Establishing the Sustainability of Banksia Gardens Community Centre's Science Education Program

A project by:

Caroline Allen

Mariana De Obaldia

Nicole Smolko

Danielle Wisheart

Date:

1 March 2013

Presented to:

Jaime de Loma-Osorio Ricón

Banksia Gardens Community Centre Liaison

Professor Paul Davis

Advisor

Establishing the Sustainability of Banksia Gardens Community Centre's Science Education Program

An Interactive Qualifying Project Report completed in
partial fulfilment of the Bachelor of Science degree at
WORCESTER POLYTECHNIC INSTITUTE
by
Caroline Allen
Mariana De Obaldia
Nicole Smolko
Danielle Wisheart

Presented to:
Professor Paul Davis, Advisor
Jaime de Loma-Osorio Ricón, Banksia Gardens Community Centre Liaison

Date:
March 1st, 2013

ABSTRACT

This project established the sustainability of Banksia Gardens Community Centre's science education program, which aims to increase interest in science-based careers in the underprivileged community of Broadmeadows. We created a research-based framework for sustainable programs based on seven principles: vision, community needs, adaptability, program results, partnerships, funding, and leadership. We contributed to five of these by stating a vision, identifying key community needs, exploring the feasibility of bringing the program to schools, developing three program versions, and establishing two partnerships.

ACKNOWLEDGEMENTS

We value the fact that our project allowed us to see a part of Australia that tourists do not usually get to see. It was an enriching experience that gave us the opportunity to positively influence children of an underprivileged community. The success of our project would not have been possible without the support of many individuals and organisations.

First and foremost, we would like to thank our project liaison, Jaime de Loma-Osorio Ricón, the Community Development Manager of Banksia Gardens Community Centre. Our project would not exist if not for his vision for the sustainability of the science education program and his request for a project team from Worcester Polytechnic Institute (WPI) to make his vision become a reality. His guidance, knowledge, and connections contributed greatly to our project work and it would not have been possible without him.

We would like to recognise the staff of Banksia Gardens Community Centre including Gina Dougall, Rana Tbaileh, Nick MacHale, Jonathon Chee, Rachel Wood, Natasha Alabakov, Natasha Harby and the rest of the staff for their support of our project. We felt as if we were a part of the Banksia Gardens Community Centre family.

Our team would like to express our utmost appreciation for our advisor from WPI, Paul Davis, for guiding us through the Interactive Qualifying Project (IQP) process. His insight, recommendations, and feedback were invaluable in delivering a report and presentation that we are proud of.

We would like to express our gratitude to Nicola Bulled for her instruction of our ID2050 class at WPI. Her guidance in developing our project proposal was much appreciated, as it prepared us well for our work in Australia.

We would like to thank the Director of the Melbourne Project Centre, Holly Ault, and the Interdisciplinary and Global Studies Division of WPI for giving us the opportunity to come to Australia to complete our IQP.

We would like to acknowledge the local coordinator for the Melbourne Project Centre, Andrea Bunting, for helping us to transition from WPI to Melbourne, Australia.

We are much obliged to last year's team of students from WPI who created the science education program at Banksia Gardens Community Centre. Without their hard work, we would not have a project. We appreciated all their advice and suggestions, as they played a large part in our success in facilitating the Magic Science Day.

We greatly appreciate the support and feedback from our fellow IQP teams of the Melbourne project site. They motivated us to continue to improve our project to reach a high-quality end result.

We are greatly indebted to the Hume City Council and the University of Melbourne, who agreed to partner with the Banksia Gardens Community Centre in providing resources for the science education program. The sustainability of the program would not be possible without their support.

AUTHORSHIP PAGE

Section	Writer	Editor
Abstract	Nicole Smolko	All
Executive Summary	Caroline Allen, Nicole Smolko	All
Chapter 1: Introduction	Nicole Smolko	All
Chapter 2: Framework for a sustainable program	All	All
2.1 Model for a sustainable program	Nicole Smolko	All
2.2 Introducing informal science education to the Broadmeadows community	Nicole Smolko, Danielle Wisheart	All
2.3 Other informal science education programs	Caroline Allen	All
2.4 Marketing strategies for non-profit organisations	Mariana De Obaldia	All
Chapter 3:Implementing the framework of a sustainable program	All	All
3.1 Having a vision	Mariana De Obaldia, Danielle Wisheart	All
3.2 Understanding the needs of the community	Nicole Smolko	All
3.3 Maintaining flexibility and adaptability	Danielle Wisheart, Mariana De Obaldia	All
3.4 Demonstrating program results	Danielle Wisheart	All
3.5 Establishing partnerships	Caroline Allen, Mariana De Obaldia	All
Chapter 4: Conclusions and Recommendations: Status of the sustainability of the science education program	Caroline Allen	All

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

As science and technology become more influential in our everyday lives, a troubling trend has been observed worldwide: despite the increasing demand for scientific and technological progress, young people's interest in pursuing science-based careers is decreasing. One such country where this trend appears is Australia, where only 15.2% of secondary students felt that science careers were worth pursuing (Tytler, 2007). Statistics like this have prompted the creation of several informal science education programs in Australia.

While these programs are making progress towards increasing interest in science, the majority of them are not conducive to areas of low socio-economic standing, where parents lack the resources necessary for their child to participate in a program. One such community is Broadmeadows, which is considered one of the most disadvantaged in the state of Victoria, as the education and employment statistics in Table 1 suggest.

	Broadmeadows	Greater Melbourne
Completion of Year 12	35%	56.7%
Completion of Tertiary Degree	11.1%	23.6%
Unemployment Rate	10.6%	5.5%

Table 1: Education and Employment in Broadmeadows Compared to Greater Melbourne

To combat these troubling statistics, the Banksia Gardens Community Centre, located in Broadmeadows, had a team of students from WPI create a science program in 2012 designed to serve this specific sector of the population. The program was designed to be low cost and easily accessible by the community.

As students of WPI completing our IQP, we partnered with Banksia Gardens Community Centre to contribute to the sustainability of this science education program. This goal was accomplished by creating a research-based model for sustainability and applying the elements of this model to the science education program. The seven elements were:

- Having a vision
- Understanding the community
- Maintaining flexibility and adaptability
- Demonstrating program results
- Establishing partnerships
- Obtaining funding strategically
- Ensuring effective leadership

Having a vision is the first step in creating a sustainable program. While the vision of the science program is not explicitly stated by the Centre, we have proposed an implied vision based on the report by last year's team of IQP students:

> *The goal of the Banksia Gardens science program is to promote interest in science and science-related careers amongst children from a culturally diverse and low socioeconomic background, as well as encourage children to stay in school.*

Understanding the community gives context to the vision. It is important that the Centre has a customer-based mindset rather than an organisation-based one. In order to understand the customer, we interviewed parents whose children attend the Centre's programs. The results of these interviews showed that a significant portion of parents value the educational merit of the programs the Centre runs. This data allowed us to conclude that the educational merit of the science program satisfies the desires of parents whose children attend the Centre. We also surveyed parents of Broadmeadows and the surrounding community. The results of these surveys identified several barriers that must be overcome in order for parents to be able to bring their child to a science program. These barriers included 60% of parents not knowing about the Centre, 59% of parents having little to no interest in science, and 48% of parents not having the time to bring their child to the Centre. We also interviewed science and maths teachers from a local secondary school, which allowed us to identify what aspects of a science program are valued by teachers. The most common responses were that 42% of teachers valued hands-on activities and 16% valued practical applications of science. The idea of bringing the science program to schools would address the needs of parents of this community and the desires of the teachers for a science education program.

Maintaining flexibility and adaptability would ensure that the needs of the community are continually met. We developed three versions of the education program: the in-school version, the after-school version at the Centre, and the Holiday Program version at the Centre. In our interviews and surveys with parents, we presented three possible versions of the science program and asked them which one they would prefer for their child. Even though 45% of parents of the Centre and 45% from Broadmeadows preferred the Holiday version, these responses might be biased because this is the only version of the program that currently exists and that they may know of. Although the in-school version was not the most popular response, this option would eliminate many of the barriers identified by the survey.

Demonstrating program results would allow community members, stakeholders, partners, and funders to witness the success of the program. We facilitated sessions of the science program for Magic Science Day of the Holiday Program and obtained photos, videos, quotes, and observations to demonstrate the successful results of the program to potential sponsors, funders, and the community. We also facilitated a session of the program with Year 11 students from the Hume Valley School and obtained photos, videos, quotes, and observations to demonstrate the program results with secondary school students. The information we gathered from running the experiments—including smiles, positive feedback, and exclamations of excitement—gave us a tangible way to demonstrate the merit of the program to the community.

To make this evidence of the program's success available to a larger audience, we utilised two distinct multimedia methods: updating the Banksia Gardens website and appearing on a local radio show called "Environmentality".

Establishing partnerships gives a program the support it needs to be sustainable. Hume City Council currently runs a science competition and an academic program for children, so they were eager to partner with the Centre in hosting and funding the annual competition and event for the in-school version of the program. Similarly, the University of Melbourne runs science outreach programs, so they felt a connection to Banksia Gardens' science program and agreed to partner with the Centre in providing volunteers to serve as mentors, judges, and facilitators.

Our conclusion for this project is that the Banksia Gardens science education program is well on its way to sustainability, but there is still more work to be done. Five of the seven elements have been addressed, but the final two still need to be completed. In order to secure the sustainability of the science education program, we recommend that Centre addresses the final two elements in the sustainability model.

One element that remains to be addressed is obtaining funding strategically for the program. We recommend that the Centre communicates with the established partners to inquire about contacts they have that could potentially fund the program. Another form of funding that we suggest is crowd funding, which could be accomplished by partnering with the video editing department of Kangan Institute to develop a video to post online.

Ensuring effective leadership is essential to the success and longevity of the program. We recommend that the Centre trains and evaluates facilitators to ensure that they are prepared to facilitate and do so effectively, a step that would require the Centre to develop a training manual and a method for evaluation such as testing or observations.

Finally, we note that the research-based sustainability model we developed here could be applied equally well to other programs at the Centre, helping to insure that they too enjoy long, successful lives serving the needs of the Broadmeadows community.

Chapter 1: Introduction

The 21st century is an era of scientific discovery, medical advancements, and technological improvements. As science and technology become more influential in our everyday lives, a troubling trend has been observed worldwide: despite the increasing demand for scientific and technological progress, young people's interest in pursuing science-based careers is decreasing. This trend has been studied in a number of first world countries, including Australia. A survey conducted in 2007 revealed that only 15.2% of Australian secondary students felt that careers in science were worthwhile to pursue (Tytler, 2007).

Troubling statistics like this have prompted the creation of several informal science education programs in Australia. These programs aim to boost science interest in young people by taking a hands-on approach to scientific learning. Such programs are offered by several organisations throughout Australia, including the Commonwealth Scientific and Industrial Research Organisation (CSIRO)[1], the Melbourne Museum[2], and Monash University[3]. One element that links these programs is the resources required to participate in them: the money to pay for the entrance fee, a way to transport a child to and from the program, and the time it takes to transport the child.

Families that live in low-income communities may not have these extra resources for participating in science education programs; however, these are arguably the families that would most benefit from this kind of program. One such community is Broadmeadows, which is considered one of the most disadvantaged neighbourhoods in the state of Victoria. The people of this community face a variety of challenges, including a high unemployment rate (10.6%), a high level of need for additional income support (38%), and high levels of students not meeting national school literacy (14%) and numeracy standards (10%) (Neville, 2012). Additionally, the Hume City Council community profile states that only 34% of people in Broadmeadows over the age of 15 years have completed Year 12 of their education (Hume City Council, 2012). In the

[1] http://www.csiro.au/en/Portals/Education/Programs.aspx

[2] http://museumvictoria.com.au/scienceworks/

[3] http://sciencecentre.monash.edu.au/shp/index.html

face of the community's high secondary school drop-out and unemployment rates, lack of interest in science is limiting young adults' options for pursuing higher education and obtaining jobs.

These alarming statistics prompted Banksia Gardens Community Centre, located in the heart of Broadmeadows, to take action. Banksia Gardens took the perspective that keeping children in school would ultimately reduce the unemployment rate. With this in mind, plans were formed to develop a hands-on science education program, similar to many others in Australia and elsewhere. It was the hope of Banksia Gardens that this program would introduce children to a new, exciting side of learning, as well as to the practical applications of science, thereby encouraging them to stay in school. However, to address the needs of the community, this program would have to be low-cost for the Centre, so that parents would not have to pay for their child to participate. It would also have to be more accessible to the parents of the community, so that transportation and time constraints would not prohibit them from attending. Taking these factors into consideration would ensure that all children, even those from disadvantaged backgrounds, would be able to benefit from this type of program.

In early 2012, a team of students from WPI created a low-cost science education program for the Banksia Gardens Community Centre. They designed and piloted a hands-on science education program, specifically tailored to the diverse interests of Broadmeadows students. This program successfully stimulated the children's interest in the hands-on realm of experimental science, but lack of time prevented the team from addressing the sustainability of the program (Butler, Czapkowski, Dragonas, & Tran, 2012).

Once the science education program had been designed and piloted, the next step was to ensure the continuation of the program. We proposed a research-based model for a sustainable program that included seven elements:

- Having a vision
- Understanding the community
- Maintaining flexibility and adaptability
- Demonstrating program results
- Establishing partnerships
- Obtaining funding strategically
- Ensuring effective leadership

We began by explicitly stating the vision of the science education program developed by last year's IQP team. Next, we interviewed and surveyed parents in order to better understand the needs and desires of the community of Broadmeadows. These interviews and surveys revealed that parents want their children to attend an educationally-enriching program held in a safe environment. However, there are certain logistical factors that may prevent them from attending the science program, including time constraints and transportation. The interviews with teachers allowed us to verify the feasibility of implementing the science program into the curriculum as a solution to the needs identified in the parent interviews. After learning more about the community, we contributed to maintaining the flexibility and adaptability of the program by creating several versions of the program and identifying the version that best suits the needs of the community. We demonstrated the program results by running a session of the science program at the Centre, and utilising observations, quotes, photos, and videos to illustrate the success of the program to potential partners and supporters. We met with two local organisations, the Hume City Council and the University of Melbourne, to explain the Centre's vision for the program and highlight ways in which they could be of assistance. Both organisations offered to contribute resources to the program, thereby boosting the credibility of the program.

After contributing to these components of the sustainability model, we were able to offer Banksia Gardens an assessment of the sustainability of the science program. We were also able to make recommendations for the next steps that need to be taken in order to fully establish the sustainability of the program.

Chapter 2: Framework for a Sustainable Program

2.1 Introducing Hands-On Science Education to the Broadmeadows Community

Banksia Gardens Community Centre is a neighbourhood house located in Broadmeadows, Victoria, Australia that provides several services and educational outreach programs to members of the Broadmeadows community and the surrounding city of Hume. Broadmeadows, and many other suburbs within the city of Hume, are considered some of the most disadvantaged in the state of Victoria. According to an article in the *Hume Leader*, 10.6% of the Broadmeadows community is unemployed—almost double greater Melbourne's unemployment rate of 5.5% (Jefferson, 2012). Holleman wrote recently, "The loss of legitimate, family-supporting jobs; the concentration and exacerbation of poverty; and a concurrent decline in effective public services translated directly into poor outcomes for its citizens—particularly its children and youth" (Holleman, Jane Sundius, & Bruns, 2010, p. 406). Due to their disadvantaged circumstances, youth living in low socio-economic communities face barriers to achieving higher education.

Educational statistics from the Australian Bureau of Statistics support Holleman's assertion that economic status affects the pursuit of higher education. For example, the census found that only 35% of people in Broadmeadows have completed Year 12 of their education as compared to 56.7% in greater Melbourne (Hume City Council, 2012). The census showed a similar trend in completion of tertiary education; only 11.1% in Broadmeadows completed a tertiary degree compared to 23.6% in Greater Melbourne (Australian Bureau of Statistics, 2011). The Banksia Gardens Community Centre attempts to combat this low educational attainment with several informal education programs. These programs aim to expose youth of Broadmeadows to the joys of learning, thus empowering them to break free of their socio-economic barriers.

