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SCIENCE EDUCATION FOR THE FUTURE

Assessing the Impact of Non-Formal Education in Australia

**Science Education for the Future:
Assessing the Impact of Non-Formal Education in Australia**

An Interactive Qualifying Project
submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfilment of the requirements for the
degree of Bachelor of Science

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Date:
30 April 2010

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This report represents work of WPI undergraduate students submitted to the faculty as evidence of a degree requirement. WPI routinely publishes these reports on its web site without editorial or peer review. For more information about the projects program at WPI, see <http://www.wpi.edu/Academics/Projects>.

ABSTRACT

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) of Australia conducts science-based workshops for K-12 students. The CSIRO seeks a method to assess the impact of these workshops on student interest and attitude toward science. This project developed and administered a set of assessments to gauge the programs' effects on student interest and attitude. The project team collected data through the use of surveys, interviews, and observations providing the CSIRO with recommendations for program improvements and tools for ongoing assessment.

ACKNOWLEDGEMENTS

First and foremost, the team would like to thank our advisors, Professors Peter Christopher and Lauren Mathews for their continued support and assistance with our project. Additionally, we would like to express our gratitude to Professor Stephen McCauley for his guidance throughout the preliminary stages of this project. This project would not have been possible without their timely feedback, constant revisions, and numerous suggestions for the improvement of our project.

We would also like to express our gratitude to our project liaisons, Chris Krishna-Pillay and Cath McLaren for all the time they spent helping us set up our project and answering the important question of *“Why is Science Important”*. We are also grateful to Nicola Steward, Sean Elliott, Elke Barzcak, Simon Matheson, Sarah Harvey and Greg Crocetti at the CSIRO for allowing us to observe their programs. Without the data collected from these programs we would have been unable to perform our analysis and provide the CSIRO with recommendations. In addition, we would like to express our appreciation to the remainder of the CSIRO employees for providing their assistance whenever we needed it. We would also like to thank Chris for introducing us to both Australian comedy and the unforgettable sport of Footy.

Next we would like to thank Professor Holly Ault and Dr. Prapaipit Ternai for setting up the Melbourne Project Center and assisting us in making our transition to a foreign country easy and painless. In addition, our gratitude goes out to the Victorian Deaf Society for hosting the final project presentations.

Furthermore, we would like to thank the teachers at Bayside Christian College, Bentleigh Secondary College, Emmaus College, Malvern Central School, Mount View Primary School, Mt. Eliza College, and St. Aloysius College for taking time out of their day and allowing us to administer surveys to their students. We would also like to thank all the students for taking the time to fill out our surveys.

We also express our gratitude to Nadia Chernyak for teaching us how to use SPSS and for assisting us with the selection of appropriate statistical methods for our analyses.

We would next to like to thank Diane Gordon and Janine McCoy, of the Healesville Sanctuary *Zoo Keeper for a Day* Program, for allowing us to observe their program and interact with all of the Australian wildlife.

Additionally, we appreciate the assistance of Craig Cormick of the Department of Innovation, Industry, Science, and Research and Jenn Romatelli of the Boston Museum of Science. By providing us with studies and insightful information they allowed us to better understand the impact of science on society.

Finally, we would like to thank our local WPI resources Professor Janice Gobert and Laura Hanlan for giving us valuable insight of how to conduct surveys interviews and observations as well as providing us with numerous articles and research methods.

Without the generous assistance provided by all those mentioned above this project would not have been possible.

AUTHORSHIP PAGE

This report was written as a combined effort by all four members of our group: Vadim Chernyak, Daniel DeCiero, Wesley Dittrich and Alexander Meyer-Lorentson. All sections were authored by one lead author and then heavily edited and revised by all group members to ensure that the report was a consistent and uniform representation of the project as a whole.

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LIST OF ABBREVIATIONS

ACARA	Australian Curriculum Assessment and Reporting Authority
ANOVA	Analysis of Variance
BET	Back End Table
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DIIRD	Department of Innovation, Industry, and Regional Development
EC	Emmaus College
FF	<i>Forensic Frenzy</i>
GM	Genetically Modified
GPS	Global Positioning System
GUI	Graphical User Interface
IEE	Impact Enhancing Elements
IHE	Impact Hindering Elements
INE	Impact Neutral Elements
ISAIA	Inventory of Science Attitudes, Interests, and Appreciations
MAST	Metropolitan Advanced Science Test
MPEX	Maryland Physics Expectation Survey
MT	Main Table
N	Number of Participants
NSF	National Science Foundation
P1	First Post-Test
P2	Second Post-Test
P3	Third Post-Test
PR	Pre- Test
P-Value	Significance Values
ROSE	Relevance of Science Education
SD	Standard Deviation
SE	Standard Error
SEC	Science Education Center
SPSS	Statistical Package for the Social Sciences
TOSRA	Test of Science Related Attitudes
VASS	Views about Science Survey
VBA	Visual Basic for Applications
VCE	Victorian Certificate of Education
VOSTS	Views on Science, Technology, and Society
VSSEC	Victorian Space Science Education Center
WPI	Worcester Polytechnic Institute

EXECUTIVE SUMMARY

Australia has experienced a decline in enrollment in post-secondary science programs over the past twenty years. This trend follows that experienced throughout the developed world. The decline has potential to cause serious problems due to the close integration of science and technology into the Australian way of life.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia's national science agency, runs non-formal educational workshops in K-12 schools for the purpose of promoting interest and positive attitude in the fields of science and technology. These ninety-minute programs are generally conducted at the participating schools during school hours. Both students and teachers appear to enjoy these programs and the majority of participating schools book the programs year after year.

