their first CSIRO program may lead to more schools that re-book.

Use testimonials from teachers more regularly in advertising. Generally, teachers who have participated in CSIRO programs are satisfied. Many teachers learn about these programs from other teachers in their school. They are more likely to trust that the program is worthwhile if another teacher has had a positive experience with the program. We recommend that teacher testimonials be used more heavily throughout advertisements, and generally made more available. This will allow sceptical teachers to see what others think of the program.

Other ways testimonials can be made more available are through social networking websites. Options for the organisation include creating CSIRO Education pages on general social networking websites such as *Facebook* and *Twitter*, as well as education focused networking websites such as *Education Network Australia*. Not only can this form of advertising make teacher testimonials more available to other teachers, it also makes them more visible to parents who are sometimes responsible for funding programs.

5.3 Conclusion

CSIRO Education, Victoria's informal education programs are used to improve science teaching by linking hands-on activities with concepts being taught in the classroom (C. Krishna-Pillay, CSIRO, personal communication, March 11, 2011). However, the centre currently only reaches 7% of Victorian students.

According to post-program evaluations, teachers using CSIRO programs, for the most part, are satisfied with the program design and presentation. However, we found that if CSIRO's advertising strategies are improved, they may be able to reach more students.

With this information and these recommendations, CSIRO will hopefully be able to better adapt their programs and advertising to target *why* and *how* teachers use informal education, and reach more Victorian teachers and students. Making CSIRO aware of this information could create new opportunities for the organisation to gain appeal throughout Victorian schools. Hopefully, with these opportunities, CISRO will see an increase in the number of schools who choose to book their programs.

Glossary of Terms

ACARA – Australian Curriculum, Assessment and Reporting Authority

ABS – Australian Bureau of Statistics

ACB – Australian Census Bureau

ACER – Australian Council for Educational Research

CSIRO – Commonwealth Scientific and Industrial Research Organisation

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

DEECD - Department of Education and Early Childhood Development

CEOM - Catholic Education Office of Melbourne

IQP – Interactive Qualifying Project

OECD – Organisation for Economic Co-Operation and Development

SES – Socioeconomic Status

SMET – Science, Mathematics, Engineering, and Technology

TIMMS – Trends in International Mathematics and Science Study

VCE – Victorian Certificate of Education

VELS – Victorian Essential Learning Standards

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Appendix A – Interview Protocol for CSIRO Staff

CSIRO staff interview template:

Staff Member: _____ Permanent / Casual

General information on staff member:

Expansion/ Marketing:

What are the challenges that CSIRO faces to increase school participation in programs?

What are the opportunities CSIRO has to increase school participation in programs?

Development:

What criteria are used when developing CSIRO programs?

How are CSIRO programs designed so that they fit into science curriculums?

Are programs built more towards the goal of aiding teachers or stimulating student interest?

Success Rate:

What makes certain programs more or less successful?

Understanding the booking process:

How do teachers request and book programs

Influencing factors:

What factors you do think influence teachers decision to book programs?

Appendix B – CSIRO Incursion Program Schedule for School Visits

Date	Program	Presenter	Year	School	Location	Type	Level	Team
17/03/11	Minibeasts	Elke	1,2	Birralee	Doncaster South	Govt	Prim	All
18/03/11	ND	Sean	5,6	Fitzroy North	Fitzroy North	Govt	Prim	Krysten Kurt
21/03/11	Toys	Gemma	1,2	Wheelers Hill	Wheelers Hill	Govt	Prim	Ernie Ariel
22/03/11	ND	Sean	5,6	Wales Street	Thornbury	Govt	Prim	Kurt Ernie
24/03/11	R&Ch	Sean	3,4	Mordialloc Beach	Mordialloc	Govt	Prim	Ariel Ernie
24/03/11	TS	Sean	5,6	Mordialloc Beach	Mordialloc	Govt	Prim	Ariel Ernie
25/03/11	Physics	Sean Kate	12	De La Salle College	Centre	Cath	Sec	All
28/03/11	Physics	Sean	12	Bentleigh	Centre	Govt	Sec	Ariel Ernie
28/03/11	Polymers RMIT	Simon Sarah	11	St. Peter's	Cranbourne	Cath	Sec	Krysten Kurt
29/03/11	Polymers RMIT	Simon Sarah	11	Mt. Saint Joseph	Altona	Cath	Sec	Ariel Ernie
30/03/11	ND	Sophie	5,6	Lloyd Street	Malvern	Govt	Prim	Krysten Kurt
01/04/11	Forensic	Cath	9	Westbourne Grammar	Werribee	Priv	Prim	Ariel Ernie
04/04/11	Nanotech	Caitlin	9	Overnewton Anglican	Taylors Lakes	Priv	Sec	Ariel Ernie
05/04/11	Forensic	Elke	9	Sunbury Downs	Sunbury Downs	Govt	Sec	Krysten Kurt