While Banksia Gardens has several education programs, such as computer classes, English as a second language, and youth study groups, the organisation lacked a program specifically focused on science. In an attempt to fill this void, a team of students from WPI created a science education program for the Centre in the spring of 2012. The program was designed to increase children's interest in science and, ultimately, inspire science-based careers.

Based on community input, as well as preliminary data from their literature review, the WPI students developed a hands-on education program for Banksia Gardens Community Centre. They ran a pilot session called "Magic Science" that featured some of the experiments outlined in the design of the program. Based on surveys conducted before and after the pilot session, their results indicated that participants in the program discovered the importance of science in society (Butler *et al.*, 2012).

The lessons students learn through hands-on activities, such as the ones developed by the WPI students Butler *et al.*, are directly relevant to the science curriculum in Australian schools. According to the Australian Curriculum, Assessment and Reporting Authority (ACARA), "the science curriculum should foster an interest in science and a curiosity and willingness to speculate about and explore the world" (2009, p. 5). ACARA also states that students should be able to "investigate scientific questions" so that they may learn to draw conclusions based on evidence (2009, p. 5). These invaluable life skills of investigation, assessment, and curiosity are encouraged by the experiential nature of the Banksia Gardens science program.

ACARA also emphasises the importance of science inquiry skills. The science inquiry skills section of the curriculum would be well-served by integrating the hands-on activities of the Banksia Gardens science program. This section emphasises the importance of "planning, conducting, and critiquing investigations" (2009, p. 6). The elements of planning and conducting investigations are not satisfied by textbooks and lecture-based learning. The experiential activities that compose the Banksia Gardens program would allow students to practice collecting their own data, rather than simply analysing existing data. This additional form of education, provided by the Banksia Gardens science program, would satisfy an important piece of the Australian science curriculum by introducing students to the exciting, hands-on side of science education.

2.2 Other Hands-On Science Education Programs

The Banksia Gardens Community Centre does not offer the only informal science education program in Victoria, Australia. Another organisation that offers a science education program is the Commonwealth Scientific and Industrial Research Organisation (CSIRO). Founded in 1927, CSIRO is Australia's national science agency. One sector of the agency, CSIRO Education, Victoria, provides hands-on science education programs to students and teachers throughout Victoria. CSIRO Education offers a wide range of science programs from travelling school programs to holiday vacation programs. While CSIRO aims to make their programs widely available, only 7% of primary and secondary students in Victoria experience a CSIRO Education program annually (Australian Bureau of Statistics, 2011).

Attempting to increase how many students experience a CSIRO Education science program, the organisation has taken several steps to try to perfect its programs. In 2001 and 2011, teams of WPI students completed IQPs sponsored by CSIRO, in which the goal was to recommend ways to increase participation rates of their science education programs (Carney, Hyman, Mello, & Snieckus, 2011; Douglas, King, & Meleschi, 2001). Both teams accomplished this goal by analysing the responses to surveys and interviews they conducted to determine what aspects of the programs deterred participation. In the 2001 project, the important factors in the teachers' assessments of the programs were cost, convenience of applying for the program, time of the program compared to class time schedule, availability of in-classroom programs, and the relationship between class size and program size. In the 2011 project, the important factors were curriculum relevance, cost, teacher engagement, and program reputation and familiarity. While most of the factors changed over the ten-year time span between the projects, the recurring problem uncovered in both projects was cost.

A key difference between the programs mentioned above and Banksia Gardens Community Centre's science program is the target audience. The Centre serves the low-income community of Broadmeadows, while the other programs are catered to the general public with no specific demographic group in mind. In order for Banksia Gardens' hands-on science education program to be sustainable, the Centre would benefit from taking into account the issue with cost discovered in the two CSIRO projects, as well as the other barriers identified that may impact low-income communities, including transportation and time constraints.

2.3 Marketing Strategies for Non-Profit Organisations

Banksia Gardens Community Centre is a non-profit organisation located in a low-income community, so its staff must pay particular attention to the affordability of the science education program in order to maximise the number of participants. Banksia Gardens does not have a means of income, but it wants to keep the cost low for their participants. In order to bridge this gap, the science education program needs to attract potential partners and funders to contribute to its sustainability. In the minds of most people, marketing and non-profit organisations do not necessarily go hand-in-hand. Philip Kotler points out that prior to 1970, the concept of marketing focused on “how goods and services [were] priced, promoted, and distributed in commercial markets for for-profit firms” (2005, p. 115). Mitchell Ross (2007) applies the findings of Kotler to his work on educational institutions, asserting that many educational institutions understand the term “marketing” as a synonym for “selling,” underestimating the benefits marketing methods could bring to their establishment.

This mistake of thinking of marketing as only “selling your product” has been criticised for years, and yet several studies show that educational institutions have been struggling to move past this mindset (Oplatka, 2004; Ross *et al*., 2007; Stachowski, 2008). Despite the efforts and advice of Kotler and his colleagues, research has indicated that the majority of those working for non-profit organisations, including educational institutions, are still unaware that marketing strategies are applicable to them. For example, Akchin (2001) conducted a survey of marketing, public relations and communications officers of the Maryland Association of Non-profit Organisations. He questioned the officers regarding what they felt was most important for their success as an organisation (choices were fundraising, event planning, public relations, media relations, publications, and marketing strategy). Only 10% of those surveyed stated that a marketing strategy was the most necessary element for success; the majority (53%) said that fundraising was most important (as cited by Dolnicar & Lazarevski, 2009). This study implies that not only are marketing strategies not being implemented, but those working for non-profit organisations are generally uninformed about the place of marketing when revenue is not involved.

Kotler and Andreasen (2008) assert that a single misconception underlies marketing failures in all sectors of non-profit organisations— they tend to have an organisation-centred mindset, rather than a customer-based one. According to these researchers, an organisation-centred mindset causes them to adopt the false belief that they do not need to employ a marketing strategy because their service is “needed by the market”(Andreasen & Kotler, 2008, p. 2). This is not necessarily the case. Kotler and Andreasen (2008) encourage a customer-based marketing concept, which is heavily centred on market research and customer reviews. In their opinion, placing the customer at the centre of all executive decisions will bring greater success to non-profit organisations, including non-profit educational institutions.

This idea of having a customer-based marketing strategy can also be adapted to the sustainability strategy we created for this project. In order for this project to succeed, the values and needs of the community have to be analysed and addressed to build a base for the sustainability of the Banksia Gardens' science education program. Once this base has been formed, the program can be presented to potential partners to generate support rather than simply obtain funding.

2.4 Model for a Sustainable Program

Based on the sustainability literature, marketing literature, and the background of the Broadmeadows community, we were able identify elements of sustainability that could feasibly be implemented by the Centre. These sustainability elements are:

a. Having a vision
b. Understanding the community
c. Maintaining flexibility and adaptability
d. Demonstrating program results
e. Establishing Partnerships
f. Obtaining funding strategically
g. Ensuring effective leadership

Having a vision is the first step in creating a sustainable program. According to the *Road to Sustainability* manual published by the Afterschool Alliance (2000), vision is the element that "unifies all of [the] program's sustainability efforts" (p. 28). The vision explains the purpose of the program, and this explanation will ultimately be what attracts support from participants, sponsors, funders, and the general community (Afterschool Alliance, 2000). The Carnegie Council on Adolescent Development argues that since vision is the driving force, it should be an integral piece of planning any program; without a clear purpose, there will be little motivation to sustain the program (Carnegie Council on Adolescent Development, 2000).

Understanding the community gives context to the vision. One source defines sustainability as "the capacity of programs to continuously respond to community issues" (Mancini & Marek, 2004, p. 2). A common theme that is emphasised throughout the literature is the importance of understanding the community that the program will serve (Carnegie Council on Adolescent Development, 2000; Mancini & Marek, 2004; Okorley & Nkrumah, 2012; Wisener, 2011). Understanding the community involves a number of elements, outlined by Mancini *et al*. (2004): general knowledge of the community's needs, respecting the people of the community, and involving relevant community members in the process of program development . The combination of these elements will result in the development of a "needs-based and demand-driven" program, which will make it worthwhile to sustain in the eyes of the community members (Carnegie Council on Adolescent Development, 2000).

Maintaining flexibility and adaptability ensures that the needs of the community are continually met. Atiti (2006) asserts that a program must be "dynamic and responsive" in order to elicit sustainability (as cited by Okorley & Nkrumah, 2012, p. 9). This is especially true for programs that involve children or young adults; The Carnegie Council on Adolescent Development states that "programs need to be flexible enough to be able to respond to adolescents' requests to integrate specific activities, as they occur, into the ongoing program" (2000, p. 8). This theory is generalised by Mancini *et al.*, who state that the benefits of the program should be sustained, rather than the particular activities (2004). A program must be able to adapt in response to a community's changing needs, or the program will quickly become irrelevant and unable to be sustained.

Demonstrating program results allows community members, stakeholders, partners, and funders to witness the success of the program. The Carnegie Council on Adolescent Development (2000) states that program credibility is crucial for creating a sustainable program. To prove the credibility of the program, first-hand successes must be illustrated; this illustration will help to "secure future funding" and establish the program's place in the community (Mancini & Marek, 2004, p. 3).

Establishing partnerships gives a program the support it needs to be sustainable. Once the successes of the program have been highlighted, these successes must be shared with potential partners in order to rally support. A critical piece of the sustainability puzzle is securing the resources required to run the program (Elliott & Mihalic, 2004). These resources are not limited to funds, but can also include elements such as space to run the program and volunteers to facilitate it. With this in mind, it is important to explicitly state to partners what their role could be in sustaining the program (Afterschool Alliance, 2000; Carnegie Council on Adolescent Development, 2000); different organisations can provide different resources, so it is important to decide the most beneficial contribution for each partner (Afterschool Alliance, 2000). Developing partnerships can also have the additional benefit of opening doors for funding contacts, since most local organisations are associated with funders (Afterschool Alliance, 2000). Having connections with various partners increases the likelihood that the program will consistently have support.

Obtaining funding strategically increases the chance of maintaining sufficient monetary resources. As the *Road of Sustainability* by the Afterschool Alliance points out, many factors can alter a funder's ability to contribute to a program, including "grant time limits, public budget fluctuation, [and] shifts in the economy" (2000, p. 14). With this level of uncertainty, it is best to maximize the funding options and sources to give the program the best chance for success and sustainability (Afterschool Alliance, 2000; Carnegie Council on Adolescent Development, 2000; Elliott & Mihalic, 2004; Mancini & Marek, 2004). Alternative methods of funding could include online funding or writing proposals for grants (Elliott & Mihalic, 2004). The Road of Sustainability by the Afterschool Alliance states that collecting a variety of funding sources "will provide a diverse and stable base of resources over time", which will improve the likelihood of sustainability (2000, p. 5).

Ensuring effective leadership is an important consideration for the survival of any program. Leaders and administrators have many crucial tasks in sustaining a program, including developing and promoting the purpose of the program, understanding and responding to the continually-changing needs of the community, adapting the program to fit current needs, supervising the program, lobbying for funds and partnerships, training new staff, and maintaining the morale of the team (as cited by Elliott & Mihalic, 2004; Mancini & Marek, 2004). A strong, understanding leader can synthesise sustainability efforts, allowing for the continuation of a program over an extended period of time.

This project utilised these sustainability elements to aid in establishing the longevity of Banksia Gardens' science program. Guided by these elements, we made our own contributions to the sustainability of the science program, and we provided an assessment of where the program stood in February 2013 on its road to sustainability.

Chapter 3 Implementing the Framework of a Sustainable Program

The overall goal of this project is to contribute to the sustainability of the Banksia Gardens Community Centre's science education program. This goal was accomplished by outlining the elements of a sustainable program and implementing them in relation to the science education program:

- Having a vision
- Understanding the community
- Maintaining flexibility and adaptability
- Demonstrating program results
- Establishing Partnerships
- Obtaining funding strategically
- Ensuring effective leadership

3.1 Having a Vision

Having a vision is the foundation for a sustainable program; therefore, it is important that this vision is clearly defined. The vision serves as a guide because it reminds the organisation why the program exists and what the main purpose is. Even though the vision of the Banksia Gardens science education program was not explicitly stated, it was implied from the goals of last year's IQP team. With last year's report in mind, we propose the following vision for the science education program:

> *The goal of the Banksia Gardens science program is to promote interest in science and science-related careers amongst children from a culturally diverse and low socioeconomic background, as well as encourage children to stay in school.*

The science education program consists of five different types of activities designed to stimulate interest in science. The five types of activities and their purpose are:

- Wow Factors: short science demonstrations that quickly and easily grab the attention of the audience

- Competitions: students compete as individuals or as a group to either design or build a structure
- Workshops/Labs: step-by-step activities in which the students create something based on science principles
- Field Trips: take a group of students to a nearby science facility for demonstrations and interactive displays
- Career Exploration: linking each activity to a career in science

These types of activities form the basic framework of the science education program. The goal of creating these different types of activities was to have a flexible program that could be adapted to accommodate several situations (Butler *et al*., 2012).

Expanding upon the goals of the last IQP team, the Centre's vision for the science program also aims to motivate youth to stay in school. Programs like the science education program give children a chance to aspire to do better, an objective that aligns with the overall mission of the other educational programs the Centre offers.

3.2 Understanding the Needs of the Community

Broadmeadows enjoys a distinctly wide range of cultural diversity, varying from Australian-Italian to Iraqi immigrants. In order to create a science program that could be sustained within this community, it was important to understand what qualities are valued by the richly-diverse population that inhabits this suburb.

To begin to understand the community of Broadmeadows, we turned to the people who would ultimately decide whether or not children attend the programs: parents. We spoke with two distinct groups of parents to ensure that our results were not biased. We interviewed parents whose children attend programs at Banksia Gardens, and surveyed parents from the general community whose children do not necessarily attend programs. This variation prevented discrepancies that would arise if the values of the general community differed from those of parents who bring their children to the Centre.

The purpose of interviewing parents whose children attend Banksia Gardens programs was to understand what features they value in its programs. With this information, we could ensure that the science program was aligned with their desires for their children. We conducted these interviews in a semi-structured format with twelve parents—four in person at the Centre and eight by phone. The staff of the Centre provided us with a list of parents who could easily be interviewed due to their fluency in English. In order to include a diverse sample of parents, we had a translator help us with four of the interviews with parents that were not proficient in English. Four of the five questions asked in these interviews, as well as the purpose of each of those questions, can be seen in Table 2. This table excludes Question 4, which discusses parents' preferences regarding scheduling and location of the program. Those matters, along with the responses to Question 4, will be described in Section 3.3.

Question	Purpose
1.) How did you learn about the Centre?	Determine the most effective advertising strategy for the Centre.
2.) Why do you bring your child to the Centre? How have the programs at the Centre helped your child?	Find out what aspects of the Centre are valued by parents to make sure that the science program addresses those values.
3.) Did you know that the Centre has a science session during the Holiday Program?	Understand the level of awareness about the Centre's science education program in order to determine if the Centre needs to advertise the program more.

Table 2: Interview with Banksia Parents- Questions and Purposes

Only the major findings of these interviews will be analysed here. The full responses to all questions can be found in Appendix A.

When we asked parents why they send their children to programs at Banksia Gardens (Question 2), the responses were highly varied; however, most answers shared common themes. Therefore, we categorised the responses into five groups in order to quantify them: educational, environment, social, cultural adjustment and emotional. For example, many parents responded that they sent their child to the Centre to improve English skills; this was categorised under *cultural adjustment*. Another frequent response was that their child listens more to "a stranger" when studying and doing homework than they would to their mother, so they send them to the Centre for help; such answers were grouped under the *educational* category. The responses to each question, as well as which category the answer was grouped under, can be found in Appendix A.