Our project team formally assessed the CSIRO programs to determine the degree to which student interest and attitude toward science changes as a result of the program. We developed surveys, observation rubrics, and teacher interview questions to assess student interest in and attitudes toward science, curriculum relevance, and the extent of student engagement in the programs. We worked with the CSIRO to build upon surveys and suggestions developed by a previous Worcester Polytechnic Institute (WPI) assessment team to design new surveys for the *Forensic Frenzy*, *Nanotechnologies*, *Materials and Structures*, *Biodiversity*, and *Cool Chemical Science* programs. We developed four surveys to be administered immediately prior to the program, immediately following the conclusion of the program, one week following the program, and one month following the program. Using suggestions from the previous WPI assessment team we also developed a new observational rubric to assess student interest throughout the program. This included adding a time component to the observational data which allowed us to track student behaviors throughout the program. Working from suggestions provided by the previous WPI

assessment team, we modified previously developed interview questions to assess curriculum relevance and teacher expectations of the CSIRO programs.

We administered surveys to students, conducted interviews with teachers, and conducted observations of the students during each program. We observed a total of 15 programs, administered 985 surveys, conducted 25 interviews, and observed 326 students.

Upon receipt of data from surveys, observations, and interviews, we developed tools by which data could be easily stored and analyzed. An important consideration when developing these tools was the wide variety of data types resulting from the surveys, observations, and interviews. We developed a highly-customizable database in Microsoft Excel with extensive programming using Visual Basic for Applications (VBA). Several user interfaces were developed in order to provide a user-friendly means by which data could be entered from the surveys into an electronic format. Observational data was also stored in the same database. Interviews were transcribed into electronic format for the purposes of data storage.

Using the data gathered from surveys, observations and interviews, we applied a number of statistical tests to check for correlations as well as overall trends in the data. The quantitative data collected from these assessments were analyzed using the Statistical Package for the Social Sciences (SPSS). Frequency analyses, independent samples t-tests, bivariate Pearson analyses, and paired samples t-tests tests were used to conduct analysis on the survey responses. Additionally, observational data were analyzed graphically.

Our tests suggested that overall student interest significantly increases immediately following the programs. However, interest returns to pre-program levels by one week following the program. We also conducted more tests, dividing the students into cohorts by age, gender, and initial interest in science. Following the suggestion of the previous WPI assessment team, we investigated the

importance of having a strong central theme within a program. Our findings on the importance of a strong central theme were inconclusive and further study is needed on this topic.

The final stage of this project focused on providing recommendations on how the CSIRO programs can better achieve existing goals and providing recommendations for potential improvements to the programs. In order to obtain a different perspective on non-formal education programs, we contacted the Healesville Wildlife Sanctuary and observed their *Zoo Keeper for a Day* program, a program the Sanctuary runs for years 9-12 students during school holiday periods. Our observations of the *Keeper for a Day* program afforded the opportunity to provide comparisons between the Healesville and the CSIRO programs.

Our final assessments concluded that, for the most part, the CSIRO's programs do cause a significant increase in student interest in science immediately following the programs. We also found that older students are less likely to display a change in their interest in science as a result of the program. Our data also suggest that females are more affected by the programs than males with regard to interest in science. Furthermore, students often did not believe they learned all of the topics which the CSIRO programs aimed to cover. Additionally, program length appears to be an important factor of student engagement in the program. Finally, we concluded that the distribution of students' interest in science differs from that of the adult population of Victoria, Australia. We found that a far higher proportion of students have a neutral interest in science than the adult population of Victoria; in addition, there is a far smaller proportion of students who are not interested in science than that of the adult population of Victoria. From these conclusions we recommended that the CSIRO implement the following:

- Increase focus on key topics within the *Forensic Frenzy*, *Nanotechnologies*, and *Cool Chemical Science* programs.
- Conduct further study on the CSIRO programs to determine the following:

- Importance of a strong central theme within the programs,
- Student exposure to topics that the CSIRO aims to cover in the programs,
- Change in student awareness of the concepts and issues relating to the program material following participation in the programs.

We hope that by implementing these recommendations the CSIRO will be able to further improve their programs and, by doing so, continue to expose students to a wide variety of scientific topics.

CHAPTER 1: INTRODUCTION

Advancements in science and technology underlie the rapid developments and achievements that characterize modern society. The Internet allows information to easily be passed to many parts of the world, airplanes make worldwide travel possible, and the Global Position System (GPS) using satellite technology will give your location when you get there. Tasks that were once unimaginable are now second nature. Every advance in science has had someone behind it, someone who has had a passion for creating something new or fulfilling an intellectual need. These scientists, inventors, and tinkerers all had something in common: knowledge of science. Their knowledge and passion leads them to create the science infrastructure upon which advancements can be made. Many who work with science gain this knowledge from formal science education at the post-secondary level. However, enrollment in post-secondary science programs has declined across the developed world in the past 20 years. Studies have shown decreasing enrollment in post-compulsory science courses in Australia, Canada, India, Japan, the United States, Russia, and every country within the European Union (Lyons, 2004). These declines have generated widespread concern and stimulated multiple initiatives to address the issue of declining interest in science.