Program	Full Name
Minibeasts	Minbeasts and Miniworlds
ND	Natural Disasters
Toys	Toys
Biodiversity	Biodiversity and the World Around Us
R&Ch	Reaction and Change
TS	Thinking Scientifically
Physics	Physics
Polymers	Polymers and Nanochemistry
Forensic	Forensic Frenzy
Nanotech	Nanotechnologies

Appendix C – Initial Teacher Questionnaire

Date:	Team Member:
Program:	Presenter:
School:	Year Level:
Teacher Name:	Phone:
E-mail:	

Follow-up contact times:

Teacher role in booking: □ Booking teacher □ non-booking teacher (involved in decision) □ non-booking teacher (not involved in dec.) □ Not teacher's class, watching kids Other:

Year Levels Taught: P 1 2 3 4 5 6 7 8 9 10 11 12

Teacher's role in school:

Past CSIRO program experience:

1. How did you learn about this program?
2. What criteria did you look for when choosing this program?
3. How well does this program fit the criteria?
4. What would you do without these types of programs?

Appendix D – Interview Protocol for Participating Teachers

Date:	Team Members:	
School:	Primary / Secondary	
Government / Private / Catholic	Year Level:	
Male / Female	Years Teaching:	Schools taught at:

1. What are the primary reasons teachers book specific programs? Rate them.

    a. What different educational programs do you book/use?
    b. Why do you book/use these programs over others?
    c. What appeals to you about these programs?
    d. What are the primary reasons teachers book specific programs?

2. How are you using the programs in your classroom?

    a. Where in a specific learning unit or topic would be the best place for an informal education program (or hands-on activity)? Why?
    b. Is this when you book informal education programs for?
    c. If yes, does it accomplish what you want it to?
    d. If no, what prevents you from using it in the way you would prefer?

3. What prevents teachers from booking CSIRO programs?

    a. How much time is spent on science per week?
        i. How many hours are student in class a week?
        ii. How much of the time devoted to science is hands on?
    b. How many informal education programs would you prefer to book yearly? (if price was not a factor)
    c. Where does the money come from for programs?
    d. How many do you actually book?
    e. What prevents you from booking more?

4. Where could CSIRO programs be improved?

    a. Has the program delivered what you expected?
    b. Has it delivered anything you didn't expect?
    c. Where you satisfied with the program(s) you booked?
    d. Have you ever been disappointed by a particular program?
    e. How might they be improved?

Appendix E – Interview Protocol for Non-participating Teachers

Date:	Team Members:	
School:	Primary / Secondary	
Government / Private / Catholic	Year Level:	
Male / Female	Years Teaching:	Schools taught at:

1. Have you heard about CSIRO Programs?
    a. If yes, why do you choose to not book their programs?
2. Do you use educational programs in your classroom?
    a. If yes, what different educational programs do you use, including excursions and incursions?
        i. Why do you use these specific programs over others?
        ii. What appeals to you about these programs?
        iii. Using all the factors you consider when booking programs, give each individual factor a rating between 1-10 on how important they are, 1 being not very important and 10 being very important.
        iv. What time frame within a specific learning unit or topic would be the best place for an informal education program? Why?
            1. Is this when you realistically get to book informal education programs?
            2. If yes, how do you use the program at this time?
            3. If no, what prevents you from using it in the way you would prefer?
    b. If no, why do you choose not to use educational programs?
        i. What other teaching methods do you use?
3. How much time is spent on science per week in your classroom?
    a. How much of that time is devoted to hands on science?
4. How many informal education programs would you prefer to book (if price was not a factor)?
    a. If none, why do you prefer to not book programs?
    b. What prevents you from booking programs?
    c. Where would the money come from to pay for the programs?

Appendix G – Program Evaluation Form

PROGRAM EVALUATION

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 is greatly appreciated.

SCHOOL NAME: _____ **POSTCODE:** _____

TEACHER'S NAME (optional): _____

EMAIL (optional): _____

YEAR LEVEL (please circle): P 1 2 3 4 5 6 7 8 9 10 11 12

PROGRAM: _____

DATE OF PROGRAM: _____ **NAME OF PRESENTER:** _____

	strongly agree	**agree**	**neutral**	**disagree**	**strongly disagree**
1. The program was engaging					
2. The program was educational					
3. The program encouraged student participation					
4. The program related well to the curriculum/learning unit					
5. The program is likely to encourage students to think about a career in science					
6. The program helped students understand the value of scientific research					
7. The program format, activities were appropriate for this age group					
8. The program support materials were useful (if applicable)					

9. The program is likely to have a lasting positive impact on the students					
10. Program cost was appropriate					
11. I would use this program again					
12. This program was easy to book (booking teacher only)					
13. This program was easy to host (travelling programs) (booking teacher only)					

5.4 14. Overall score for Program out of 10; 10 = excellent, 5 = avera = unacceptable

10

15. What were the best features of the program?

_____

_____

_____

_____

5.5 16. What features could have been improved?