As shown in Figure 1, the most common theme of responses at 39% was that parents brought their child to the Centre because they valued the educational opportunities that the Centre offered. The second most popular theme, at 22%, was that parents liked the environment the Centre provides for their children.

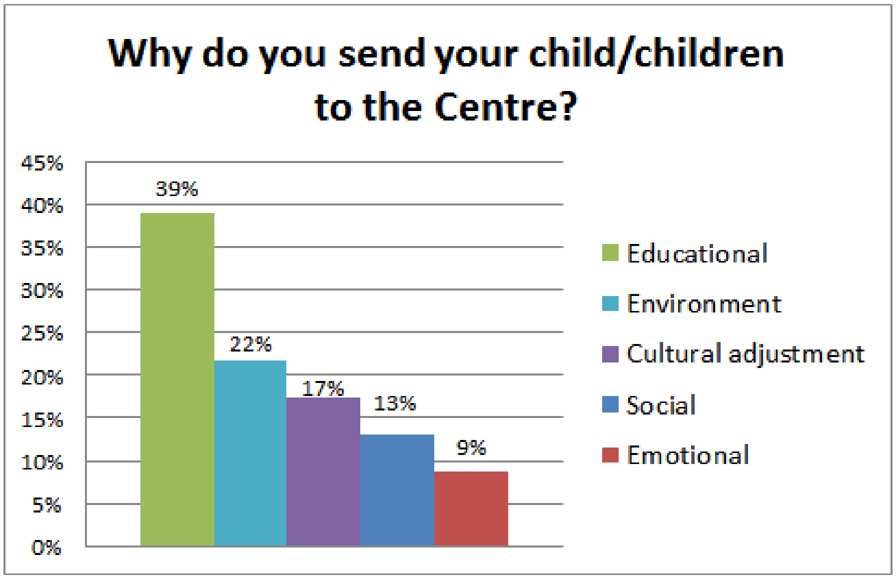

Figure 1: Parents of Banksia Gardens- Reasons for Sending their Children to the Centre

Based on these responses, the Centre is valued most by parents for its educational opportunities and for being a safe and fun environment for their children.

In addition to speaking with parents whose children attend programs at the Centre, we surveyed 25 parents of Broadmeadows and surrounding suburbs at the Hume Public Library. The purpose of these surveys was to identify what might prevent parents from bringing their child to programs at the Centre, and to mould the Centre's science program to attempt to address these needs. Similar to the phone interviews, translators were required for several of the survey participants, who mainly spoke Arabic or Assyrian. All questions asked, as well as their purpose, can be seen in Table 3 with the exception of Question 8. Like Question 4 of the interviews with the parents of Banksia Gardens, Question 8 inquires about scheduling and location of the program; responses will be analysed in Section 3.3. The formatted survey can be found in Appendix B.

Question	Purpose
1.) Are you a parent? If yes, how old is your	Determine if the respondent was part of the

child?	target audience and if the age of the parent's child made a difference in how they responded to questions.
2.) Do you live in Broadmeadows? If no, where do you live?"	Determine if the parents lived in the community we were working with or in its surroundings.
3.) Have you heard of the Banksia Gardens Community Centre? 4.) If yes, have you participated in any of their programs?	Understand the level of awareness about the Centre and of participation in programs in order to determine if the Centre needs to advertise more.
5.) How interested are you in science?	Determine how many parents are interested in science and possibly identify another barrier.
6.) Which of the following programs at the Centre would you bring your child to? Rank each program from 1 to 5 with 1 being most likely and 5 being least likely	Identify in an indirect way how popular the science program would be.
7.) Which of the following would prevent you from bringing your child to a program at the Centre?"	Identify needs of parents that must be addressed by the science program.

Table 3: Survey of Broadmeadows Parents- Questions and Purposes

The key findings of the survey have been highlighted below; the results of omitted questions may be found in Appendix B.

We assessed the level of public knowledge about the Centre with Question 3. As shown in Figure 2, only 40% of parents had heard about the Centre, while 60% had not.

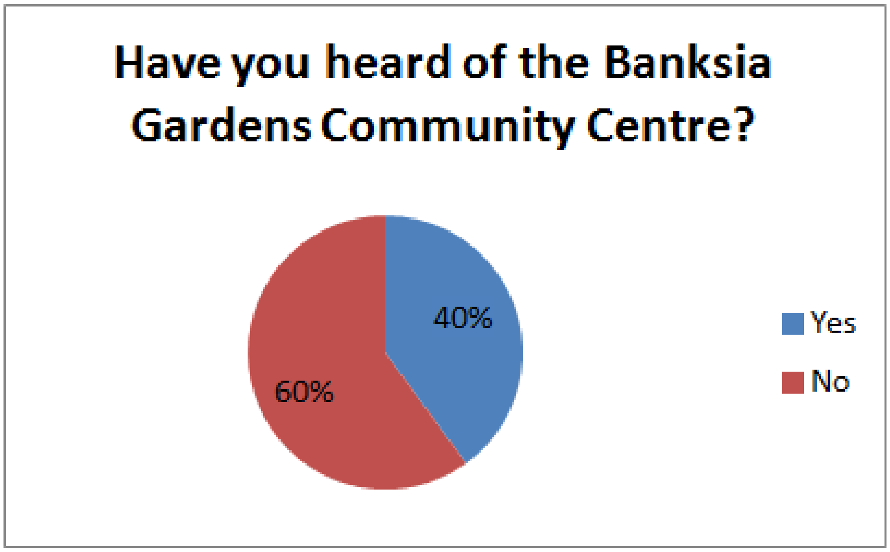

Figure 2: Parents of Broadmeadows- Knowledge of the Community Centre

Based on the responses, less than half of the parents surveyed knew about the Centre; therefore, they did not know about the science program at the Centre. When we asked the parents who had responded positively to Question 3 if their child had ever participated in any programs at the Centre, only 10% of children had participated in programs at the Centre while 90% had not. The data from Questions 3 and 4 suggests that the Centre is not well-known enough to attract parents to the science education program.

The answers to Question 5 revealed another potential reason parents might not bring their child to a science program. When we asked parents about their personal interest in science, only 18% chose the ranking of a very interested, 23% chose interested, 36% chose a little interested, and 23% chose not interested (Figure 3).

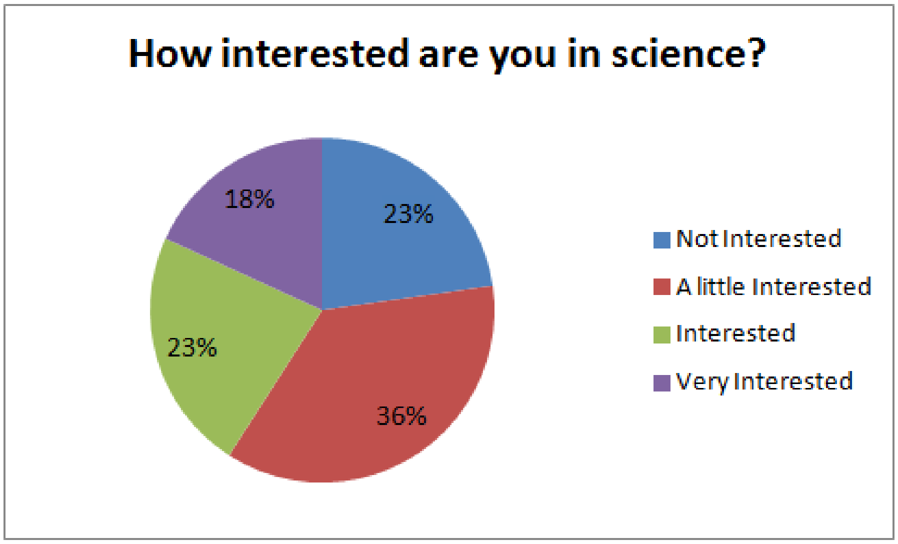

Figure 3: Parents of Broadmeadows- Assessing Science Interest among Parents

Therefore, we can say that 59% of the total parents did not have much of an interest in science, if any at all; this statistic could indicate another barrier that would prevent parents from bringing their children to a science program. If parents are not interested in science, children might not be motivated to pursue science-based careers.

In order to discretely probe at the parents' interest in bringing their children to a science program, we had them rank Banksia Gardens programs in order of preference. The programs listed included a study group program, a sports program, a science program, a music/theatre program, and a computer program. As shown in Figure 4, the most common ranking for the science program was 3rd out of the five programs listed.

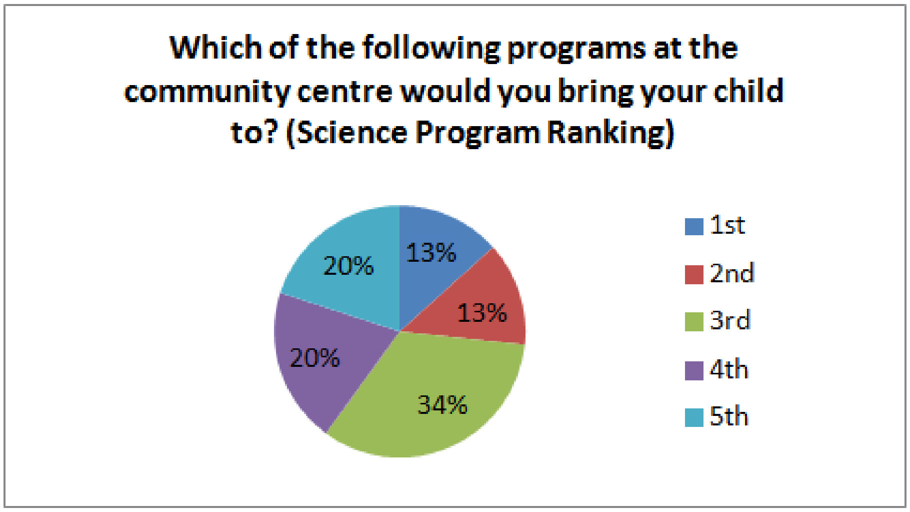

Figure 4: Parents of Broadmeadows- How Likely They Would Be to Bring Their Child to the Science Program Over Other Programs

Figure 5 shows that the sports program received the most first-place rankings at 38%, followed by a study group program at 29%, a music/theatre program at 19%, a science program at 9%, and a computer program at 5%.

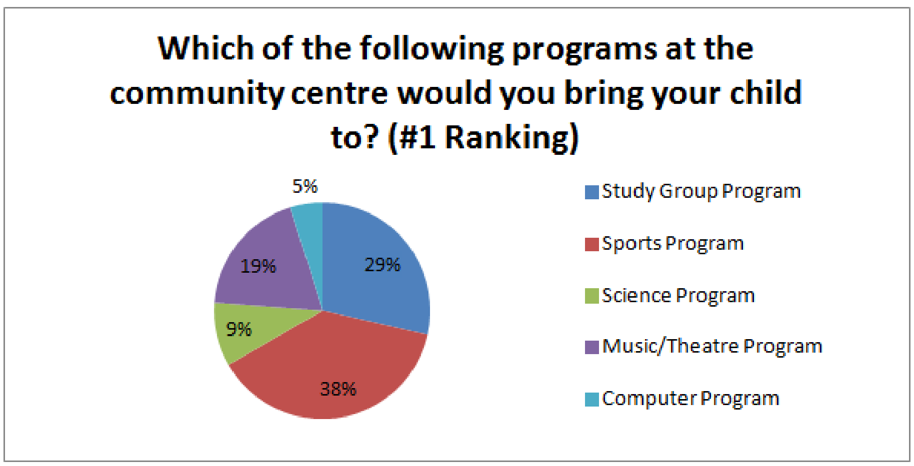

Figure 5: Parents of Broadmeadows- Parents' Top Choices for Their Child to Attend

The position of the science program relative to the others indicates that while parents are not particularly enthusiastic about a science program, they are also not discounting the idea of it.

Question 7 of the survey asked parents to directly identify what would prevent them from bringing their child to the Centre. Figure 6 illustrates that 48% of parents chose time constraints as a barrier, 28% chose transportation, and 24% chose cost.

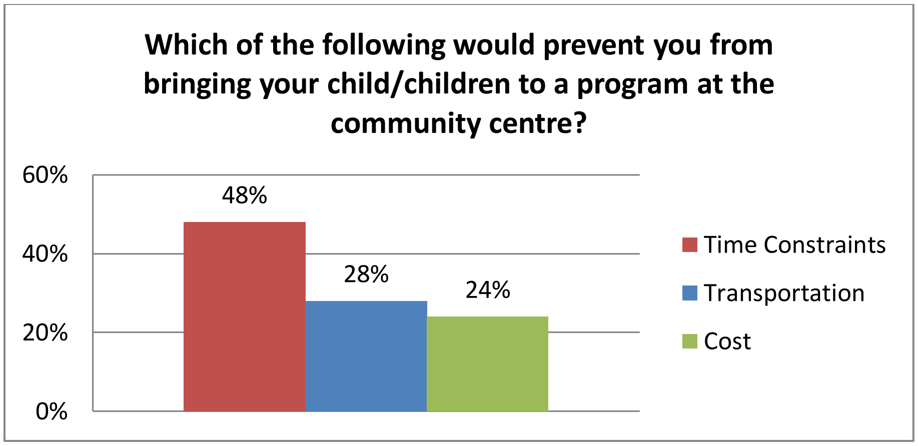

Figure 6: Parents of Broadmeadows- What Would Prevent Them from Bringing Their Child to the Centre?

One way to go about addressing the common barriers of time constraints and transportation could be bringing the science program to schools as a part of the children's class schedule. This way, the children will already be there for classes, so it will present no extra transportation arrangements or time commitment for the parents.

To assess the feasibility of bringing the program into schools, we interviewed fifteen science and maths teachers of Hume Central Secondary College. We conducted these interviews during a staff meeting of maths and science teachers. After presenting the details of the Centre's science program and our desire to bring it to schools, we wrote questions on a white board, and the teachers answered anonymously on sheets of paper provided to them. Table 4 lists each question asked and its purpose. Full responses to all questions can be found in Appendix C.

Question	Purpose
1.) What is your gut reaction to bringing the science program to schools? Rate from 1 to 10 with 1 being it is fantastic and 1 being it is a bad idea.	Determine what the teachers thought about the idea of bringing the program to schools.
2.) Do you think the students would be interested in this sort of program? Why?	Determine students' level of interest in the program from the perspective of the teachers.
3.) What features would you like to see in a science program?	Get suggestions for the science program from the teachers.
4.) Do you feel there is room in your curriculum to fit this competition? Do you have time to help?	Assess the feasibility of having an annual maths and science competition.

Table 4: Interviews with Teachers- Questions and Purposes

To determine the teachers' honest opinions of bringing the program to schools, we asked them to rate their "gut reaction" from 1 to 10, with 1 being it is a bad idea and 10 being it is a fantastic idea. By framing the question in this way, we hoped to elicit honest feelings, rather than polite responses. As Figure 7 shows, 20% of teachers ranked the program as a 10, 27% ranked it as a 9, 13% ranked it as an 8, and 40% ranked it as a 7. None of the teachers ranked the program lower than 7 out of 10.