Australia's declining enrollment in post-secondary science typifies the problem seen worldwide. Nationwide, enrollment in science majors decreased from 71,839 students in 1997 to 66,708 students in 2002, a 7% decrease in 5 years (Dobson, 2006). Dobson's (2006) study particularly notes a strong move away from the enabling sciences (i.e. chemistry, physics, and mathematics). Between 1989 and 2002 the number of full time students majoring in these enabling sciences in Australian universities dropped from 17,064 to 13,105 students. Contrasting this declining science enrollment, student enrollment in other subjects in Australia's post-secondary schools continues to grow every year. Since 1989, the number of post-secondary school students has

increased from 441,074 to 750,940 students, a 70% increase. A number of theories explaining this lack of enrollment in science have been proposed. Two such theories are an influx of overseas business students (Dobson, 2006) and a lack of inspiring grade school teachers (Jane & Peeler, 2005).

The Commonwealth Scientific and Industrial Research Organisation (CSIRO), a government agency responsible for increasing and advancing science in Australia, has taken a keen interest in the problem of declining science enrollments. The CSIRO has initiated a set of programs encouraging students to become interested in science and technology. Central among these programs is a set of non-formal science workshops aimed at giving students an opportunity to experience science in a hands-on and interactive environment. The topics of the workshops are widespread, and allow students to explore entirely new topics or to delve deeper into subject matter from their classes. By exposing students to this environment, the CSIRO hopes to improve student attitudes toward science and to foster student interest and curiosity about the world in which they live. Teachers enroll their classes in the programs to give their classes the opportunity to experience the hands-on learning environment afforded by the programs. Since the early 1990s, over 10,000 students have participated and indications suggest that the programs are immensely popular. However, a systematic understanding of the program's impacts, and particularly its long term impact on increasing student interest in and improving student attitudes toward science, is needed.

The CSIRO has administered a standardized survey to the teachers involved in these programs for the past five years. The surveys are distributed after the programs are completed in order to evaluate teacher opinions of the CSIRO programs. On average, 10% of the distributed surveys are returned; the majority of them yield positive feedback (Krishna-Pillay, personal communication). This current survey method focuses on the perspective of teachers and does not provide student feedback regarding interest towards science. During the beginning of 2010, a team

of Worcester Polytechnic Institute (WPI) students worked with the CSIRO to develop a series of surveys which they administered to the participants of the CSIRO workshops. The surveys focused on student interest in science and technology (see Donahue, et. al, 2010). Expanding the current assessment scheme is critical in order to provide quantitative and qualitative data that will help the CSIRO improve its programs. The previous WPI assessment team initiated this process by developing surveys, making observations, conducting teacher interviews, and analyzing the results to provide recommendations for possible improvements to the CSIRO's programs. Further information on the work of the previous WPI team can be found in Section 0.

Our project contributed to the efforts of the CSIRO to advance science and technology education by evaluating the success of the CSIRO's science programs towards increasing student interest in and improving student attitudes toward science. This project developed survey tools which contributed to an ongoing, long term study, relating to the CSIRO's science programs, and it evaluated the cumulative results of the study. To facilitate this evaluation, a set of data storage frameworks were developed. Administration and analysis of a series of surveys assessing student interest and attitude provided our team the necessary data to determine student interest in the material and science in general. Based on these analyses we determined the achievement of the CSIRO's stated program goals and provide recommendations to further improve the programs and ultimately increase student interest in science.

CHAPTER 2: REVIEW OF BACKGROUND LITERATURE

There has been a documented decline in enrollment in science programs throughout the developed world (Lyons, 2004). This decline has far-reaching consequences for anyone who relies on some form of technology in his or her life; namely, the vast majority of people living in the developed world. There are efforts aiming to reverse this decline and rekindle interest in science. In Australia, one agency is dedicated to the advancement of science and technology is the Commonwealth Scientific and Industrial Research Organisation (CSIRO). As part of its efforts to increase interest in science and technology in the country, the CSIRO conducts science workshops for primary and secondary school students. These programs are interactive lessons that are 1-2 hours long and are presented to students from years 1-12. The programs use hands-on learning in order to spark students' interest in the subject matter as well as science as a whole. In order to ensure these programs are effective in sparking this interest, the CSIRO must be knowledgeable about the effects its programs have on student perceptions of science. To this end, the CSIRO has been collaborating with WPI students to create assessment tools to analyze the impact of their programs on student interest in and attitudes towards science (Donahue, et. al, 2010).

This chapter will detail the importance of science and science education for the advancement of technology and society's ability to deal with the issues created as a result of scientific advancement as well as methods to assess scientific programs. The chapter continues by addressing the declining enrollment in science in Australia and the efforts to combat it. An overview of the CSIRO and its programs will be given in Section 2.2.2. This chapter then provides an overview of the Australian science curriculum followed by an explanation of informal, non-formal, and formal education styles. The chapter concludes with descriptions of methods for educational assessment.