_____

_____

_____

_____

17. Do you have any additional comments or suggestions for new program topics?

_____

_____

_____

1.1.1.1 Please fax or mail to:

1.1.1.2 The Manager
CSIRO Education, Victoria

PO Box 56 Highett Vic 3190

Appendix H – Program Evaluation Summary

Total number of evaluations returned vs. programs since August 2005: 1300/13392= 9.7%

Total overall score out of 10:

10	568	43.7%
9	348	26.8%
8	210	16.2%
7	58	4.5%
<7	34	2.6%
Did not answer	82	6.3%

Best feature of the program:

Hands on Activities	511	39.3%
Activities that were engaging and fun	57	4.4%
Variety of Activities	58	4.5%
Presenter	269	20.7%
Age appropriate	41	3.2%

What feature could be improved?

More hands on	27	2.1%
Less talking	31	2.4%
More student participation	10	.8%
More time	181	13.9%
Price	4	.3%
Organized rotation so children visit all activities	2	<.2%
More information about a career in science	1	<.1%

Additional Comments:

Great Presenter	32	2.5%
Great program	52	4%
Fantastic	24	1.8%

The program was engaging: 1292 responded (99.4%)

Strongly Agree	1037	80.3%
Agree	241	18.7%
Neutral	12	0.9%
Disagree	2	<0.1%
Strongly Disagree	0	0

This program was educational: 1295 responded (99.6%)

Strongly Agree	1088	84.0%
Agree	204	15.8%
Neutral	3	0.23%
Disagree	0	0

Strongly Disagree	0	0

The program encouraged student participation: 1287 responded (99.0%)

Strongly Agree	1107	86.0%
Agree	142	11.0%
Neutral	26	2.0%
Disagree	10	0.8%
Strongly Disagree	2	0.2%

This program related well to the curriculum/ learning unit: 1284 responded (98.8%)

Strongly Agree	1044	81.3%
Agree	204	15.9%
Neutral	27	2.1%
Disagree	9	0.7%
Strongly Disagree	0	0

The program support materials where useful: 1183 responded (91.0%)

Strongly Agree	762	64.4%
Agree	358	30.3%
Neutral	55	4.2%
Disagree	8	0.7%
Strongly Disagree	0	0

Program cost was appropriate: 1198 responded (92.2%)

Strongly Agree	620	51.8%
Agree	435	36.3%
Neutral	94	7.8%
Disagree	36	3.0%
Strongly Disagree	4	0.3%

I would use this program again: 1283 responded (98.7%)

Strongly Agree	940	73.3%
Agree	287	22.4%
Neutral	38	3.0%
Disagree	13	1.0%
Strongly Disagree	5	0.4%

This program was easy to book: 829 responded (booking teachers only) (63.8%)

Strongly Agree	668	80.6%
Agree	146	17.6%
Neutral	10	1.2%
Disagree	3	0.4%
Strongly Disagree	2	0.2%

Appendix I – Teacher Interview Rubric

We are a group of students working closely with CSIRO Education to discover ways in which CSIRO's programs can be designed or altered to be more useful for teachers. What we want to learn from this interview is **why** teachers book CSIRO programs and **how** they use the programs in learning units. To gain this information, we want to discuss the overall nature of science education in your school, and what you believe to be the role of CSIRO Education's programs in your science teaching. We would appreciate as much information as possible which will be used to help CSIRO design their programs around teachers' needs, but please do not feel required to respond to any questions that you may feel uncomfortable answering. Your responses will be kept anonymous.

Research Question	**Way of getting there in an interview**
What are the primary reasons teachers book specific programs?	1. What different educational programs do you book/use? 2. Why do you book/use these programs over others? 3. What appeals to you about these programs?
How are teachers using programs in their classrooms?	1. Where in a specific learning unit or topic would be the best place for an informal education program (or hands-on activity)? Why? 2. Is this when you book informal education programs for? 3. If yes, does it accomplish what you want it to? 4. If no, what prevents you from using it in the way you would prefer?
What might prevent teachers from booking programs?	1. How much time is spent on science per week, how many hours are student in class a week, how much of the time devoted to science is hands on? 2. How many informal education programs would you prefer to book yearly? (if price was not a factor) 3. Where does the money come from for programs? 4. How many do you actually book? 5. What prevents you from booking more?
How can programs be improved?	1. Has the program delivered what you expected? 2. Has it delivered anything you didn't expect? 3. Where you satisfied with the program(s) you booked? 4. Have you ever been disappointed by a particular program? 5. How might they be improved?