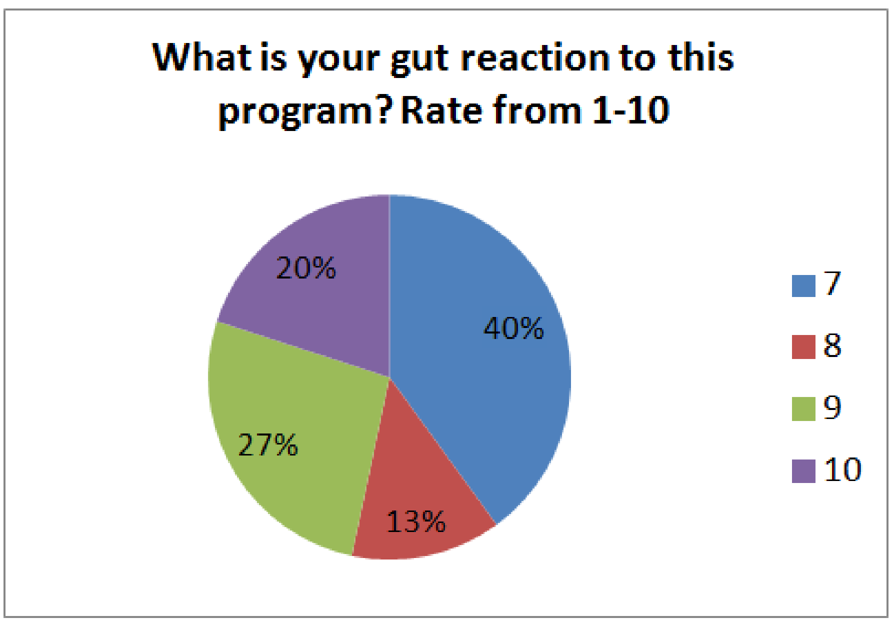

Figure 7: Teachers- Reaction to In-School Version of Science Program

Although we did not directly interview students, we wanted to know if this program would be something they would enjoy. We asked the teachers to speculate on whether or not the students would be interested in this science program. As illustrated in Figure 8, 47% of teachers said the students would be interested, and 53% said some students would be interested. All teachers agreed that at least some of the students would be interested in the program.

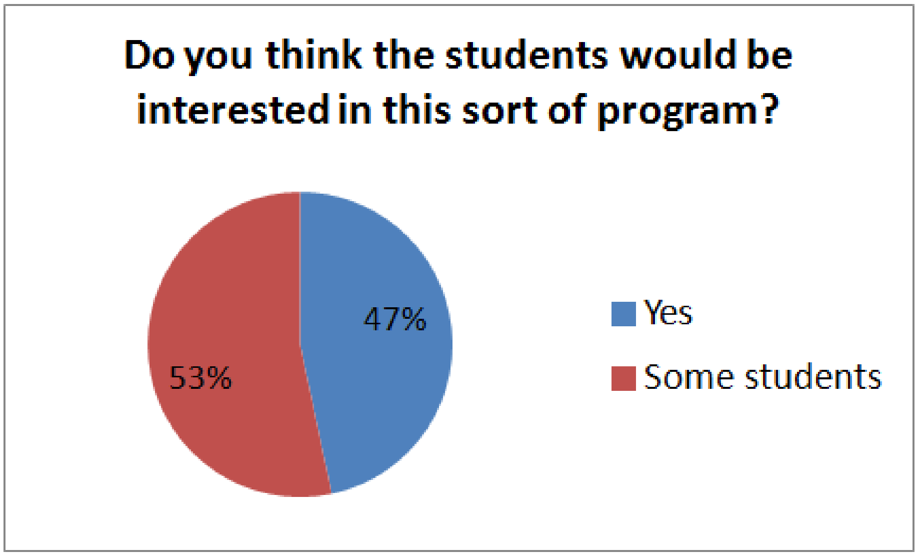

Figure 8: Teachers- Speculated Student Interest in Science Program

When we asked the teachers why they felt that the students would enjoy it, the most popular responses were that the program involves engaging/hands-on activities at 40%, followed by the program giving the students a sense of purpose at 13% (see Figure 9).

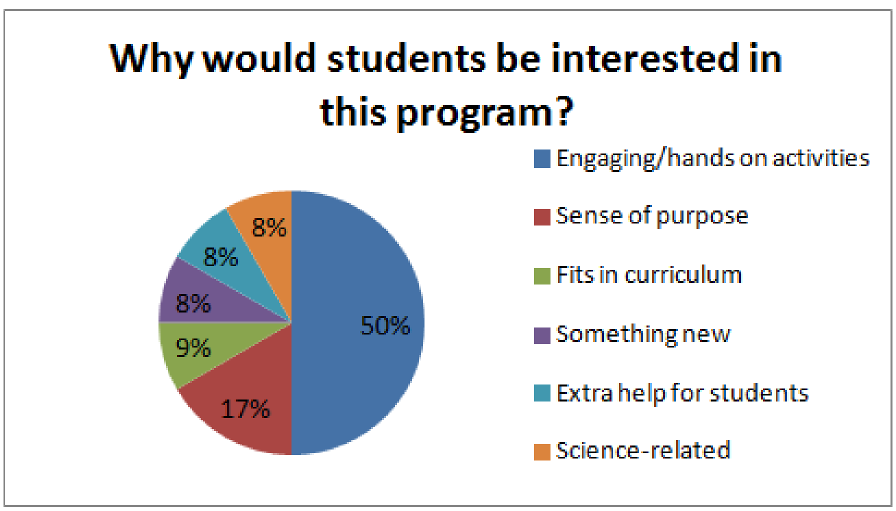

Figure 9: Teachers- Speculation of Reasoning for Student Interest

The teachers felt that students would appreciate the engaging/hands-on activities offered by the Centre's science program, which was corroborated by the students' positive response when the program was run at Banksia Gardens.

Next, we asked teachers what features they would like to see in a science program, so that we could be sure to include those features in the Banksia Gardens science program. The majority of teachers said they would like to see engaging/hands-on activities (42%) and practical applications of science (16%) (see Figure 10).

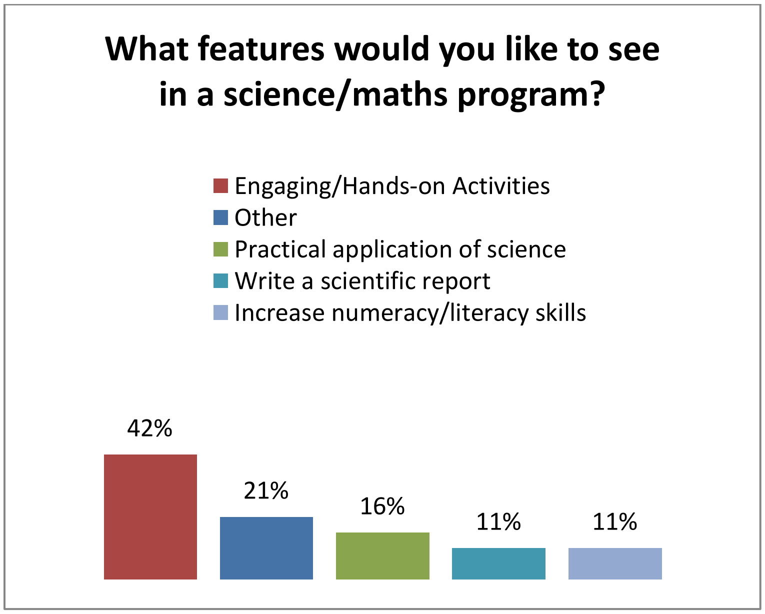

Figure 10: Teachers- Features They Desire in a Science/Maths Program

Based on these responses, teachers liked the features of engaging/hands-on activities and practical applications of science that were already part of the Centre's science program.

The responses to Questions 2 and 3 allowed us to conclude that bringing the program to schools would satisfy the desires of both the students and the teachers.

The final question of the interview assessed the feasibility of having an annual science and maths competition component in the science program. It asked teachers to give their thoughts on whether or not there is room in their curriculum to support this competition and time to help students who may participate. As shown in Figure 11, 33% of teachers said there was room, 20% said it depends on various things such as the day selected or if it is in junior or senior level, 13% said they have limited time but are willing to help, 13% said yes if the school provided time, 13% said no, and 7% said they do not know.

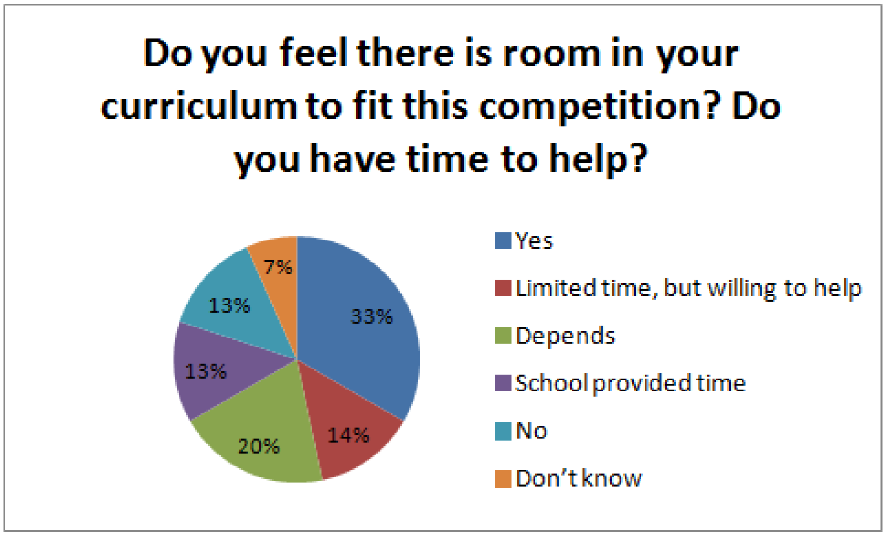

Figure 11: Teachers- A Place in the Curriculum to Support the Annual Competition

These responses allowed us to conclude that the competition was feasible in terms of time constraints, as 80% of the teachers responded positively to whether or not there was room for the competition and if they had time to help, as long as various conditions were met.

Based on the interviews with parents of Banksia Gardens, surveys of parents of Broadmeadows and surrounding suburbs, and interviews with teachers from a local school, we were able to understand what the community wants from a science program, and ensure that the Banksia Gardens science program addresses their needs, desires, and values. Firstly, we confirmed that the science program lives up to the expectations of the parents of Banksia Gardens; it is an educational program that supports social interaction in a safe environment. The survey of parents of Broadmeadows pointed out that, although parents may not favour the science program, there are several factors that could contribute to this, besides the actual program itself. If the program was easier to access, and if they were more informed about the Centre, they would be more likely to give the science education program a try. Lastly, the interviews with teachers confirmed the feasibility of bringing the program to school as a way to address the needs identified in the parent surveys.

3.3 Maintaining Flexibility and Adaptability

Last year's IQP team developed a science education program that was designed to be flexible (Butler *et al*., 2012). The characteristic of the science program's design that originally made it flexible was the fact that the program had five different types of activities (labelled *wow factors*, *competitions*, *workshops/labs*, *field trips*, and *career exploration* in that report). The facilitators could pick and choose from a variety of activities in order to adapt sessions of the program to their own needs and time constraints. It falls on the facilitators to carefully plan activities that they believe would work best for the situation at hand; however, this can be more challenging than just having a set program to follow. The advantage of having a program that is designed to be adaptable is that, if planned well, it can be run for several types of situations.

In efforts to contribute to the sustainability of the program, we took the existing program framework a step further by designing three versions that differed only in when and where they would be implemented. Having different ways of implementing the program would permit wider access to the science program than if it were run only at the Centre at a specific time of the year. Figure 12 shows the three different versions of the science program including when and where each program would be run:

1.) At the Centre during school holidays (Magic Science Day)
2.) At the Centre after school during school terms
3.) At schools during the regular school day

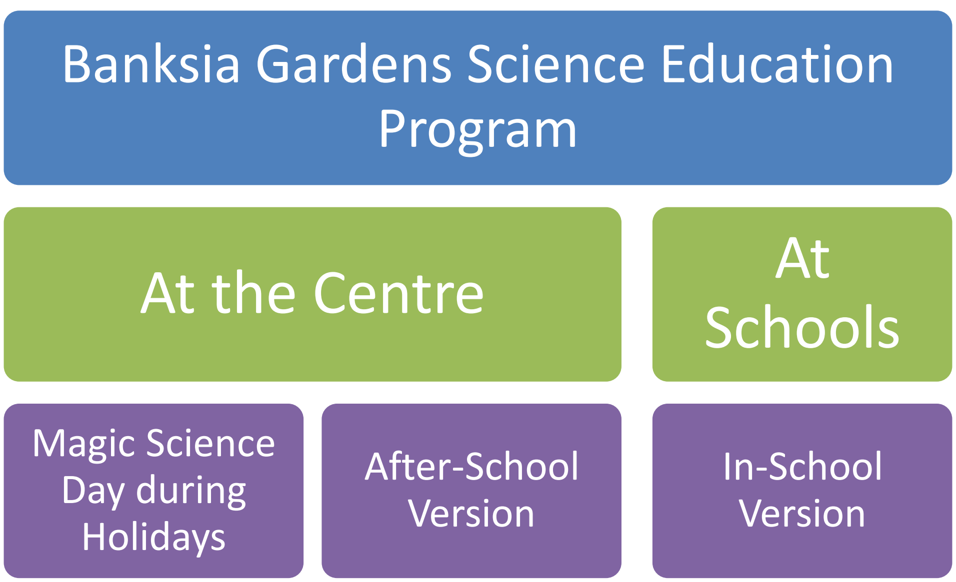

Figure 12: Three Versions of the Science Education Program

The Magic Science Day during the Holiday Program was the original program designed and implemented by the 2012 IQP team. The after-school version involves a staff member from Banksia Gardens facilitating ten afterschool sessions over the course of a school year at the

Centre. The in-school version of the science program involves a staff member from Banksia Gardens facilitating science experiments and activities during four sessions at local schools. By offering three versions of the program, more people would reap the benefits of the program.

In addition to the science sessions, the versions would also include an annual science and maths competition and event. The competition would be Hume-wide and involve teams of secondary school students from ages 12-14 working on a term-long science project and presenting their findings and successes at an end-of-the-year event. We suggested different options for what the competition could entail, including a science fair, a maths/science question challenge, a video competition, a model building competition and a reverse engineering challenge. A detailed description of these options can be found in Appendix D.

We developed a budget for each version of the science program, including the cost of the annual competition and event, in order to compare the advantages and disadvantages of cost and number of participants. We found that the in-school version was the cheapest per student and would reach the greatest number of students. A comparison of the three versions, including number of sessions per year, number of students, and cost can be seen in Table 5.

	At the Centre During Holidays	**At the Centre After School**	**In Schools Run by the Centre**
Number of Sessions Per Year	4	10	24*
Number of Students Per Session	15	20	25
Cost Per Student Per Year	$105	$154	$66

Table 5: Comparison of the Three Versions of the Science Education Program

*4 sessions per school at 6 schools

The advantages of bringing the program to schools would be that the experiments could directly correlate with the current curriculum and the Centre could reach more students. However, one disadvantage of integrating the program into schools is that the reduction in individualised attention compared to the program run at the Centre; the student to facilitator ratio would be approximately 25:1 in schools as opposed to approximately 15:1 at the Centre.

After determining that the in-school version was the cheapest and most accessible option, we developed an outline for a one-year pilot program that would be implemented in six schools in the Broadmeadows community (see Figure 13). This pilot was designed to be free of charge to schools, and it includes one two-hour sessions per term at every school. It also incorporates a science and maths competition, an annual event to celebrate the children's achievements during the competition, and a multimedia component, which would allow participants to post videos of their projects online. The final component of the pilot is an evaluation of the effectiveness and success of the program.