2.0 Effects of Science on Society

In our fast-paced society, science is just one of many topics that we must deal with on a daily basis. Science has seemingly contributed much to society, but it is difficult to conclude that science is, in itself, a positive force that deserves resources for continuing. Important topics, such as history, languages, and the arts, for example, have arguably also resulted in positive benefits for society through their applications. Furthermore, the general public recognizes that not all applications of science contribute positively to society. In a survey of adult Victorians in Australia conducted in 2007, 50% of those surveyed indicated their belief that science has both positive and negative impacts on society. At the same time, however, 88% of respondents said they have a positive feeling towards the developments in science (Market Attitude Research, 2009). Understanding this public opinion is difficult at best, but insight can be gained from looking at how scientific applications can both help and hurt a variety of social aspects.

2.0.1 Economy

Numerous studies and essays have attempted to describe the nature of the impact of science on national and global economies. Some studies (e.g., Stephan, 1996) provide rationale for their arguments simply by stating that science is important to economies. A study by Nelson (1959) argues that scientific research can provide the ability to understand the nature of a phenomenon to predict its behavior in other applications that are difficult to test, resulting in enhanced productivity which cuts project costs and saves time.

Studies conducted over the past several decades claim that 80% of economic growth (in the United States) can be attributed to developments in science (Solow, 1956). An additional study, found that approximately 60% of the differences in income between countries were related to corresponding differences in productivity (Helpman, 2004). Helpman (2004) also found that these

differences in productivity were directly correlated to the varying degrees of technological advancement found in different countries. Further links between science, technology, and the economy were found when correlating the accelerating growth rate of the global economy with the accelerating growth rate of technology and science. Globally, science's impact has increased because many countries have become dependent on one another for sharing scientific information. The benefits of this networking are manifested by increased productivity in countries that have trade relations with other countries that invest more heavily in research and development. Globally, many less-developed countries have taken advantage of trade relationships to help them further develop their science (Helpman, 2004). This dependence, however, can lead to a larger financial gap between rich countries and poor countries. Becoming more self-reliant in terms of scientific knowledge by investing in science education can help prevent this gap from growing (Fischer, 2005).

Statements from the Clinton administration of the United States recognized that the investment in science and its education is important to improving the quality of life, creating "high quality" jobs, protecting the environment, and enabling the nation to defend itself. Other vital social needs such as food, housing, transport, and healthcare can also benefit from investment in science (Office of the Press Secretary, 1993). Current policy from the Obama administration of the United States concurs with many of these benefits, with climate change, infrastructure, and alternative energy also cited as reasons to support the importance of science in society (Scientific American, 2009).

Although investment in science could be considered a purely positive course of action for nations, negative societal implications can also result. For example, in an effort to increase productivity and worker wages, economists agree that human labor must be replaced, to some degree, by machinery. There are many benefits to business with this replacement: machines will not threaten to stop working and often result in lower recurring costs than human workers. The

benefits of machine labor provide an impetus for replacing skilled laborers; however, this process will ultimately eliminate jobs. If technology eliminates more jobs than it creates, rising unemployment may have a negative economic impact (O'Keefe, 1984).

When weighing positive and negative impacts of investments in science, it is easy to see that the issue is complex. Investing in science can provide many benefits, but can also lead to negative impacts from job elimination. The control of investment is largely determined by national and industry policy, but increasing science education will ultimately allow for countries to prepare a workforce ready to tackle future scientific and technological issues (O'Keefe, 1984).

2.0.2 Energy

An increasingly important social issue has been energy and issues surrounding its sources, production, and conservation. Access to cheap energy allows us access to sources of fast transportation, cheaply manufactured goods, and other comforts in modern life. Much of this access has been made possible by the scientific advancements of the past several decades. Advances in hydrocarbon refining, for example, have been a part of making access to cheap petroleum products possible. Furthermore, advances in science provide the promise of new, efficient, and clean energy sources. Developments in solar cell technology, wind power, and advanced materials for fuel cells have led to potentially cleaner sources of energy for the future (Pickrell 2006).

It is important to consider that science has led to the technologies that provide inexpensive sources of energy, but it is these same sources that cause significant amounts of pollution. In fact, the same sources of fuel that scientific advancements made inexpensive and accessible are the leading source of carbon dioxide emissions in the United States and most other locations around the world (Environmental Protection Agency, 2010). This impact of science can also lead to negative environmental effects, including disrupting ecosystems and weather patterns (Pearce, 2006).

Accordingly, it is possible to see that science has positive benefits in the promise of future energy technologies while having had negative effects in contributing to the development of polluting technologies.

2.0.3 Biotechnology

Over the past several decades, advances in biotechnology have led to advancements in the areas of medicine and agriculture. In agriculture, biotechnological advances pertaining to genetically modified (GM) organisms have opened up significant debate as to whether science in this context has positive or negative effects. Surveys of public opinion on the matter indicate that some people believe that GM plants may have a higher yield, better quality of food, and require less pesticide. In this respect, contributions of science in this area could be seen as positive. However, many are still concerned over how science can contribute negatively in this field. Such impacts include hazards of food safety, unknown impact on nature, and the potential for harmful mutations. As a result, science in this area is judged in a non-unilateral manner – people see both positive and negative effects of science (Blaine et al., 2002).