Appendix J – Web-Based Survey Distribution Letter

E-mail to Generic School Addresses:

Subject used for primary schools: "ATTN: Teacher in Charge of Science: Science Education Study"

Subject used for secondary schools: "ATTN: Science Coordinator: Science Education Study"

Dear Colleague,

We are a group of students from Worcester Polytechnic Institute working with CSIRO Education to determine teachers' perspectives of informal science education programs. We would appreciate it if you could take the time to fill out this 5-minute survey and forward it to any teachers or school staff that may have further insight or interest.

Link to survey: <>

If you have any questions please call us on (03) **** ****.

Many thanks for your time.

Krysten Carney, Ariel Hyman, Ernie Mello and Kurt Snieckus

PLEASE NOTE: If you no longer wish to receive emails from CSIRO Education, please reply to this email with the subject "please remove from this list". To the extent permitted by law, CSIRO does not represent, warrant and/or guarantee that the integrity of this communication has been maintained or that the communication is free of errors, virus, interception or interference. The information contained in this e-mail may be confidential or privileged. Any unauthorised use or disclosure is prohibited. If you have received this e-mail in error, please delete it immediately and notify us on (03) **** ****. Thank you.

E-mail to Teacher's Personal Addresses:

Subject: Science Education Study

Dear Colleague,

You may have heard about a science education study from CSIRO Education. If you have already completed the online survey, we appreciate your response and you may delete this message. If you have not responded, we would appreciate it if you could take the time to fill out this 5-minute survey.

<Survey link>

If you have any questions please call us on (03) **** ****.

Many thanks for your time.

Krysten Carney, Ariel Hyman, Ernie Mello and Kurt Snieckus

Appendix K - Victorian Teacher Survey

Victorian Teacher Thoughts on Informal Science Education

The inclusion of informal education programs, such as incursions and excursions, in science curricula has been shown to enhance students' interest in science education. We are university students working with CSIRO Education, Victoria to help expand the reach of these informal education programs, and to learn how teachers are using them in their classrooms. Your input will help focus the design of informal education programs around Victorian teacher needs. The following questions will take about five minutes to answer, and your response will be kept anonymous.

* Required

What is your gender?
□ Male
□ Female

What is your age range?

How many years have you been teaching?

Which school level do you teach? *
□ Primary
□ Secondary

Continue »

Victorian Teacher Thoughts on Informal Science Education

Primary School Teachers

What is your teaching role?
□ General classroom teacher
□ Science coordinator/ teacher in charge of science
□ Science specialist
□ Principal
□ Vice principal
□ Other:

What year levels do you teach?
Please mark all that apply
□ Prep
□ 1
□ 2
□ 3
□ 4
□ 5
□ 6

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Victorian Teacher Thoughts on Informal Science Education

Secondary School Teachers

What is your teaching role?
□ Science teacher
□ Science coordinator/ head of science
□ Curriculum coordinator
□ Principal
□ Vice principal

What year levels do you teach?
Please mark all that apply
□ 7
□ 8
□ 9
□ 10
□ 11
□ 12

What science subjects do you teach?
Please mark all that apply
□ General science
□ Chemistry
□ Biology
□ Physics
□ Environmental science
□ Psychology

Do you teach any other subjects?
If so, please list.

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Victorian Teacher Thoughts on Informal Science Education

* Required

What school sector do you work in?
□ Government
□ Independent
□ Catholic
□ Other:

In what region is your school located?
□ Northern metropolitan
□ Southern metropolitan
□ Eastern metropolitan
□ Western metropolitan
□ Barwon south western
□ Gippsland

□ Grampians
□ Hume
□ Loddon Mallee

Have you or your students ever participated in a CSIRO science education program? *
□ Yes
□ No

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Victorian Teacher Thoughts on Informal Science Education
Previous CSIRO Program Experience

Do you personally book the CSIRO program?
□ Yes
□ No

What criteria do you use when booking informal science education programs?
Please list in order of importance, beginning with most important

How do you use CSIRO programs in your teaching?
Please describe how and where CSIRO programs fit into your teaching practices

Have you or your students participated in any informal science education programs/activities other than those offered by CSIRO?
Please list all

«Back Continue»

Victorian Teacher Thoughts on Informal Science Education
No Previous CSIRO Program Experience

Have you or your students participated in any informal science education programs/activities?
Please list

What criteria would you use, or do you use, when booking informal science education programs?
Please list in order of importance, beginning with most important

Why have you chosen not to use CSIRO's science education programs?
Please mark all that apply
□ Unaware of their existence
□ Not available in my location
□ Lack of funding
□ Content not relevant
□ Not a useful experience for my students
□ Not engaging or interesting
□ Not supported by other staff in my school
□ Other:

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Victorian Teacher Thoughts on Informal Science Education

How many hours do you spend on any type of "hands-on" science education per week?
Please estimate the number of hours

If you have unlimited resources, how many hours would you like your students to spend on "hands-on" science education per week?
Please estimate the number of hours

Thank You

Thank you for completing this survey. If you would like more information about CSIRO and their science education incursion and excursion programs, visit www.csiro.au/educationvic.