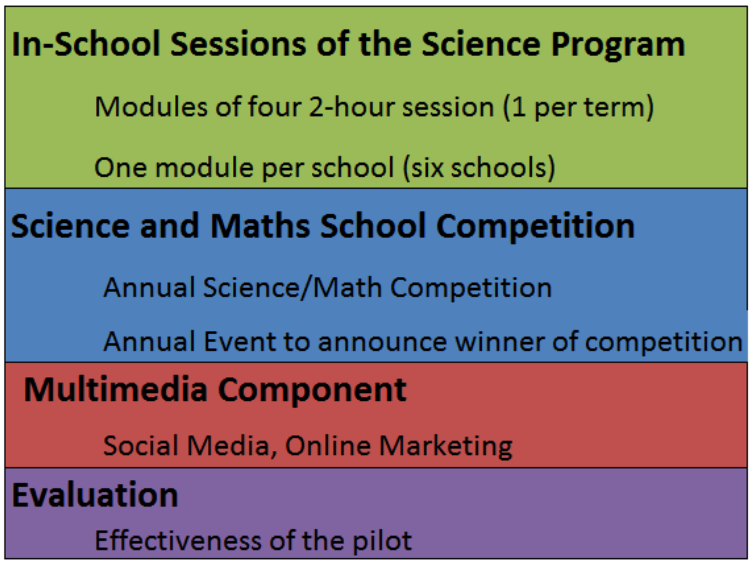

Figure 13: Major Components in the Pilot of the In-School Version of the Science Program

Despite the in-school version of the program being the cheapest and reaching the most students, we realised from the interviews with parents whose children attend the Centre that the benefits offered by the Centre— including a relaxed environment and more personalised attention— are difficult to replicate in a school environment (see Appendix A). Therefore, the Centre should continue to implement the Magic Science Day during the Holiday Program. Question 4 of the interviews with parents asked which version of the science program they preferred. The responses showed that 45% of parents preferred having the science program at the Centre during school holidays, 27% preferred it at schools, and 27% preferred it at the Centre after school (see Figure 14).

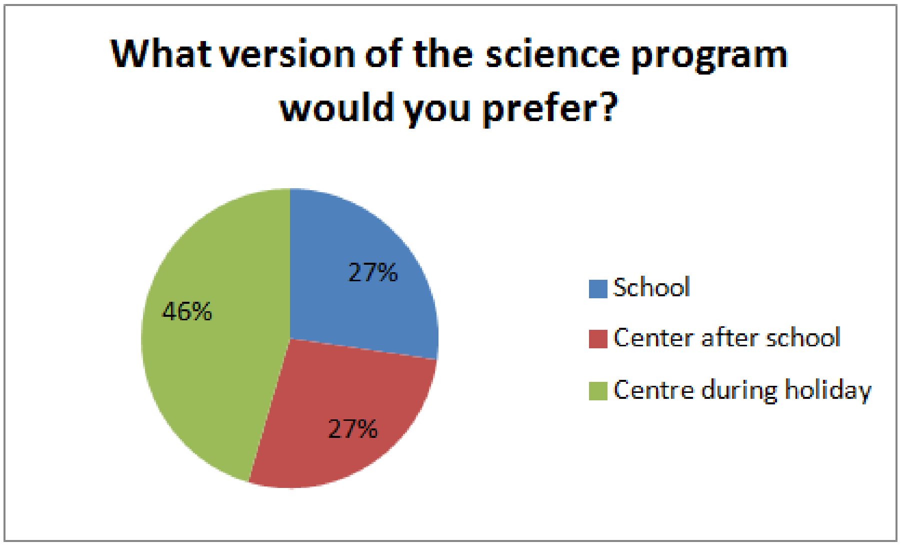

Figure 14: Parents of Banksia Gardens- Science Program Location/Time Preference

We got similar responses when we asked the parents of Broadmeadows what kind of program they would like best (Question 8 of the survey). In these surveys, 45% of parents liked having a science program at the Community Centre during school holidays, 32% liked having the program at school, and 23% liked having the program at the Community Centre after school (see Figure 15).

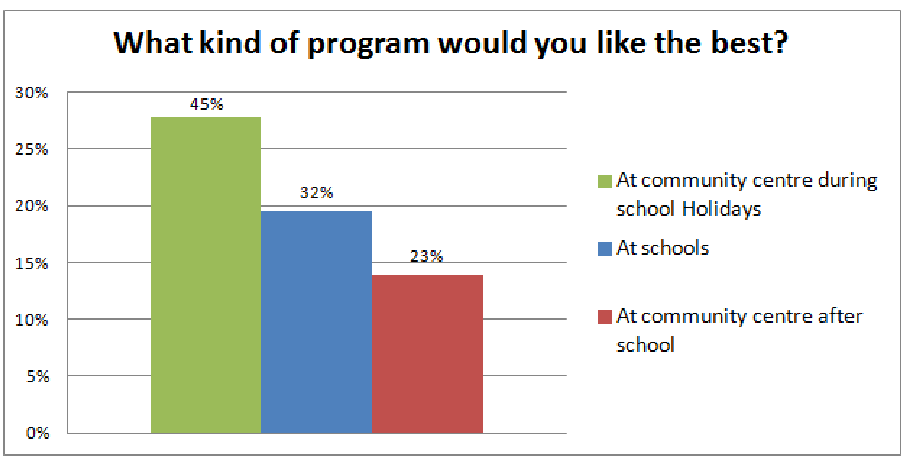

Figure 15: Parents of Broadmeadows-Science Program Location/Time Preference

Based on the responses to the interviews and surveys, a science session at the Centre during the Holiday Program was the most preferred; however, this response might be biased because this is the only version of the program that has been implemented.

From the surveys distributed to the parents of Broadmeadows, we learned that there are many barriers that could prevent them from bringing their child to the science program, such as transportation, cost, time constraint, parents' disinterest in science, and even lack of knowledge about the existence of the Centre (refer back to Figure 2, Figure 3, Figure 6). The in-school version of the science education program would help eliminate these barriers and reach more students that otherwise could not participate in the program.

3.4 Demonstrating Program Results

Magic Science Day, one of the three versions of the science program, was developed by last year's IQP team as a flexible program that contains five types of activities: wow factors, competitions, workshops/labs, field trips, and career exploration. Each type of activity was designed to both engage youth in fun science experiments as well as expose them to future careers in science (Butler *et al.*, 2012). This year, we had the opportunity to facilitate the Magic Science Day in order to continue to improve upon the existing program by running new experiments and observing their level of success.

Prior to running the Magic Science Day, we were advised by last year's IQP team to prepare more experiments than necessary because the children's attention tended to drift easily. Taking their advice, we identified new experiments to run, having plenty of back-up experiments. Preparing new experiments took additional time, but it proved to be a worthwhile effort based on the success of the program. The back-up experiments were necessary to keep the children engaged throughout the entire session.

This year, when the Magic Science Day was run, four of the five types of activities—*wow factors*, *competitions*, *workshops/labs*, and *career exploration*—were incorporated into two two-hour sessions (see Appendix F). Each session began with a *wow factor* to quickly grab the children's attention, followed by a *competition* to motivate them to improve their designs. We started off the first two-hour session with a Mentos-Diet Coke Rocket *wow factor* to quickly grab the children's attention (see Figure 16).

Figure 16: "Mentos-Diet Coke Rocket" *Wow Factor*

We followed that activity up with a Catapult Building *competition*, where the children competed to build a catapult that could get the farthest trajectory and hit the targets they had built (see Figure 17).

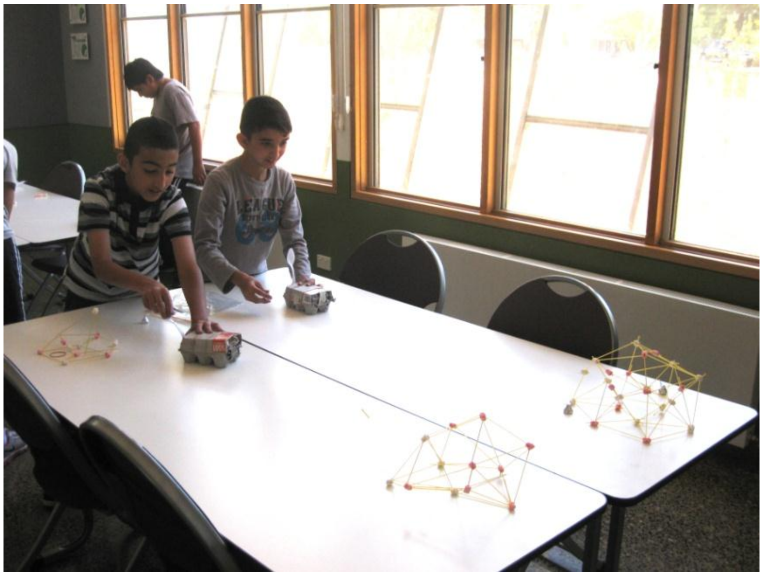

Figure 17: "Catapult Building" *Competition*

During the second two-hour session, we ran another *wow factor* to refocus the children's attention after lunch. In the Milk Rainbow *wow factor*, the children observed the effects of food colouring in milk when dish soap is added (see Figure 18).

Figure 18: "Milk Rainbow" *Wow Factor*

After the Milk Rainbow, the children created their own lava lamps using oil, water, Alka-Seltzer, and food colouring (see Figure 19).

Figure 19: "Lava Lamp" *Workshop/Lab*

Afterwards, the children participated in a Bridge Building *competition* to see who could build the sturdiest bridge (see Figure 20).

Figure 20: "Bridge Building" *Competition*

Finally, at the end of the day, we had the children make their own ice cream by shaking a bag of cream, sugar, and vanilla inside another bag full of ice and rock salt.

Figure 21: "Ice Cream Making" *Workshop/Lab*

As a result of running Magic Science Day, we had the opportunity to increase our understanding of the interest level of the local children in science and validate the importance of this program in the community.

Throughout our facilitation of Magic Science Day we observed that the children who attended not only enjoyed the program but also were interested in the science behind the activities. We further notice that the younger children were engaged with the activities, and the older children began to ask the how and why questions that form the foundation of scientific study. During the Milk Rainbow *wow factor*, the children were impressed with this activity; almost every child wanted to repeat the activity because they were having a lot of fun colouring the milk. At the beginning of the Catapult Building *competition*, the children were not very enthusiastic about building the catapult. However, as the activity went on and they started to have a finished product, they started to get excited and started to ask how to use it. They really enjoyed playing with the catapult. As time went by, they started to compete with each other to see which catapult shoot the farthest and they started to ask how they could make the catapult better. During the Lava Lamp experiment, one of the older children asked if the bubbles in the lava lamp formed the same way that they formed in the Mentos-Diet Coke Rocket experiment we did earlier in the day. They further asked if replacing Alka-Seltzer tablets with Mentos would work because they realised it was the same reaction as the Mentos and Diet Coke. Another example of this was during the Ice Cream experiment, one of the older children had asked if the experiment would work without salt. One of the facilitators explained how the salt kept the ice colder; as a follow-up, they wondered whether the same experiment would work with regular salt. This made us believe that they were actually paying attention to the science behind the science experiments; by asking questions, they were forming the basis of scientific inquiry.

When we were planning the Magic Science Day, we expected the majority of the children to be between the ages of 10-16. However, the majority of the children that attended were between the ages of 5-9. As a result, we had to adapt the scientific explanation of the experiments to be more age appropriate. The success of the program, despite the modifications on a moment's notice, points to the practical adaptability of the program; the program is able to be adapted to a new situation when some effort is employed.

The importance of this science program lies in its potential to change children's attitudes toward science to a more positive one. These positive reactions were observed during the facilitation of the Magic Science Day. For example, during the Bridge Building activity, one of the children said that he would never be a scientist because he wanted to be a computer programmer. After explaining that computer science was a big part of programming and that he needed basic knowledge of design to create a video game, he better understood how science fits in his careers aspirations. This change in attitude toward science demonstrated the potential of this program to positively influence children's views toward science and learning in general, which could prove to be an asset to a community like Broadmeadows, with its low graduation rates and low higher-education pursuits.

In addition to our observations, photos and videos of Magic Science Day illustrate the children's enjoyment of the activities; for example, notice the smile on the child's face in the photo in Figure 22. Additional photos can be found in Appendix G[4].

Figure 22: Engagement and Enjoyment During the "Milk Rainbow" *Wow Factor*

In addition to the children's enjoyment of Magic Science Day, the session satisfied the parents' desire for their children to take part in educational activities. Our interviews with parents revealed that approximately 40% bring their children to the Centre because they value the educational opportunities that the Centre offers (refer back Figure 1). Furthermore, parents were pleased that in addition to learning, their children were also having fun. Specifically, one

[4] All photos and videos were given to Banksia Gardens Community Centre.

parent happily stated that her children were very excited to show her all the things they had made during the day.

In addition to the positive response from children and parents, the Magic Science Day was also a successful day from the staff's perspective. Post-evaluations from the volunteers of the Holiday Program revealed that the Science Day was their favourite day of the Holiday Program (Appendix H). Rachel Wood, a member of the staff, stated in her post-evaluation that "the Magic Science Day was a very successful part of the program….I felt it was one of the better programs I have seen delivered at Banksia Gardens due to the team facilitation, structured approach to planning and having various activities that were fun and interesting for the age group". Another member of the staff, Natasha Alabakov, said in her post-evaluation that, "each activity kept the children of varying ages entertained and enthused, and because it was hands on they could go at their own pace and expand their imagination." Such quotes led us to the conclusion that the Magic Science Day was considered successful by all parties involved.

Along with facilitating Magic Science Day, we also facilitated a session for Year 11 students from the Hume Valley School, who were significantly older than the children who participated in Magic Science Day. This hour-long session included one *wow factor* activity to get the students' attention and one *competition* to motivate them to create the best possible product. The eleven students that participated in this session had no background in science; therefore, we explained the science concepts in a way that they could relate to real-world situations. For example, to explain pressure in the Diet Coke bottle, we described a situation where a group of people are in a crammed elevator. The moment the doors open, everyone tries to get out at the same time to make the elevator less cramped. We explained that the number of people in the elevator represented the pressure inside the bottle, and the doors opening represented the release of pressure through the bottle cap. With explanations like this one, the students were able to better grasp the scientific explanations.

The session we facilitated for the students of the Hume Valley School gave us a better understanding of how the program could also be successful with older students. At the beginning, some of the students were not paying much attention, but over time, they started to enjoy the activities. We noticed that the students in this session were more engaged with the activities than the children who participated in Magic Science Day; they were constantly trying to improve their product using scientific methods. Many students understood the concept of distributing the weight when building their bridges and strived to improve their designs using this concept. The results of this understanding could be seen in the complexity of their bridges compared to the children who participated in Magic Science Day (see Figure 23). Although we did not conduct a formal evaluation of the session with the Hume Valley Students, this session provided proof of concept that the activities developed for the science education program could suit an older audience, provided that slight modifications are made, like more in-depth explanations of the science behind the activities.

Figure 23: Students of Hume Valley School Applying Weight Distribution Principles in the Bridge Building *Competition*

To make this evidence of the program's success available to a larger audience, we utilised two distinct multimedia methods: updating the Banksia Gardens website and appearing on a local radio show called "Environmentality".

Before our project began, the website contained a section for each of the programs that they offer with a detailed description, the dates when they are offered, the program's intended audience, pictures, and videos; however, it lacked a webpage for the science education program. Following the same format, we added a section about the science program with detailed information about the program and pictures from the Magic Science Day (see Figure 24).

Figure 24: Magic Science Day Page of the Banksia Gardens Website

Another way we shared the success of this program with the community was by appearing on a local radio show (see Figure 25). We had a segment in which we interviewed vendors at the Sustainability Festival to learn about their cause, ideas, and opinions. After these interviews, we explained why we are in Australia and what our project is about. The airing of this segment helped to get the word out about the science program and capture the attention of potential partners and funders.

Figure 25: Appearance on Radio Show "Environmentality"

3.5 Establishing Partnerships

To fulfil the next element of our sustainability strategy, partnerships were established in order to gain more support and credibility for the science education program. The Afterschool

Alliance (2000) suggests that working with a diverse group of partners can increase the sustainability of the program by providing the necessary resources and a range of contacts to support to the program. Establishing partnerships with local organisations and schools would allow Banksia Gardens to obtain the necessary resources to run the science program as well as create a stronger reputation for the program.