2.0.4 Public Opinion of Science

Clearly, the benefits of science advancement can be both tangible products and general societal benefits. However, these benefits are not without costs. There are many political and moral dilemmas with which societies must cope that result from advancement of science (Osborne and Dillon, 2008). Ultimately, it is important to remember that whether it is new forms of energy or the ability to cope with societal issues, science “gives us new insight into the natural world, broadens our knowledge, shows us how to ask questions and solve problems” (Russell, 2006).

Recent surveys on public opinion indicate that a sizeable majority of populations believe in the importance of science. In a 2010 National Science Foundation (NSF) report, 68% of respondents believed that the positive effects of science outweigh the negative effects (National Science Board, 2010). In a recent study of Victorians, 84% of respondents believed that science (and its advancement) are improving society and improving their quality of life (Quantum Market Research, 2008). In a similar study investigating Australian community attitudes about nanotechnology and science in general, 88% of respondents said that they have a positive feeling towards developments in science (Market Attitude Research, 2009). On a personal level, people continue to understand how science can improve their lives. Although a majority of respondents have positive feelings about science, understanding the issues and dilemmas created by scientific application is important. Science education can help in achieving this understanding, but do people believe science education is important? In the Quantum Market Research (2008) study, 93% of respondents believed that young people should learn science so that they can effectively participate in society. Given this sentiment, it is evident that education about science is important to Victorians. As a result, the efforts of the CSIRO in its non-formal education of science are considered important, and are worthy of study regarding their effectiveness and long-term impacts.

2.1 Interest in Science

2.1.1 Declining Enrollment in Science Programs in Australia

Australia has experienced a decline in the number of students enrolling in science programs for post-secondary education (Dobson, 2006). The decline is occurring both in terms of absolute number of students enrolled and the number enrolling compared to other programs of study. Figure 1 visually illustrates Australia's recent declining enrollment rates in science. Studies have shown that university students have moved away from the enabling sciences such as chemistry, mathematics and physics and moved on to other disciplines such as behavioral sciences, biological sciences, and non-science based disciplines. While for a short period of time, interest in behavioral sciences was found to be increasing, even those disciplines now show declining numbers. Overall enrollment in universities, however, still continues to grow (Dobson, 2006).

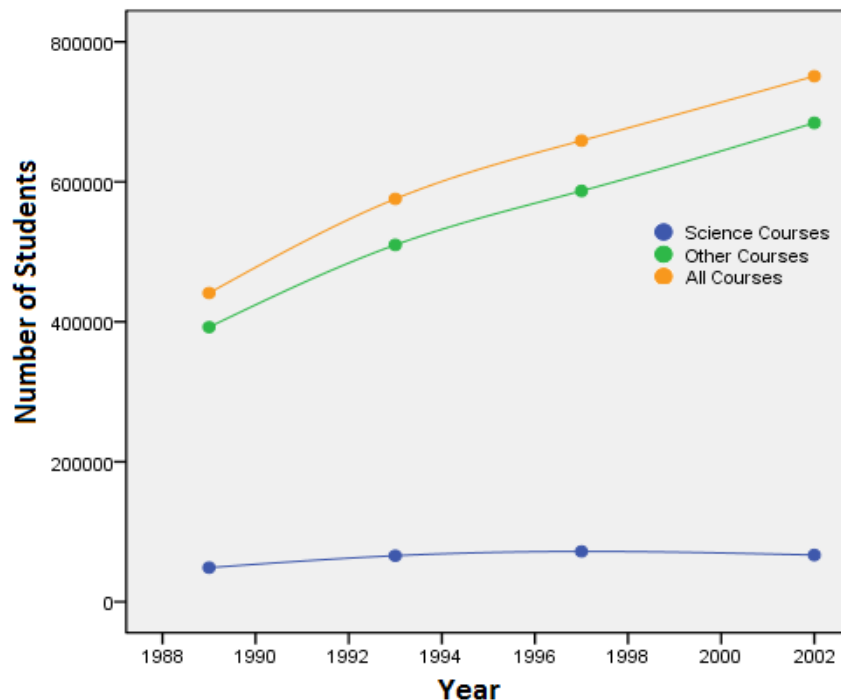


Figure 1 – Number of students enrolling in post-secondary education in Australia by year. (Modified from Dobson, 2006)

Figure 2 depicts the number of student enrollments in each respective field since 1989. It is only thanks to the limited decline in these soft sciences that Australia's educational interest in science has increased at all from 1989 to 1997. From this study it is clear that there has been a declining rate of enrollment in science in post secondary schools.