«Back Submit

Appendix L – Primary Programs Brochure

Teacher Professional Development

We present professional development sessions covering a wide range of subject areas, including chemistry, energy, robotics, inquiry-based learning, literacy in science and inexpensive hands-on activities. These sessions generally run for 90 to 120 minutes but can be adjusted to suit your needs. Please contact us for details.

Family Science Evenings

These are a great way to explore science and bring the school community together. We can help with activities, demonstrations and advice. Please contact us for details.

Other programs for teachers and students:

Double Helix Science Club

Get your hands on our two kids' science magazines with free online teacher's guides. There are big savings available on bulk subscriptions and free membership available through the School Science Prize. It also provides diverse scientific inspiration for students, including regular events and engaging holiday programs (see below).
www.csiro.au/helixschools & www.csiro.au/vichelix

Holiday Science Activities

Every school holidays, the Double Helix Science Club provides entertaining and educational whole day science activities for a range of age groups at venues around Melbourne.
www.csiro.au/vicholidays

Scientists in Schools

Scientists in Schools matches scientists, mathematicians and engineers with primary and secondary school teachers in ongoing partnerships which are supported by resources, emails, phone calls and face-to-face events.
www.scientistsinschools.edu.au

Carbon Kids

CarbonKids enables students, teachers and communities to understand climate change. It is an innovative school-based education program that combines the latest science with sustainability education and encourages positive actions that make a direct contribution to becoming more sustainable.
Find out more at **www.csiro.au/carbonkids**

What do teachers think?

95% of teachers find programs relate well to the curriculum and are likely to have a lasting positive impact on students.

"Great links to real life and science careers switches kids on. Excellent hands-on activities."

"The hands-on aspect of your programs is the best way for students to engage and hence learn about science."

"FANTASTIC!! Totally engaged the children. Terrific experience—motivating and linked to our topic. Thank you!!"

CSIRO Education's nine education centres see over 380 000 students and teachers annually and over 5 million have completed our programs.

CSIRO Education operates in every state and territory.

Want more teaching resources?

FREE ACTIVITIES:
www.csiro.au/sciencemail & www.csiro.au/diy

AWARDS PROGRAMS:
http://scienceawards.bhpbilliton.com & www.csiro.au/crest

CSIRO SHOP (teacher's resources): www.csiroshop.com

Bookings / Contact Us
Phone: 03 9252 6387 / 03 9252 6410
Fax: 03 9252 6256
Email: education.vic@csiro.au
Web: www.csiro.au/educationvic
Graham Rd Highett VIC 3190

www.csiro.au

CSIRO

CSIRO Education
Victoria

Primary school programs 2011

Travelling curriculum-linked, hands-on programs for your students. Inspiring and educating young Australians.

A partnership with:

Introducing Robots

P-2 60

In this engaging hands-on session, students will have fun learning simple programming to guide a robot across a map. This helps to develop spatial reasoning, numeracy, literacy and communication skills.
$170 (metropolitan) or $225 (regional).

Solids, Liquids & Gases

P-2 45

Celebrate the International Year of Chemistry with CSIRO Education! This hands-on session shows students the three most common states of matter and how substances can be altered by a chemical or physical change.
$130 (metropolitan) or $170 (regional).

Minibeasts & Miniworlds

P-4 60

This hands-on program features live insects, bizarre and beautiful specimens and exciting activities to help students appreciate why Minibeasts are so important for the health of our environment.
$170 (metropolitan) or $225 (regional).

Starlab

P-6 30 (P-2), 60 (3-6)

In our portable planetarium, students observe the sun, moon, stars and planets. Observations are linked to the Earth's rotation, day, night and the seasons.
Metropolitan schools $170 (P-2) or $190 (3-6); regional schools $190 (P-2) or $215 (3-6).

Costs & general info

SCHOOL YEAR SUITABILITY

MINUTES PER SESSION

PROGRAM CAN TRAVEL TO YOUR SCHOOL

Costs listed are for programs in your school; programs at the Science Education Centre in Highett are at a lower cost—please contact us for details.

Unless noted, all programs have a maximum of 30 students per session and are available all year subject to bookings.

Minimum daily charges apply in schools. GST may apply to some programs. Prices valid 2011.