In order to most effectively market the program, it was suggested to us to establish partnerships before seeking funding. Partnerships increase the level of credibility of the program in the eyes of a potential funder, because it suggests that the program its worth being funded. We held meetings with Hume City Council, the University of Melbourne, and the science and maths teachers from Hume Central Secondary College to discuss specific ways in which they could contribute to the expansion of the science program besides simply donating money.

To pitch the importance and success of the Banksia Gardens science education program, we developed presentations to promote the expansion of the program to partners and funders. These presentations represented the first step in acquiring resources: raising awareness of the program within the community and demonstrating program results to potential partners and funders[5]. An important factor we considered when preparing these presentations was to know the audience and tailor the presentations to meet the audience's specific values and possible contributions. We identified connections between the science education program and the targeted organisation in order to demonstrate the program's relativity to their values and the work that they are already involved in.

The goal of these presentations was to gain partners' or funders' support for the program, which, in turn, would prompt them to provide the resources necessary to run the program. Each presentation, informed by our facilitation of the Magic Science Day, highlighted what makes Banksia Gardens' science program unique and worthwhile to partner with, as well as the vision of the program. They included pictures and videos of the children performing science experiments (shown in Appendix G), as well as an outline of how the specific organisation could contribute to the program.

We met with Bill Dear and Rana Alakus from Hume City Council to discuss the possibility of having the organisation host the annual science and maths competition. Prior to our meeting, we learned that the Council hosts a competition called i-tech Challenge, which

[5] Copies of the presentation files were left with Banksia Gardens Community Centre for future use.

encourages students to test their technological skills and showcase their projects. Since this competition has a very similar structure to the competition proposed for the science education program, our goal was to have the council support the Banksia Gardens annual competition and event. Besides explaining the structure of the in-school version of the program and the link between both competitions, we built a case that the program would be beneficial for the community. We did this by showing statistics about unemployment and secondary and tertiary degree completion in Broadmeadows, which resonated strongly with their desire for community advancement. The partnership established with Hume City Council will provide the resources and funding necessary to run the annual science and maths competition component of the science education program.

The next potential partner with whom we met was the University of Melbourne. We met with Dr. Roger Rassool, a professor from the Physics Department, to discuss the possibility of having the University support the science education program. Dr. Rassool manages a program called MUPPETS (Melbourne University Physics Promotion, Education, and Teaching Services), which is a science road show that tours around Australia. The University also offers another outreach program in which secondary school students complete hands-on science activities; however, this program lacks participants from low-income communities in north-eastern Melbourne, including Broadmeadows. In essence, the University has the resources to run a science outreach program, while Banksia Gardens has the connections to which the program is targeted. This common interest in promoting science to disadvantaged communities, as well as our presentation of the success of the Magic Science Day, enabled a partnership with the University.

As we established partnerships, a chain reaction of support and credibility for the program occurred. When we presented to Hume City Council, they were impressed by the support that WPI gives Banksia Gardens. Consequently, the University of Melbourne was enthusiastic about the support of a local government organisation, and the teachers of Hume Central Secondary College were influenced by the partnership with the University. All these partnerships brought the science education program to a point where it could be presented to potential funders to obtain the missing funds necessary to run the in-school pilot.

Chapter 4: Conclusions and Recommendations

Status of the Sustainability of the Science Education Program

The science education program does not have an explicitly stated vision. The implied vision of the science program, based on last year's IQP report, is to promote interest in science and science-based careers and to encourage children from a low socioeconomic community to stay in school (Butler *et al*., 2012). We suggest formalizing a vision statement, such as:

> *The goal of the Banksia Gardens science program is to promote interest in science and science-related careers amongst children from a culturally diverse and low socioeconomic background, as well as encourage children to stay in school.*

This vision statement is aligned with the values and needs of the community. Parents of the Centre valued the programs offered by the Centre because of the educational opportunities they provide for their children (see Figure 1). The educational merit that parents value forms the foundation of the vision for the science program. The teachers stated that some, if not all, students would be interested in the science education program if it was brought to schools (see Figure 8). Based on these responses, the teachers believe that the science education program would be successful in promoting interest in science to their students, which is directly in line with the vision. The parents of Broadmeadows expressed a lack of interest in science (Figure 3), which validates the vision statement in that interest in science needs to be promoted among children in this community. If the parents are not interested, then the children will likely not be interested unless they have a positive experience with science, which could be provided by the Banksia Gardens science program.

While we gained insight into the values and needs of parents and teachers, we were only able to speak with a small sample of the community, which may not necessarily be an accurate representation of the community as a whole. We recommend that the Centre continue to interview and survey parents and teachers in order to gain insight from a larger sample of the community. By talking with more parents, the Centre could more accurately determine what values and needs are common amongst parents of the community. We also suggest that the Centre interview as many teachers as possible, preferably from multiple schools in Broadmeadows, in order to determine if the values of teachers is common across the school system. With a strong understanding of the community, the Centre would be able to more effectively adapt the program to better meet the needs of the community.

The science education program is a flexible program that is adapting to the needs of the community. The program was designed to be flexible by including five different types of activities that vary in length. The activities run during a session of the program can be chosen from a list of activities or from new ideas the facilitator develops. This flexibility in activity choices makes the program adaptable to many different situations and needs. For example, we were able to develop three different versions of the program, each of which addressed different needs within the community (see Figure 12). The most cost effective and wide-reaching of the three versions, the in-school version, was adapted from the original Magic Science Day to address the issues of time constraints, transportation, and cost. The facilitation of Magic Science Day and the session with students from Hume Valley School was proof of concept that the program is adaptable to both primary and secondary school students. However, the adaptability is not a given. It requires time and effort on the part of the facilitator to decide which activities to run in a session of the program and to adapt them to different age groups.

Establishing partnerships gave resources and credibility to the science education program. Our facilitation of the two sessions of the program, Magic Science Day and later for students from Hume Valley School, allowed us to collect observations, photos, videos and feedback that we could present to potential partners to demonstrate the results of the program. Partnerships were formed not only by the display of the program's success, but also by a partnership chain reaction. The partnership with WPI provided resources to the Centre in the form of a team of students to work on making the science education program sustainable. Impressed by the science program and WPI's support, Hume City Council agreed to provide resources and funding for the annual competition aspect of the in-school version of the program. Attracted by the science program itself and by the support of a local government organisation, the University of Melbourne agreed to provide resources for the program including volunteers to serve as judges, guest speakers, and mentors. The teachers of Hume Central Secondary College, influenced by the partnership with a well-known university, expressed interest in the possibility of integrating the in-school version of the program. While we have established some key partnerships to push the program towards sustainability, we recommend that the Centre continue to contact local organisations that share similar values, values likely to make them see the value of joining the Centre's other partner's. Similarly, we also recommend that the Centre communicate with other local schools about the possibility of partnering to integrate the program into their curricula.

In order to obtain funding strategically, we recommend that the Centre emphasise the partnerships already created and the success of the program it has run. It should tailor its presentation of these assets to the interests of the potential funder. We also suggest that the Centre make use of the chain reaction phenomenon by displaying the list of established partners to potential funders. From our experience, the more partners the program has, the more impressive it appears to other potential partners and funders. Additionally, we recommend that the Centre use its partnerships as a means of finding funding. The Centre should communicate with established partners to inquire about contacts they have who could potentially fund the program. An additional, unique method that could secure funds for the program is crowd funding. We suggest that the Centre partner with the multimedia department of the Kangan Institute in Broadmeadows to develop a crowd funding video that will elicit donations for the science education program.

We suggest that if adequate funding is obtained for the science education program, a portion of the funding should be allotted to ensuring the effectiveness of the staff and volunteers. The Centre should train and evaluate the facilitators of the program regularly. The Centre could train facilitators and volunteers by creating a training manual that would explain how to run sessions of the science program and how to effectively teach the science concepts behind the activities. Some examples of ways the Centre could evaluate the facilitators could include requiring the facilitator to pass a test in which they would demonstrate their knowledge of the training manual, or having a staff member observe how well the facilitator runs a session of the program. Having effective leaders of the science program is a major factor in ensuring the success of the program.

The science program is on its way to becoming sustainable, but there are still missing pieces in the sustainability puzzle. There is still work to be done in the areas of understanding the community, establishing partnerships, obtaining funding strategically, and ensuring effective leadership. We have left the Centre with some recommendations of how to accomplish these elements. Once these have been completed, the science program will have a good chance of continuing for years to come.

Finally, we note that the research-based sustainability model we developed here could be applied equally well to other programs at the Centre, helping to insure that they too enjoy long, successful lives serving the needs of the Broadmeadows community.

Bibliography

ACARA. (2009). Shape of the Australian Curriculum: Science.

Afterschool Alliance. (2000). The Road to Sustainability. Sustainability Workbook (pp. 51). Washington, DC.

Akchin, D. (2001). Nonprofit marketing: Just how far has it come? *Nonprofit World, 19,* 33-35.

Andreasen, A. R., & Kotler, P. (2008). *Strategic marketing for nonprofit organizations*. Upper Saddle River, NJ: Pearson/Prentice Hall.

Australian Bureau of Statistics. (2011). Schools, Australia, 2011. Retrieved November 9, 2012, from http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4221.0main+features202011

Butler, V., Czapkowski, B., Dragonas, M., & Tran, M. (2012). Science at the Crossroads: Enhancing Students' Interest in Science through a Community Learning Centre. Worcester, MA, USA.

Carnegie Council on Adolescent Development. (2000). Consultation on Afterschool Programs. (pp. 34). Washington, DC.

Carney, K., Hyman, A., Mello, E., & Snieckus, K. (2011). Teacher's Insight into Informal Science Education. Melbourne, Victoria, Australia: Worcester Polytechnic Institute.

Dolnicar, S., & Lazarevski, K. (2009). Marketing in non-profit organizations: an international perspective. *International Marketing Review*, *26*(3), 275-291.

Douglas, M., King, J., & Meleschi, S. (2001). School Participation in Commonwealth Scientific and Industrial Research Organisation Science Education Programs. Melbourne, Victoria, Australia: Worcester Polytechnic Institute.

Elliott, D., & Mihalic, S. (2004). Issues in Disseminating and Replicating Effective Prevention Programs. *Prevention Science*, *5*(1), 47-53. doi: 10.1023/B:PREV.0000013981.28071.52

Holleman, M., Jane Sundius, M., & Bruns, E. (2010). Building Opportunity: Developing City Systems to Expand and Improve After School Programs. *American Journal of Community Psychology*, *45*(3-4), 405-416. doi: 10.1007/s10464-010-9308-y

Hume City Council. (2012). Community Profile: Broadmeadows Highest level of Schooling. from Hume City Council http://profile.id.com.au/hume/schooling?WebID=120

Jefferson, A. (2012). Unemployment is falling, *Hume Leader*.

Kotler, P. (2005). The Role Played by the Broadening of Marketing Movement in the History of Marketing Thought. *Journal of Public Policy & Marketing, 24*(1), 114-116. doi: 10.2307/30000565

Mancini, J. A., & Marek, L. I. (2004). Sustaining Community-Based Programs for Families: Conceptualization and Measurement. *Family Relations, 53*(4), 339-347. doi: 10.2307/3700173

Neville, I. (2012). North Western Melbourne Priority Employment Area: Department of Education, Employment and Work Place Relations.

Okorley, E. L., & Nkrumah, E. E. (2012). Organisational factors influencing sustainability of local non-governmental organisations: Lessons from a Ghanaian context. *International Journal of Social Economics, 39*(5), 330-341.

Oplatka, I. (2004). Marketing informal education institutions in Israel: the centrality of customers' active development in service development. *The International Journal of Educational Management, 18*(6/7), 417-424.

Ross, M., Heaney, J.-G., & Cooper, M. (2007). Institutional and managerial factors affecting international student recruitment management. *International Journal of Educational Management, 21*(7), 593-605.

Stachowski, C. A. (2008). Internal marketing in a New Zealand language school: lessons for all educational leaders. *Management in Education, 22*, 31-38.

Wisener, K. (2011). *Aboriginal health education programs : examining sustainability.* University of British Columbia.

Appendix A: Interview Script and Notes with Banksia Gardens Parents

Script for Banksia Parents Phone Interview

Hi am I speaking to [insert name]. Good [insert morning/afternoon/evening]! My name is [insert name] and I am working on a project for the Banksia Gardens Community Centre.

Do you have time to answer a few short questions about the Centre? Your responses will help us to improve the science program to better serve the community!

If no:

Can we call back at another time that would be more convenient for you?

If no: No worries! Have a nice day!

If yes:

1. How did you first find out about the Centre?
2. Why do you send your child/children to the Centre?
3. Did you know that the Centre has a science session during the Holiday Program?
4. The Centre is thinking of having three versions of the science program:
    a. At the school run by a Banksia staff member
    b. At the Centre after school
    c. At the Centre during school holidays

   Which of these versions would be easiest for your child/children to participate in?

Thank you for your time! Have a nice day!

Notes from Interviews

Interview 1:

1.) Word of mouth (told by a friend)
2.) I want him to learn something new (*educational*); I want them to improve their language skills (*cultural adjustment*); I want my kids to be happy (*emotional*); I want them to have a change in their routine (not just school and home) (*environment*); socialisation. They come here to meet new friends (*social*); they have met new friends and enhanced self confidence (*emotional*)
3.) Had read about it in the program, but doesn’t exactly know what the word science means; didn’t recognise the program when we first said it
4.) He thinks the things they learn at school are different than what they learn in Banksia programs; he thinks the Centre is more informal and fun, so the kids would benefit more from having the session at the Centre

Interview 2:

1.) A friend of mine told me they are good teacher and Rana; and friendly; they can go and meet her and see if you like it; Rana treat the kids very well, and I'm happy with that
2.) He's 16 years old; his age little bit needs push for education; they help him, especially Rana; came for her older son, who was struggling with science and maths (*educational*). Meet new friends (*social*); they are happy with the kids here; the program has increased their self esteem (*emotional*)
3.) Yes ☺
4.) It's easier here; they feel comfortable; more friendly environment; easier after school; when you're on holiday, you go see family or other things; more dedication after school; brings kids right from school to program (much easier)

Interview 3:

1.) I applied for a job and they invited me for an interview; online
2.) To get more friends (*social*) (still new arrivals to the country) (*cultural adjustment*); don't have the wide connection with friends (*social*); they don't listen to me and home when I try to help them with their school homework; they listen better to a stranger. Its widened their knowledge; they start to ask why and how questions; think more deeply (*educational*); friendly environment; they are free to ask questions; they are safe and sound (*environment*), so more confident and comfortable (*emotional*); the things they learn here, they try at home; ask questions about how to make bouncy ball when they did it at home
3.) Yes ☺
4.) At the Centre after school; informal environment; they can work freely and ask freely; flexibility that they won't find in a formal environment with a formal teacher; easier as a worker to have her kids with her after school

Interview 4:

1.) My sister; she's to come for her homework.
2.) I was having trouble with my son when I would sit down with him to do his homework and he wouldn't do it and I'd get angry and then he wouldn't do it. Very good. The way they sit with them and they tell them to do something they do it. At home they throw their bags, sit on the couch, and watch TV. Lie and say they have no homework. Get calls from school saying the children aren't doing anything. I can't push and push and push (*educational*).
3.) I think I knew about science day; attended holiday program last year. If it was in program, they must have attended. I just drop them off and go
4.) In the school

Interview 5:

1.) Friend
2.) Happy with the help and support we supply for her kids, especially with their formal learning (maths, science, etc.) (*educational*). She wants kids to get better scores in English, maths, etc. (weakness because of the language barrier) (*cultural adjustment*)
3.) Yes (no?)
4.) Here during the holidays

Interview 6:

1.) through Ceres
2.) ex-volunteer, so her and her child both attend
3.) her daughter enjoyed the Holiday Program she attended
4.) Holiday Program easiest- doesn't live in Hume- transportation is an issue

Interview 7:

1.) through a mental health service- with daughter
2.) doesn't bring kids to Centre anymore
    a. kids don't enjoy it
3.) yes interested if it was in school
4.) Have they been to Holiday Program in the past? Yes, but didn't enjoy it because cultural differences (they have an Australian-Italian background).
    a. be good to bring it to schools to eliminate cultural difference

Interview 8:

1.) Lives right next door in housing complex. Jaime introduced them to the Centre. He said there are lots of kids and they should come.
2.) Helps children a lot. Helps with homework that we can't help with (*educational*), since we are not from here (*cultural adjustment*). It is also better when someone who is not their parents helps them with the homework; they get more done
3.) Yes, aware of the science program. Couldn't bring them this year, but brought them last year. They liked science and loved the program
4.) Prefer the school Holiday Program. It gives the kids something to do during the holiday. It also gives them other kids to interact with besides their school friends

Interview 9:

1.) Did not remember exactly. Possibly walked by, or heard from at library, or the local paper
2.) Something to do during the holidays. Talk to other kids (*social*).
3.) Yes child participated in twice
4.) Holiday Program

Interview 10:

1.) Heard from daughter's primary school
2.) Doesn't have any brothers or sisters so it provided her an opportunity to play with other kids (*social*)
    a. Gave her something to do during the holidays and it was affordable to send her to
3.) No
4.) School/Holiday→if she is already in school why not!