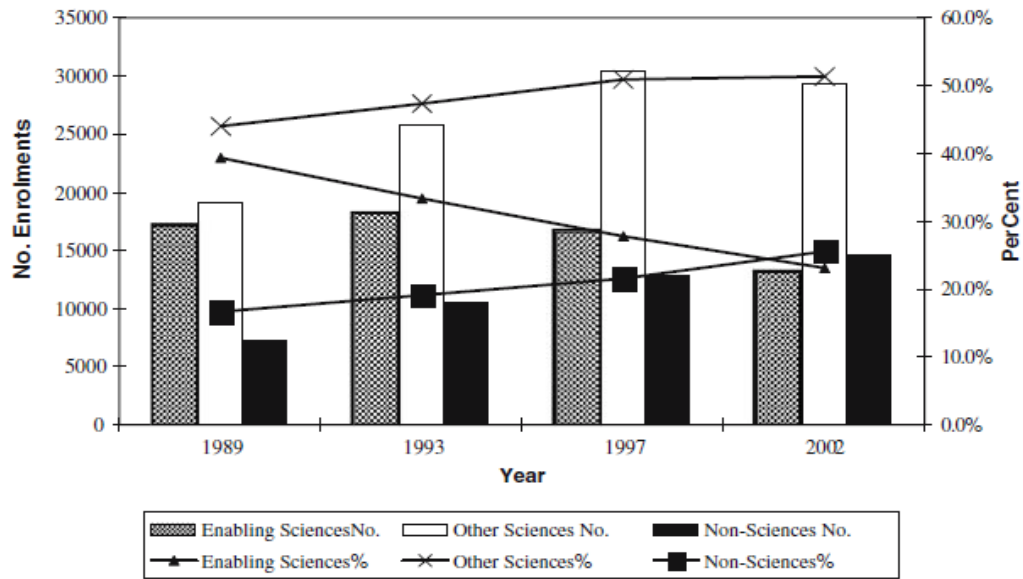


Figure 2 – Enrollment in science and non-science based post-secondary education programs. In this case, the enabling sciences are the hard sciences such as chemistry, mathematics and physics. (Dobson, 2006).

2.1.2 Reasons for the Declining Enrollment in Science Programs in Australia

Dobson (2006) hypothesizes that the rapid influx of overseas students has caused the rapid shift from the enabling sciences to the behavioral sciences such as psychology as well as other non-science based programs. From 1989 to 2002, the number of overseas students has increased from 4.8% to 16.6%. Australia is willing to accept overseas students as these students usually pay in full for their education. Studies have shown, however, that overseas students rarely come to Australia for their science education. Typically, overseas students are enrolled in a business degree. While the enrollment in science from overseas students did increase in the 13 years covered by the study, the number of business students increased at approximately a four times faster rate (Dobson, 2006).

Another study suggests that Australian teachers are the cause of the declining interest in science based programs. A report prepared by the Australian Council of Deans of Science (Jane & Peeler, 2005) reports that 43% of senior physics teachers and 25% of chemistry teachers lacked a major in their respective field. Furthermore, the study concluded that a great number of these teachers did not even hold a major in a science related field (Jane & Peeler, 2005). While the study does not provide empirical data to prove that teachers holding degrees in their respective fields are more inspiring to students, the study suggests that the lack of advanced training in the field could lead to a mundane curriculum and a lack of inspiration for students. This factor could contribute to explaining why so many students choose to pursue a path unrelated to science.

DECLINE OF ENROLLMENT IN SCIENCE AROUND THE WORLD

Australia is not the only country experiencing a decline in interest in science enrollment. There are many other countries throughout the developed world which are also experiencing this decline (Lyons, 2004). Two such countries are the United States and Russia.

The United States has noticed declining enrollment in their science based majors. Astin and Astin (1993) reported that 40% of freshman engineering, science, and mathematics majors choose to move away from those majors by their senior year. In addition, very few students chose to transfer into these majors. The United States has also experienced a decrease in the number of freshman enrollments in science majors (NSF, 1990). Freshman enrollment in science has decreased from nearly 12% of students enrolled in post secondary schools to just fewer than 6% from 1969 to 1989. This includes an abrupt decrease which occurred between 1983 and 1989 (Seymour, 2000). Clearly, the United States has been experiencing a serious drop in student interest in science and science related fields.

For Russia, the early 1980s were a time of strong scientific development with an overwhelming abundance of scientists and engineers. Russia was home to the largest community of

scientists and engineers, exceeding the United States by 20 percent. Following the Cold War, research budget cuts forced many scientist and engineers to leave their careers and find new ones unrelated to the science field. In the times of the Soviet Union all educational institutions were free and had no tuition fees. Additionally, private or nongovernmental universities or colleges did not exist. Finally, institutions had highly specialized fields meaning students were required to make decisions about their career paths at a young age. Students could, however, choose to pursue a more difficult path without the same financial cost that other students around the world faced. With the introduction of tuition fees and significantly decreased scientific career opportunities, Russian students have begun considering alternate career paths. Consequently, while institutions were previously heavily focused on offering programs dealing strictly with science programs, many Russian institutions have begun offering programs in other subjects. Among non-governmental institutions, more than 75% of all courses taught are in management, law and economics. Today, approximately three million students are enrolled in post-secondary schools, the same as the peak number during the Cold War. Much like the rest of the world, however, the number of students enrolled in post-secondary science programs continues decreasing (Dezhina and Graham, 1999).