TURN OVER FOR BOOKING AND CONTACT DETAILS

Air & Weather

P-6 30 (P-2), 60 (3-6)

This interactive show explores the properties of air and how these influence the weather. Maximum 60 students.
Metropolitan schools $170 (P-2) or $245 (3-6); regional schools $190 (P-2) or $320 (3-6).

Toy Science – designs and inventions

P-6 60

Experimenting with toys can broaden your students' knowledge of science. This popular hands-on program also explores the ideas of form and function. Maximum 60 students.
$245 (metropolitan) or $320 (regional).

Forces, Movement & Simple Machines

P-6 60

Students identify the action of forces and simple machines. This hands-on program allows students to investigate the motion of objects in terms of single forces or combinations of forces. Maximum 60 students.
$245 (metropolitan) or $320 (regional).

Energy Sources & Uses

P-6 60

Students identify different forms of energy and investigate devices that transfer or transform energy. They look at power generation from renewable energy sources and consider the basic science that underpins this technology. Maximum 60 students.
$245 (metropolitan) or $320 (regional).

Reaction & Change

3–4 60

Celebrate the International Year of Chemistry with CSIRO Education! What are chemicals and how do we use them? What is a chemical reaction? These ideas are explored in this popular hands-on session.
$170 (metropolitan) or $225 (regional).

Exploring Robotics—robots & design

3–6 90

Students explore what makes robots different from other machines. By working with simple programs they learn about how a robot 'thinks', consider the advantages and limitations of robots and explore how design affects robot performance. Also available is 'Working with Robots', a follow-up session that introduces students to the basics of programming.
$230 (metropolitan) or $265 (regional).

Natural Disasters

3–6 75

Students explore the exciting events that occur in the Earth's atmosphere and crust. This program covers earthquakes, tornadoes and volcanoes.
$210 (metropolitan) or $245 (regional).

Biodiversity and the World Around Us

5–6 90

Changes in biodiversity, population numbers and abiotic factors (eg CO_2 levels and water availability) can have profound impacts on ecosystems. Discover how scientists use data logging, population sampling, classification and atmospheric monitoring to track changes and help make predictions. This program includes first-hand data logging and data gathering in your school, allowing students a "real world" experience.
$230 (metropolitan) and $265 (regional).

Thinking Scientifically

5–6 90

A hands-on session examining the scientific method in detail. This program considers such concepts as hypotheses, variables and fair tests, and skills such as measuring, collecting and analysing results.
$230 (metropolitan) or $265 (regional).

Forensic Frenzy

5–6 90

Solve a crime by analysing evidence left at the scene. Gain an exciting insight into the intriguing world of forensic science.
$230 (metropolitan) or $265 (regional).

Cool Chemical Science

5–6 75

Celebrate the International Year of Chemistry with CSIRO Education! Students work on a great series of hands-on experiments using chemicals and materials with unusual properties.
$210 (metropolitan) or $245 (regional).

Appendix M - Secondary Programs Brochure

VCE Photonics
VCE Physics 3 & 4 · 90

This hands-on program examines this rapidly growing and exciting new field of communications. With experiments ranging from a simple exploration of Total Internal Reflection to advanced concepts in telecommunications, students will be able to learn how new advances are enabling us all to keep in touch faster and more efficiently.
$245 (metropolitan) or $320 (regional).

VCE Immunology - NEW
VCE Biology 3 · 120

This engaging workshop investigates the specific and non-specific immune systems through the use of the advanced research technique of Enzyme-Linked Immunosorbent Assay (ELISA). Students will perform hands-on activities to gain a further understanding of the humoral and cellular immune responses and explore acquired immunity. A discussion of autoimmune diseases and other relevant theory will help students consolidate their understanding of the immune response. Maximum 24 students.
$290 (metropolitan) or $365 (regional).

VCE Genetic Engineering
VCE Biology 4 · 150 or 120

This engaging laboratory program provides students with experience and knowledge in genetic engineering processes and applications. Students undertake bacterial transformation and gel electrophoresis activities and engage in an interactive discussion of other laboratory techniques such as the Polymerase Chain Reaction, and pertinent ethical issues.

The session can also include an additional 30-minute component in which students will gather first-hand data to demonstrate Mendelian patterns of inheritance. Only available at CSIRO Education in Highett.
Maximum 24 students
$220 per session including this activity; $200 per session without this activity.

Teacher Professional Development

We present professional development sessions covering a wide range of topics including materials, biotechnology, nanotechnology, photonics and inquiry-based learning. These sessions generally run for 90–120 minutes, but can be adjusted to suit your needs. Please contact us for details.