Interview 11:

1.) Use to work
2.) No response (she organised the programs)
3.) Yes yes yes
4.) All of them

Appendix B: Survey Distributed to Broadmeadows Parents

Thanks for taking time to fill out our survey! Please check the box for the most accurate answer or write it down if it applies.

1.) Are you a parent?

☐ YES ☐ NO IF YES, HOW OLD IS YOUR CHILD/CHILDREN? ______________

2.) Do you live in Broadmeadows?

☐ YES ☐ NO IF NO, WHERE? ______________

3.) Have you heard of the Banksia Gardens Community Centre?

☐ YES ☐ NO

4.) If yes to question 3, have you or your child/children participated in any programs?

☐ YES ☐ NO IF YES, WHICH PROGRAMS? ______________

5.) How interested are you in science?

☐ NOT INTERESTED ☐ A LITTLE INTERESTED ☐ INTERESTED ☐ VERY

6.) Which of the following programs at the community centre would you bring your child to? Rank each program from 1-5.

☐ Study group program
☐ Sports program
☐ Science program
☐ Music/theatre program
☐ Computer program

1 = 1st choice (most interested)
2 = 2nd choice
3 = 3rd choice
4 = 4th choice
5 = 5th choice (least interested)

7.) Which of the following would prevent you from bringing your child/children to a program at the community centre:

☐ Transportation
☐ My busy schedule
☐ My child's busy schedule
☐ Cost
☐ Other ______________

8.) What kind of program would you like the best? Check all that apply

☐ AT SCHOOLS ☐ AT COMMUNITY CENTRE AFTER SCHOOL ☐ AT COMMUNITY CENTRE DURING SCHOOL HOLIDAYS

Responses of the Surveys

1.) Are you a parent?		
Response	*Number of Responses*	*Percentage*
Yes	21	84%
No	4	16%
TOTAL	25	100%
If yes, how old is your child/children?		
Response	*Number of Responses*	*Percentage*
Pre-school	14	54%
Primary	6	23%
Secondary	0	0%
Unreported	6	23%
TOTAL	26	100%

2.) Do you live in Broadmeadows?		
Response	*Number of Responses*	*Percentage*
Yes	6	24%
No	19	76%
TOTAL	25	100%
If no, where do you live?		
Response	*Number of Responses*	*Percentage*
Meadow Heights	2	11%
Craigieburn	2	11%
Glenroy	2	11%
Sunbury	1	5%
Hadfield	1	5%
Gladstone Park	1	5%
Unreported	10	53%
TOTAL	19	100%

3.) Have you heard of the Banksia Gardens Community Centre?		
Response	*Number of Responses*	*Percentage*
Yes	10	40%
No	15	60%
TOTAL	25	100%

4.) If yes, have participated in any of their programs?		
Response	*Number of Responses*	*Percentage*
Yes	1	10%
No	9	90%
TOTAL	10	100%

5.) How interested are you in science?		
Response	*Number of Responses*	*Percentage*
Not Interested	5	23%
A little Interested	8	36%
Interested	5	23%
Very Interested	4	18%
TOTAL	22	100%

6.) Which of the following programs at the community Centre would you bring your child to? Rank each program from 1-5					
Ranking	*Study Group Program*	*Sports Program*	*Science Program*	*Music/Theatre Program*	*Computer Program*
1st	6	8	2	4	1
2nd	3	2	2	4	3
3rd	0	2	5	4	3
4th	4	2	3	2	3
5th	3	1	3	2	4

7.) Which of the following would prevent you from bringing your child/children to a program at the community Centre?		
Response	*Number of Responses*	*Percentage*
Transportation	7	28%
Time Constraints	12	48%
Cost	6	24%
TOTAL	25	100%

8.) What kind of program would you like the best? Check all that apply		
Response	*Number of Responses*	*Percentage*
At schools	7	19%
At community Centre after school	5	14%
At community Centre during school Holidays	10	28%
At the library	14	39%
TOTAL	36	100%

Appendix C: Questionnaire for Teachers at Hume Central Secondary College

Questionnaire for Teachers at Hume Central Secondary College

1. What is your gut reaction to bring the science programme to schools? Scale 1-10
   - 1= This is a terrible idea
   - 10= This is a fantastic idea
2. Do you think your students would be interested in this sort of programme? Why or why not?
3. What features would you like to see in a science/maths programme?
4. Do you feel that there is room in your curriculum to support the annual competition?

Responses to Questionnaire

Teacher 1

1. Programme sounds like a great idea.
2. I know that some of my students would be interested in this. I think the 15-minute activities would be what draw them in and the take home activities would possibly get other students interested.
3. I would like to see practical applications of the science because kids seem to overlook the fun side of science.
4. No

Teacher 2

1.) Great! Engaging, relevant real world scientific applications, and fun

2.) Yes, introducing application of competition, cooperation, and kinaesthetic tasks engage our students.

3.) Psychological/report writing applications (i.e. Write a hypothesis & evaluating data

4.) No, VCE Year 12 Psychology has prescribed knowledge and skills. But there are junior school applications.

Teacher 3

1. 7
2. Yes, because this can help them to participate in engaging activities.
3. Some engaging activities and guest speakers
4. Probably depends on the day selected.

Teacher 4

1. 7/8
2. Students possibly interested if there was a meaningful personal outcome.
3. Relatibility and applicable to the kids
4. Probably not in senior but in junior.

Teacher 5

1. 7
2. Students would be interested if there was a dear sense of purpose and it led to benefits and improvements in their learning.
3. Challenge/competition/experiences that are only possible outside of the classroom
4. Schools may be able to support with tutors and structured learning space.

Teacher 6

1. It is a good idea but which year levels is it aimed at? Need more information. Can be included in the “Forces” Section of the curriculum.
2. Students with interested in junior science level would be interested—especially if it is hands on.
3. Well organised and resourced program
4. Students in junior school would be able to take part in competition—perhaps during the homework club time.

Teacher 7

1. 7
2. I think some students would benefit greatly from this programme. However, it would only be a select number of students.
3. Activities to help improve student’s science literacy skills.
4. As a graduate, I feel that it would be extremely hard to contribute consistently. However, if it were incorporated into the curriculum it would be easier.

Teacher 8

1. Good idea.
2. Absolutely. They would like to do hands on activities.
3. Integrated with the curriculum and engaging activities for the students.
4. Yes. We need extra time to cater this programme.

Teacher 9

1. 10- if done well, an excellent opportunity to improve results.
2. Yes, they seem to be appreciative of extra help.
3. Increase in numeracy/literacy skills.
4. Why not!

Teacher 10

1. 10
2. Some have a love of science.
3. Incursion/ local excursion
4. Yes, dependent upon support from school and timetable pressure.

Teacher 11

1. Great idea!
2. Students would be keen, something different—new people (specialists)
3. Hands on/interactive→no theory
4. Would have to ask individuals (I'm a lab tech—provided I had the time I'd help)

Teacher 12

1. 7- Good project
2. There would be some junior students interested. Particularly if it involves building models.
3. Hands on problem solving and model building
4. Although the teachers are overloaded there will be some who will offer an hour or two per week.

Teacher 13

1. 8- Very good, interesting idea
2. Some students would be very interested.
3. Needs lots of practical hands on activities; not much written work
4. My time is very limited, but I am willing to help were possible.

Teacher 14

1. 9
2. Yes. I run an accelerated programme and this could fit well.
3. Interactive, hands on content with emphasis on being relevant to the "REAL WORLD"
4. Yes

Teacher 15

1. Fantastic
2. Yes
3. Science activities and investigations
4. No idea

Appendix D: Options for the Annual Science and Maths Competition

Science and Maths Competition (in partnership with Hume City Council)

Duration: 1 term

Age group: 11-13 years

Groups: 2-4 members

*A panel of judges will review the projects/answers/submissions and decide the winner. The winner will be announced during the Annual Event

*Each group will have a mentor that will meet with them at least once a week to help them develop the project/answers/submissions

OPTION 1: Science Fair

- Each group will develop a science project and present it at the annual event for the judges to evaluate
- A prize will be provided to the top 3 projects selected by the panel of judges

OPTION 2: Maths/Science Question Challenge

- The teams will be provided with a set of questions that they have to answer by a deadline
- Each group will present their answers at the Annual Event. The presentations will be evaluated, along with the accuracy of the answers, by a panel of judges.

OPTION 3: Video Competition

- Each team will be given the challenge to create a video of them successfully completing a scientific experiment
- Each team will have to publish the video in a given website by a certain deadline.
- All the submissions will be posted on a website for people to vote on their favourite one.
- The top videos will be presented on the Annual Event where a panel of judges will determine the winner

OPTION 4: Model Building

- Each team will have to build a model of a world-famous monument made of recycled materials
- The models will be presented at the Annual Event for a panel of judges for evaluation

OPTION 5: Reverse Engineering

- Take an object apart to figure out how it works
- Try to put it back together again and still work properly

Appendix E: Budgets for 3 Versions of the Science Program

At Schools: In-School Version

THE SCIENCE EDUCATION PILOT						
Component	Price	Number of Sessions	Preparation Hours	Hours per session	Back-up	Total Price
School Incursions Program						
Facilitator	$ 30.00	4	4	2	1.14	$ 410.40
Materials	$ 126.00	4				$ 504.00
Supervisor	$ 50.00		2			$ 100.00
Administration	10%					$ 101.44
TOTAL						**$ 1,115.84**
Science and Math School Competition (linked to I-Tech Challenge) and Annual Event						
Competition	$ 1,500.00					$ 1,500.00
Multimedia Component						
Online Videos, Social Media						$ 750.00
Evaluation						
Evaluation	$ 50.00			20		$ 1,000.00
TOTAL						
Cost of Program		6				$ 6,695.04
Additional Cost						$ 3,250.00
Cost of Pilot						**$ 9,945.04**

Cost per student per year:
66.3002667

At the Centre: After School-Version

THE SCIENCE EDUCATION PILOT						
Component	Price	Number of Sessions	Preparation Hours	Hours per session	Back-up	Total Price
After School at Centre						
Facilitator	$ 30.00	10	5	1	1.14	$ 513.00
Materials	$ 40.00	10				$ 400.00
Supervisor	$ 50.00		2			$ 100.00
Administration	10%					$ 101.30
TOTAL		4				**$ 4,457.20**
Science and Math School Competition (linked to I-Tech Challenge) and Annual Event						
Competition	$ 1,500.00					$ 1,500.00
Multimedia Component						
Online Videos, Social Media						$ 750.00
Evaluation						
Evaluation	$ 50.00			20		$ 1,000.00
TOTAL						
Cost of Program		6				$ 4,457.20
Additional Cost						$ 3,250.00
Cost of Pilot						**$ 7,707.20**

Cost per student per year:
$ 154.14

At the Centre: Magic Science Day during holidays

THE SCIENCE EDUCATION PILOT						
Component	Price	Number of Sessions	Preparation Hours	Hours per session	Back-up	Total Price
Holiday Program						
Materials	$ 230.00	4				$ 920.00
Administration	10%					$ 92.00
TOTAL		4				**$ 4,048.00**
Science and Math School Competition (linked to I-Tech Challenge) and Annual Event						
Competition	$ 1,500.00					$ 1,500.00
Multimedia Component						
Online Videos, Social Media						$ 750.00
TOTAL						
Cost of Program		6				$ 4,048.00
Additional Cost						$ 2,250.00
Cost of Pilot						**$ 6,298.00**

Cost per student per year:
$ 104.97

Appendix F: Schedule and Description of Activities for Magic Science Day 30 January, 2013

TIME	ACTIVITY	CAREER	ALTERNATE ACTIVITY
10:00	Tree Game/Ninja Game		
10:15	Mentos-Coke	Aerospace Engineering/Astronaut	
10:30	Catapult Bulding	Physics/Mechanical/Civil	
10:45			
11:00			
11:15			
11:30	Fort Destruction		Object destruction
11:45			
12:00	Lunch		
12:15			
12:30	Rock-Paper-Scissor Torunament		
12:45	Milk Rainbow	Food Engineering/Chemist	
13:00	Bridge Building	Architect/Civil Engineer	
13:15			Tower Building
13:30			
13:45	Lava Lamp	Chemist	
14:00	Ice Cream	Food Engineering/Chemist/Nutrition	
14:15			
14:30			
14:45			
15:00	Evaluation		

WOW Factors
Workshops
Competitions
Career Exploration
Field Trip

Mentos-Diet Coke Rocket

Activity Type: Wow Factor
Topic: Elements, Compounds and Reactions
Duration: 15 minutes

Materials

- 2-liter bottle of diet soda
- 3 Mentos mints

Preparation

- Attach 3 Mentos to clear tape and tape them to the cap of the bottle. Make sure that the piece of tape is short enough so it doesn't touch the liquid when you put the cap back on
- Find a safe open space to explode the diet soda

Procedures

1. After putting the cap with the Mentos back in the diet soda, shake it until the pressure in the bottle is so high, that the gas is dripping from the cap
2. Throw the diet soda to the ground (far away from you) and watch it launch to the air

Key Terms and Definitions

Pressure	How much force you apply to an object
Pores in Mentos	Mentos contain a lot of little holes also known as nucleation sites. When the gas fills these holes, it creates bubbles. Because of the many pores in Mentos, it creates a lot of bubbles and they go out of the bottle due to pressure.

Takeaway/Discussion

1. Ask the children "Why do you think that the diet soda launched to the air?"
2. Explain that when you add the Mentos to the diet soda and recap it, the gas in the soda is creating a lot of bubbles around the Mentos. Therefore, there is a lot of pressure building inside the bottle. The pressure is so high that the moment the bottle touches the ground, the cap is push off and the Geyser forming inside the bottle makes it fly to the air.
3. Why does diet soda work better than regular soda?
4. Explain that the diet soda has more carbon dioxide; therefore more bubbles are formed around the Mentos.