This declining interest in science continues to hold true for many other countries. The Relevance of Science Education (ROSE) study is an international project based in Norway. The project aims to measure student interest in science around the world. The study developed a set of questionnaires to administer to students in Norway as well as partner countries around the world. The research focuses on students nearing the end of their secondary school career. Closed response questions with four-point Likert scales (questions on which the respondent ranks his or her level of agreement with a statement on a scale of numbers) were administered. The study individually looked at results from both male and female students. These studies reported that Uganda, Ghana, Swaziland, Zimbabwe and Botswana were found to be the five countries with the highest student

interest in science. When given the statement “I would like to become a scientist” and asked to identify their interest on a scale of 1-4 students averaged the following responses shown in Figure 3. It should be noted that the ROSE study has not been conducted in Australia (Schreiner & Sjøberg, 2008).



Figure 3 – Responses to the “I would like to become a scientist” question. The blue shaded symbols represent the male population while the white hollow circles represent the female population. The countries are partly sorted geographically (with neighboring countries listed together) and partly by level of development (with more economically-developed countries towards the bottom of the diagrams) (from Schreiner & Sjøberg, 2008).

2.2 The Commonwealth Scientific and Industrial Research Organisation (CSIRO)

2.2.1 Mission and Purpose

The CSIRO is Australia's national science agency and is one of the world's largest and most diverse research agencies (CSIRO, 2010). The CSIRO's Department of Education has provided non-formal education workshops to schools since 1981. Presentation of the programs in schools became widespread in the early 1990s and the number and variety of the programs increased greatly during the mid to late 1990s. The CSIRO's programs focus on science and technology and are intended to benefit the scholastic community by providing a more hands-on method of learning science than students receive in traditional science courses. Science programs conducted by the CSIRO cover a wide range of material including chemistry, physics, technology, and mathematics.

The CSIRO states, "By igniting the creative spirit of our people we deliver great science and innovative solutions for industry, society and the environment" (CSIRO, 2005). Furthermore, the CSIRO has developed a system of goals for its education programs. Cath McLaren, Victorian Deputy Manager at the CSIRO provided a summary of these goals (personal communication). The program goals are divided into three levels. The primary goal of the programs is to spark student interest in science. The secondary goal is to spark student interest in and increase student awareness of the subject covered in the program. The tertiary goal is to introduce students to and teach students specific concepts within the larger subject area. By emphasizing a team approach and encouraging students to work together to solve problems, the CSIRO's programs aim to improve student attitudes toward science.

The CSIRO's programs are based out of nine Science Education Centres (SEC) located throughout Australia. See Table 1 for the locations of the CSIRO-SEC offices. These centers focus

primarily on three different areas: stimulating interest in science, increasing awareness of the CSIRO’s efforts to improve the scientific community in Australia, and encouraging the pursuit of careers in science, mathematics, or technology (CSIRO, 2010).

CSIRO Center’s Name	Location
ACT Science Education Centre	Australian Capital Territory
CSIRO Education	New South Wales
CSIRO Education	Northern Territory
North Queensland Science Education Centre	North Queensland
CSIRO Education	South Queensland
CSIRO Education	South Australia
CSIRO Education	Tasmania
CSIRO Education	Victoria
CSIRO Lab, SciTech	Western Australia

Table 1 – The CSIRO Science Education Centres

2.2.2 Summary of the CSIRO Programs

The CSIRO states that great science is its foundation, and bringing science to the public is its aim (CSIRO, 2010). One way the CSIRO brings science to the public is through science education programs. These programs are intended to stimulate interest and involvement in science. The programs are booked by school teachers who feel that the material or experience would benefit their class. As a result, the type of student participating in the programs varies widely depending on the class. Some programs, for example, are designed specifically for students in years 11 and 12 enrolled in the Victorian Certificate of Education (VCE) programs. However, most programs are designed to be presented to students within a specific age group regardless of learning level. These workshops can be presented at the school during school hours or at the CSIRO centers either during or after school hours. For most programs, the CSIRO is requested to hold the workshops in the classrooms. Some schools, however, visit the CSIRO’s facilities, providing an experience similar to a field trip (CSIRO, 2006).

The Victoria programs (the focus of this study) vary widely over the scientific spectrum and include air and weather, chemistry, physics, energy, robotics, forensics, engineering and many other topics (CSIRO, 2009). According to Chris Krishna-Pillay, Manager of the Victoria Science Education Center, the “perfect program” would be free of charge, 100% relevant to the curriculum, and easily accessible (personal communication). These three factors (price, content, and accessibility) are the major factors explaining participation in the different programs. However, there are some exceptions. One such exception is the *Forensic Frenzy* program, in which students analyze a mock crime scene. This program is one of the most expensive programs offered with a cost of AU\$190 per session at the CSIRO site and AU\$230 per session if the program travels to the school (CSIRO, 2009). In addition, according to Krishna-Pillay the program has little similarity to the classroom curriculum. Regardless, it has been the most popular program in recent years. While this is the exception, a typical program has some degree of curriculum relevance and is generally less expensive. The typical cost of a program is approximately AU\$170 per session at the CSIRO center and AU\$210 per session at the school.