Other programs for teachers and students:

Double Helix Science Club

Get your hands on our two kids' science magazines with free online teacher's guides. There are big savings available on bulk subscriptions and free membership available through the School Science Prize. The club also provides diverse scientific inspiration for students, including regular events and engaging holiday programs run by this centre.
www.csiro.au/helixschools
www.csiro.au/vichelix
www.csiro.au/vicholidays

Scientists in Schools

Scientists in Schools matches scientists, mathematicians and engineers with primary and secondary school teachers in ongoing partnerships which are supported by resources, emails, phone calls and face-to-face events.
www.scientistsinschools.edu.au

Carbon Kids

CarbonKids enables students, teachers and communities to understand climate change. It is an innovative school-based education program that combines the latest science with sustainability education and encourages positive actions that make a direct contribution to becoming more sustainable. Find out more at **www.csiro.au/carbonkids**

What do teachers think?

95% of teachers find programs relate well to the curriculum and are likely to have a lasting positive impact on students.

"Great links to real life and science careers switches kids on. Excellent hands-on activities."

"The hands-on aspect of your programs is the best way for students to engage and hence learn about science."

"FANTASTIC!! Totally engaged the children. Terrific experience—motivating and linked to our topic. Thank you!!"

CSIRO Education's nine education centres see over 380 000 students and teachers annually and over 5 million have completed our programs.

CSIRO Education operates in every state and territory.

Want more teaching resources?

FREE ACTIVITIES:
www.csiro.au/sciencemail & www.csiro.au/diy

AWARDS PROGRAMS:
http://scienceawards.bhpbilliton.com & www.csiro.au/crest

CSIRO SHOP (teacher's resources): www.csiroshop.com

Bookings / Contact Us
Phone: 03 9252 6387 / 03 9252 6410
Fax 03 9252 6256
Email: education.vic@csiro.au
Web: www.csiro.au/educationvic
Graham Rd Highett VIC 3190

www.csiro.au

CSIRO

CSIRO Education Victoria

Secondary school programs 2011

Travelling curriculum-linked, hands-on programs for your students inspiring and educating young Australians.

A partnership with:

Cool Chemical Science

7–8 | 75

Celebrate the International Year of Chemistry with CSIRO Education! Students work on a great series of hands-on experiments using chemicals and materials with unusual properties.
$210 (metropolitan) or $245 (regional).

Thinking Scientifically

7–8 | 90

A hands-on session examining the scientific method in detail, including the concepts of hypotheses, variables and fair tests, and skills like measuring, collecting and analysing results.
$230 (metropolitan) or $265 (regional).

Biodiversity and the World Around Us

7–10 | 90

Changes in biodiversity, population numbers and abiotic factors (eg CO_2 levels and water availability) can have profound impacts on ecosystems. Discover how scientists use data logging, population sampling, classification and atmospheric monitoring to track changes and help make predictions. This program includes first-hand data logging and data gathering in your school, allowing students a "real world" experience.
$230 (metropolitan) and $265 (regional).

Forensic Frenzy

7–10 | 90

Solve a crime by analysing evidence left at the crime scene. Gain an exciting insight into the intriguing world of forensic science.
$230 (metropolitan) or $265 (regional).

Costs & general info

SCHOOL YEAR SUITABILITY

MINUTES PER SESSION

PROGRAM CAN TRAVEL TO YOUR SCHOOL

Costs listed are for programs in your school; programs at the Science Education Centre in Highett are at a lower cost—please contact us for details.

Unless noted, all programs have a maximum of 30 students per session and are available all year subject to bookings.

Minimum daily charges apply in schools. GST may apply to some programs. Prices valid 2011.

TURN OVER FOR BOOKING AND CONTACT DETAILS

Energy without CO_2

7–10 | 60

Australian scientists are world leaders in investigating climate change. In this engaging and interactive show we analyse causes, consequences and solutions to global warming. Presented in conjunction with the University of Melbourne.
Maximum 60 students.
$245 (metropolitan) or $320 (regional).

The Science of Good Health—Diet, Drugs & Wellbeing

7–10 | 90

This engaging hands-on program explores the impact of lifestyle choices on the health of our bodies. Students discover how diet, exercise and lifestyle affect our total wellbeing.
$230 (metropolitan) or $265 (regional).

Wonder Stuff: Science to Make You Think

7–10 | 60

Discover the weird and wonderful properties of some exciting new materials. In this interactive show, a series of intriguing and stimulating demonstrations will highlight recent developments in novel materials and fascinating technologies, such as the Air Guitar, fluidised beds, i-Glass and PSZ (Partially Stabilised Zirconia).
Maximum 60 students.
$245 (metropolitan) and $320 (regional).

Nanotechnologies—LIMITED DATES

9–10 | 90

Celebrate the International Year of Chemistry with CSIRO Education! Discover the exciting and emerging field of nanotechnology. Hands-on experiments give students an appreciation of processes at the nanoscale. They will become more aware of the innovations nanotechnologies have brought to areas such as health and medicine, consumer products, energy and the environment. Available Term 1 and Term 2 only.
Call us for pricing information.