Career Connection

Rocket Scientist	A scientist who designs rockets.
Chemical Engineer	A scientist who uses science to process raw materials and chemicals into useful forms. Work by chemical engineers can lead to the discovery of important new materials and processes

Experiment adapted from
http://www.instructables.com/id/Mentos-and-Diet-Coke-Rocket/

Definitions adapted from
http://www.sciencekids.co.nz/sciencefacts/engineering/typesofengineeringjobs.html
http://www.newton.dep.anl.gov/askasci/gen01/gen01667.htm

Catapult Building

Activity Type: Competition
Topic: Design of Structures, Projectile Motion
Duration: 1 hour

Materials

- empty egg carton (1/4 of it per team)
- 1 pair of scissors per team
- 1 masking tape

- rubber bands
- 1 plastic spoon per team
- Hershey Kisses candy

Preparation

- Distribute bags of materials

Procedure

1. Cut the egg carton in half. A cardboard carton works best, but you can also use styrofoam.
2. Stuff each socket with a ball of newspaper in order to reinforce the base of your catapult. Now close the lid and secure the carton with a rubber band.
3. Wrap two or more rubber bands (depending on the size/ strength) around the base of the carton, just *below* the opening in the middle.
4. Tape a rubber band to the end of the handle on a teaspoon.
5. Insert the handle of the spoon beneath the rubber bands you wrapped around the base in step 3.
6. Now take the rubber band you taped to the handle of the spoon in step 4 and stretch it straight up and over the spoon and wrap it around the back of the carton.
7. Now wrap two or more rubber bands (depending on the size/ strength) around the base of the carton, just *above* the opening in the middle.
8. Attach a "leash" to the spoon (not too tightly) by securing a rubber band between the spoon and the top of the egg carton. Use tape as necessary. This "leash" will enable the catapult to launch objects on an arc instead of a line drive. Adjust tightness of leash to achieve optimal results.

Key Terms and Definitions

Projectile	any object that is cast, fired, flung, heaved, hurled, pitched, tossed, or thrown
Trajectory	the path a projectile follows

Takeaway/Discussion

1. Catapults were first invented to hurl projectiles farther than any human could. The spoon applies a force to the object that sends it into flight. The object follows a parabolic path, which is an arch shape.

Ways to Expand the Activity

Angry Birds Fort Destruction

Career Connection

Aerospace engineer	A scientists who involves the design and construction of planes and space shuttles. Aeronautical engineering covers craft that stay inside the Earth's atmosphere (such as commercial planes) while astronautical engineering covers craft that leave the Earth's atmosphere (such as space shuttles).
Physicist	A scientist who observes natural phenomena and use mathematics to develop theories which help explain why they occur.

Experiment adapted from
http://spaghettiboxkids.com/blog/easy-to-make-catapult-egg-carton-design/

Definitions extracted from
http://physics.info/projectiles/
http://www.sciencekids.co.nz/sciencefacts/engineering/typesofengineeringjobs.html

Angry Birds Fort Destruction

Activity Type: Competition
Topic: Design of Structures, Projectile Motion
Duration: 30 minutes

Materials

- Several bags of marshmallows
- Spaghetti

Preparation

- Distribute bags of materials

Procedure

1. Build a fort with the spaghetti and marshmallows
2. Try to demolish the fort by launching marshmallows at it with the catapult

Takeaway/Discussion

1. What shapes were the strongest? Why do you think it was the strongest?

Career Connection

Civil engineers	A scientists who designs the construction of buildings, roads, bridges and dams. Further specialist areas such as transportation, water resources, surveying and construction.

Definitions extracted from
http://www.sciencekids.co.nz/sciencefacts/engineering/typesofengineeringjobs.html

Milk Rainbow

Activity Type: Wow Factor
Topic: Elements, compounds, reactions
Duration: 15 minutes

Materials

- Milk (whole or 2%)
- Plastic plates
- Food colouring (red, yellow, green, blue)
- Dish-washing soap
- Q-Tips

Preparation

- Pour enough milk on a plate to completely cover the dish.
- Pour some dish soap on a plate.
- Distribute food colouring.

Procedure

2. Allow the milk to settle in the plate.
3. Add one drop of each of the four colours of food colouring (red, yellow, blue, and green). Make sure to keep the colours close together and in the centre of the plate.
4. Take a clean Q-tip and dip it in the dish soap on the plate.
5. For the next part of the experiment predict what will happen when you touch the Q-tip with dish soap to the centre of the milk.
6. Then go ahead and try it! IMPORTANT: DO NOT STIR THE MILK! Just touch the Q-tip to the Centre of the plate.
7. Look at the burst of colour!
8. Add another drop of soap to the tip of the Q-tip and try it again. Experiment with placing the Q-tip at different places in the milk.

Key Terms and Definitions

Detergent	A cleaning agent that increases the ability of water to break down greases and dirt. Their molecules surround particles of grease and dirt, allowing them to be carried away.
Fat	An oily substance.

Molecule It refers to two or more atoms, which have chemically combined to form a single species.

Takeaway/Discussion

1. Milk is a mixture of a variety of substances, including protein, vitamins, minerals and fat. When soap is added to the milk it spreads out and breaks the fat molecules creating pathways that the food colouring follows.

Career Connection

Chemist A scientist who studies the composition and properties of chemicals and the way chemicals interact with each other.

Food scientist A scientist who studies the chemical properties of food and ingredients as well as evaluates the nutritional value, colour, flavour and texture of food.

Experiment adapted from
http://serc.carleton.edu/sp/mnstep/activities/35679.html

Definitions adapted from
http://chemistry.about.com/od/educationemployment/a/chemistprofile.htm
http://targetjobs.co.uk/careers-advice/job-descriptions/279551-food-scientist-job-description

Bridge Building

Activity Type: Competition
Topic: Design of Structures
Duration: 45 minutes

Materials

- 100 toothpicks per team
- 50 gumdrops or spice drops per team

Preparation

- Distribute bags of materials

Procedure

2. Students will build their toothpick and gumdrop bridges in teams. Bridges must span at 8 inches and be at least 10 inches long. Up to 4 pounds of weight will be placed on top of the bridges; the bridge that can hold the most weight wins!
3. We used water bottles and metal locks as weights, and bridges were placed on two desks placed 8 inches apart. Students should be asked to think about what makes some teams' bridges so much stronger than others.

Key Terms and Definitions

Truss A truss usually takes the form of a triangle or combination of triangles, since this design the greatest rigidity. Trusses are used for large spans and heavy loads, especially in bridges and roofs.

Takeaway/Discussion

1. Which bridge designs worked best and why?

Career Connection

Civil engineers A scientists who designs the construction of buildings, roads, bridges and dams. Further specialist areas such as transportation, water resources, surveying and construction.

Experiment adapted from
http://9-dots.org/toothpick-gumdrop-bridges/

Definitions extracted from
http://encyclopedia2.thefreedictionary.com/Truss

Lava lamp

Activity Type: Workshop/Lab
Topic: Density
Duration: 15 minutes

Materials

- Water
- 1 clear plastic bottle for each child
- Vegetable oil (enough to fill about ¾ of each bottle)
- Food colouring (12 drops per bottle)
- Alka-Seltzer (or other tablets that fizz) (1 tablet per bottle)

Preparation

- Measure out amounts for each material and distribute

Procedure

2. Pour water into the plastic bottle until it is around one quarter full (you might want to use a funnel when filling the bottle so you don't spill anything).
3. Pour in vegetable oil until the bottle is nearly full.
4. Wait until the oil and water have separated.
5. Add around a dozen drops of food colouring to the bottle (choose any colour you like).
6. Watch as the food colouring falls through the oil and mixes with the water.
7. Cut an Alka-Seltzer tablet into smaller pieces (around 5 or 6) and drop one of them into the bottle, things should start getting a little crazy, just like a real lava lamp!
8. When the bubbling stops, add another piece of Alka-Seltzer and enjoy the show!

Key Terms and Definitions

Density Because all objects are made out of molecules, it is possible to determine how tightly packed those molecules are. This is known as density. The more tightly packed the molecules of an object, liquid or gas are, the denser we say they are.

Takeaway/Discussion

1. Explain to the children that oil and water don't mix with each other. Oil being less dense, floats on water. When the effervescent tablet is introduced, it reacts with water to release carbon dioxide gas. This gas is less dense compared to oil, so it wants to rise above the oil surface. In the process, it takes some water along with it. When the gas bubbles reach the oil surface, they pop and the water falls back through the oil. Read a detailed explanation complete with chemical equation etc.

Career Connection

Chemist A scientist who studies the composition and properties of chemicals and the way chemicals interact with each other. Chemists search for new information about matter and ways this information can be applied. Chemists also design and develop instruments to study matter.

Experiment adapted from
http://pinterest.com/pin/159807486746953021/

Definitions extracted from
http://chemistry.about.com/od/educationemployment/a/chemistprofile.htm

Ice Cream Making

Activity Type: Workshop/Lab
Topic: Elements, Compounds and Reactions
Duration: 1 hour

Materials

- Thick Cream
- castor sugar
- vanilla essence
- Ice
- Rock salt
- 1 medium sized Ziploc bag
- 1 large sized Ziploc bag
- tea towel or oven mitts

Preparation

- Measure 300 ml of cream
- Measure 2 tbsp. of castor sugar
- Measure 1 tbsp. of vanilla essence
- Measure 6 tbsps. of rock salt

Procedures

2. Give one medium Ziploc bag and one large Ziploc bag to each child
3. Place the cream, sugar and vanilla in the medium bag and mix the ingredients
4. Place the ice and salt in the large Ziploc bag
5. Place the medium bag containing the ingredients in the large Ziploc bag on top of the ice and close it properly
6. Shake and massage the bag for five to ten minutes or until the mixture becomes the consistency of ice cream. Give towels to the children because the bag gets really cold.
7. Enjoy the homemade ice cream.

Takeaway/Discussion

1. Ask the children "why do you think that we can make ice cream so fast?"
2. We can explain that by adding salt to ice, you lower the freezing temperature of water. The ice is not going to melt as fast as it would without the salt, therefore the cream, sugar and vanilla will turn into ice cream. The cold temperature of the ice is being transferred to the ice cream, so it gets colder very fast.

Career Connection

Food Scientist	A scientist who studies the properties of food and ingredients as well as evaluates the nutritional value, colour, flavour and texture of food.
Chemical Engineer	A scientist who uses science to process raw materials and chemicals into useful forms. Work by chemical engineers can lead to the discovery of important new materials and processes

Definitions adapted from
http://www.sciencekids.co.nz/sciencefacts/engineering/typesofengineeringjobs.html
http://www.newton.dep.anl.gov/askasci/gen01/gen01667.htm

Appendix G: Photographs from Magic Science Day

Figure 26: Participants of Magic Science Day (30 January 2013)

Figure 27: "Catapult Building" *Competition* at Magic Science Day

Figure 28: "Angry Bird Fort" *Competition* at Magic Science Day

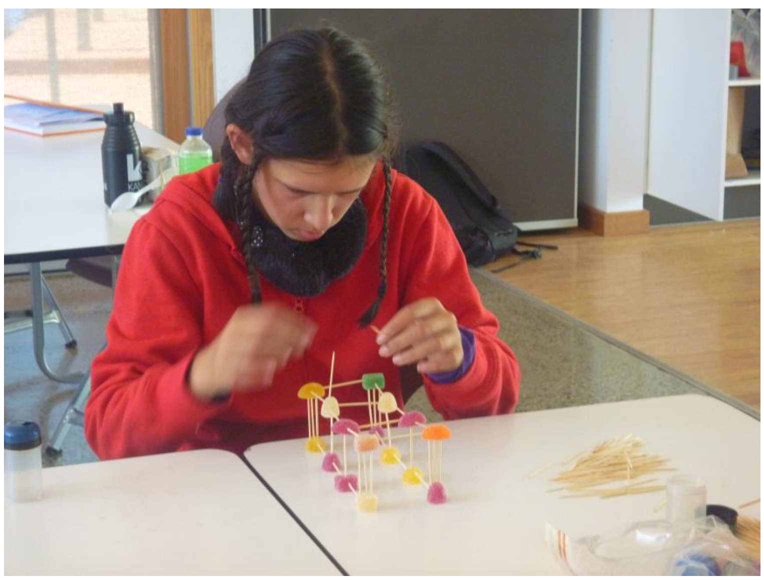

Figure 29: "Bridge Building" *Competition* at Magic Science Day

Figure 30: "Ice Cream Making" *Workshop/Lab* at Magic Science

Appendix H: Feedback from Staff on Magic Science Day

"The Magic Science day was a very successful part of the School Holiday Program for a number of reasons. The group of facilitators worked as a team and shared leadership throughout the day, making an interesting and well-supported environment for each other and the children. The facilitators factored in the children's' limited concentration and planned enough activities to keep the children entertained and interested. This is something that the Banksia staff can take into account when planning future programs, as I believe it led to good behaviour and satisfaction from both the children and volunteers (volunteers are always well behaved, not always satisfied!). The structure meant that everyone was on the same page and could participate fully.

The children took home some of the things they made, giving them a sense of achievement, a memory of the day and something to show their parents—which made the few parents I saw at the end of the day very pleased!

The activities were appropriate for the age group. Perhaps if we'd had older students attend, those students may have felt impatient or less interested in some of the activities. This often happens, regardless of how interesting we might think activities are! But perhaps we may need to keep some Plan B activities that were perhaps more involved or complex for older students that could break off in a group while the younger students do simpler activities. ?!
I felt it was one of the better programs I have seen delivered at Banksia Gardens due to the team facilitation, structured approach to planning and having various activities that were fun and interesting for each age group."

-Rachel Wood

"What I liked about the structure of the day was that each experiment was different, yet some activities linked together (e.g. activity 1 - make a catapult, activity 2 -make a structure, then bring both ideas together). Also relating the catapult/building activity to 'Angry Birds', something that is relevant to their age group kind of brought that little bit more interest and purpose, which was nice.

Each activity kept the kids of varying ages entertained and enthused, and because it was hands on they could go at their own pace and expand their imagination (e.g. building a bridge). It was cool to see how different each individual's creation was and there was enough material there for them to really challenge themselves.

I was interested in the science behind each experiment and I would've liked you's to go a little more in depth with how and why things were happening, in saying that some of the holiday group we had were too young to be as interested as I in the 'why', they just thought it was fun and wanted to make ice cream! (Which was no fault of your own, it was unfortunately the age you were working with). The 'theory' of what is behind each experiment will definitely be more successful and beneficial in a school setting (as I believe this is where ideally you'd like to run this program).

From the moment the day begun every step had been planned out and prepped, and thus the day was run smoothly and effectively. Each of you had a role in running the program, you all showed interest and got involved in the activities, were friendly and patient with the kids. I myself enjoyed and learned throughout the day so I'm sure the kids took away something, or developed a new found interest in science.

I'm sure you have a lot more experiments under your sleeves and it would be great to see what amazing, interesting experiments you can conduct when you have access to equipment in school science labs!

I would definitely support your efforts in getting a science program up and running in schools."

-Tash Alabakov

Appendix I: Photographs from Hume City Valley Students' Facilitation

Figure 31: Hume Valley Students Building Bridges

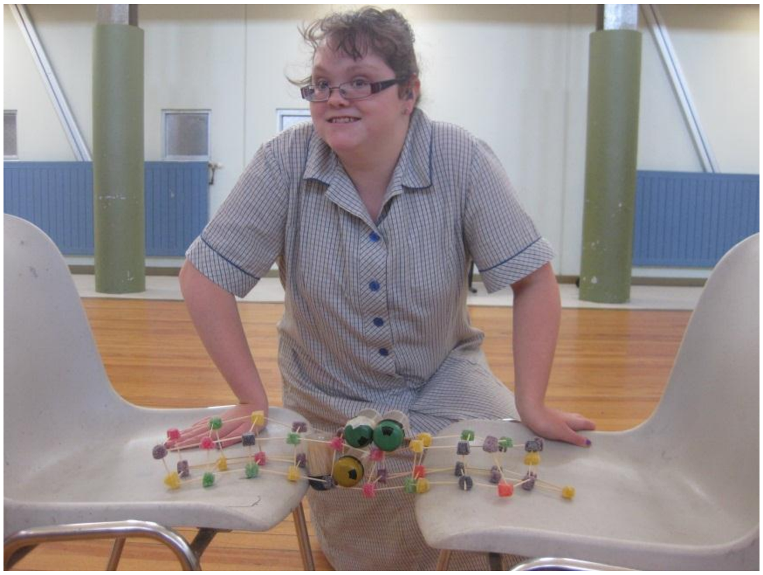

Figure 32: A Hume Valley School Student Testing the Strength of Her Bridge