Gene Technology

9–10 | 90

Introduce your students to laboratory techniques commonly used in biotechnology. Students perform a DNA extraction and a gel electrophoresis experiment, and discuss pertinent ethical and technical issues.
$245 (metropolitan) or $320 (regional).

Caveman Chemistry

9–10 | 90

Celebrate the International Year of Chemistry with CSIRO Education! Extracting metals, making alloys and using non-metallic tools helped prehistoric humans move out of caves. Students make, examine and test properties of some ancient (and modern) materials in this engaging hands-on program. Presented in conjunction with the University of Melbourne.
$230 (metropolitan) or $265 (regional).

The Periodic Table

10 and VCE Chemistry 1 | 90

This program examines trends and patterns with hands-on tests looking at reactivity, types of bonding and the way chemists classify elements in the periodic table's groups and periods. Presented in conjunction with the University of Melbourne.
$245 (metropolitan) or $320 (regional).

VCE Polymers & Nano-Chemistry

VCE Chemistry 1 | 90

This workshop investigates the properties of materials, the nature of polymer chains and applications of materials chemistry. Students will test freshly prepared polyurethane, compare the properties of traditional and recently developed polymers, measure the conductivity of intrinsically conducting polymers, determine the solubility of a biodegradable polymer and explore applications of nanotechnology, including investigating ferrofluids in a magnetic field.
$245 (metropolitan) or $320 (regional).

Analytical Instrument Workshops—LIMITED DATES

VCE Chemistry 3 | 180

Students perform analytical exercises using either HPLC, Gas Chromatography, UV/visible spectrophotometry or Atomic Absorption Spectroscopy at the University of Melbourne. The analysis is followed by a tour of NMR, IR and Mass Spectrometry instruments.

Dates available 10-22 February (9am – 12pm and 1pm – 4pm).
$27 per student. Maximum 50 students per session.

VCE Materials & Structures

VCE Physics 3 | 120

Students use specialised equipment to test materials and structures, illustrating the ideas of Unit 3 Physics to a depth of analysis unavailable in most school laboratories. This program also uses data logging technology for some experiments. Only available at CSIRO Education in Highett.
Maximum 24 students.
$200 per session.

Appendix N – Coding Categories for Booking Criteria and Use

"What criteria would you, or do you use when booking informal science education programs?"

- Curriculum Relevance / Topic
- Engagement / Student Interest
- Hands-On
- Learning Outcome / Educational
- Age Appropriate
- Price
- Availability
- Program Location
- Time Cost
- Equipment / Knowledge / Resources Provided
- CSIRO Brand / Reputation
- Presenter Skill

"How do you use CSIRO programs in your teaching?"

- Enhancement / Support
- Introduce Concepts
- School Equipment Gap
- Practical / Hands-on
- Stimulating / Exciting
- Knowledge Resources

Appendix O – Summative Team Assessment

One of the most important aspects of the *Interactive Qualifying Project*, arguably the underlying reason for which this program is implemented as part of Worcester Polytechnic Institute's degree requirements, is its ability to give students experience in the process of teamwork. Working in groups on a project which requires as much work ethic, dedication, and commitment as the IQP, allows students to learn what is effective and what is counterproductive to teamwork. Being familiar with this type of working environment prepares students for future working experiences, all of which are likely to involve some aspect of collaborative thinking.

Over the past fourteen weeks, our team has learned a lot about ourselves and how we work together. One of the most important methods we used to produce effective time management was by conducting weekly and daily team meetings. These meetings provided time where we were able to discuss future plans and personal responsibilities as a group. In addition, team meetings were used to take a step back from our individual contributions and examine the entire project as a whole. This helped us identify how well each team members' personal work flowed together throughout the entire project.

It was important to ensure that any type of criticism was both offered and received in a constructive and professional manner, in order to produce growth as a team. We found that our ability to offer and receive constructive criticism significantly improved throughout the duration of this project. At first, many times criticisms were given without explanations and were not posed in a way that produced improvements. After addressing this issue, we made sure that all criticisms were made in an appropriate and constructive manner. This allowed team members to be more open to accepting and giving criticism, and they were able to produce better team dynamics and outcomes.

One thing we would do differently in a subsequent situation would be to assign responsibilities for non-writing tasks more clearly. Specifically, when conducting data analysis portions of our project, there was a significant overlap and redundancy in what team members spent their time working on. We also believe that we could have completed writing portions of this report in a timelier manner. In a few cases, section drafts were completed within hours of their deadlines. This allowed little time for revisions to be made, which resulted in lower-quality drafts and feedback.

Overall, our team is grateful for this learning experience, which has undoubtedly given us a source of confidence and accomplishment to take to future job experiences.