The programs are designed to be highly structured hands-on workshops, usually lasting 90 minutes, in which the students gain insight on a specific topic. The time in the program is divided into three segments. The first part of the program, typically 30 minutes in length, is dedicated to discussion delivered by the instructor. During this time the presenter gives an overview of the subject of the program as well as explanations of the experiments that the students will complete. The overview often includes a demonstration to spark the students’ interest in the topic. The next 45 minutes of the program is dedicated to experiments performed by the students. These experiments are designed to introduce the students to the selected concepts within the subject that the program covers. Finally, the last 10-15 minutes of the program return to a presentation by the instructor. This presentation concludes the program by pointing out key aspects of the experiments

and linking these results back to the students' lives. A full description of the programs covered in this study; including goals, topics covered, and activities can be found in APPENDIX L.

2.2.3 CSIRO Program Assessment & WPI Involvement

According to the CSIRO, students and teachers enjoy the programs. Approximately 10% of the CSIRO's standard evaluation forms (see APPENDIX A) filled out by the teachers attending the sessions are returned. Out of those 10% the vast majority (though not a random sample of participants) are returned with positive feedback (Krishna-Pillay, personal communication). Also, knowing that these programs are repeatedly booked by schools throughout Victoria suggests that teachers have a positive opinion of them. The CSIRO's previous studies have revealed the same favorable opinions but they have not been able to identify specific programmatic components that were received favorably by students and teachers (CSIRO, 2010). The CSIRO is interested in finding out the long term effects of their programs on the participating students. Questions concerning information retained as well as scholastic interests are of interest to the CSIRO (Krishna-Pillay, personal communication).

To facilitate progress towards these assessments, the CSIRO has enlisted the aid of two WPI undergraduate project teams. From January 2010 – March 2010 a team of WPI students began a study of the CSIRO programs. The purpose of this study was to develop methods which could be used to measure the effect of the programs on student interest in science. The previous WPI assessment team developed surveys for the CSIRO *Forensic Frenzy* and *Biodiversity* programs (Donahue et al., 2010). They developed a pre-program survey, an immediate post-program survey and a one week follow-up survey in order to assess the short-term effects on student interest and aptitude for the *Forensic Frenzy* program. Additionally, the previous WPI assessment team also developed a pre-program survey and an immediate post-program survey for the *Biodiversity* program.

The team administered and gathered data for five *Forensic Frenzy* sessions and four *Biodiversity* sessions. They also conducted a preliminary analysis on topics summarized and explained in Table 2.

Analysis	Explanation of Analysis
Parents career vs. importance of science	A correlation analysis between whether or not students rank science as being important vs. their parents career choice
Short-term impacts of program on student interest in science	An analysis between student interest in science prior to the program as well as one week following the program
Short-term impacts of program on self-rated student knowledge of science	An analysis of student ratings of their knowledge in science prior to as well as one week following the program

Table 2 – Summary of analyses conducted by WPI students previously working with the CSIRO

The previous WPI assessment team also developed teacher interviews to be administered immediately prior to the program, immediately following the program’s completion and one week after the program. The team also developed an observation system to track student interest, excitement and boredom throughout the program. Finally, the WPI team developed a database to enter in all the recorded data. A detailed comparison of the previous WPI team’s work and this study’s work can be found in Section 3.0.2. All surveys and observation sheets created by the previous WPI team can be found in the previous WPI team’s report (Donahue, et al., 2010).

2.3 Education Styles

The CSIRO programs are based on a strategy of expanding learning beyond the traditional classroom setting. The process and methods by which students learn science have traditionally consisted of a routine transfer of knowledge and information from the teachers to the students. In this model, the process of education is viewed as the pipeline via which information is channeled from the knowledgeable teachers to the students (Osborne and Dillon, 2008). This description of learning has often been associated with the classroom environment, but other settings provide opportunities to learn as well. Experiences such as science workshops, museum visits, and engaging in interactive science activities are all forms of education which can be grouped into different categories of educational methods. These categories, developed by Eshach (2007) and Colardyn and Bjornalvold (2004), include: formal, non-formal, and informal education. The CSIRO workshops employ these alternate education styles to help students learn and spark their interest in science. Table 3 gives the definitions of the teaching styles that will be covered in this section.

Education Style	Definition
Formal Education	<ul style="list-style-type: none"> • Consists of learning occurring in a structured and organized context designed to be learning. • Potential for a formal recognition (i.e. diploma) • Intentional from the learner's perspective.
Non-Formal Education	<ul style="list-style-type: none"> • Consists of learning embedded in planned activities that are not explicitly designated as learning, but which contain an important learning element • Intentional from the learner's perspective
Informal Education	<ul style="list-style-type: none"> • Learning resulting from life's daily activities including those related to work, family, or leisure. • Experimental (accidental) learning • Not structured regarding objectives, schedule, etc. • Typically viewed as unintentional

Table 3 – Definitions of teaching styles.
(From Colardyn and Bjornalvold, 2004)

Table 4 presents a summary of the different aspects of education and how they are manifested in the three classes of education used. Considering the ways in which these aspects differ among formal, non-formal, and informal education programs can help clarify the distinctions between these different educational approaches.

Education Style	Formal Education	Non-Formal Education	Informal Education
Curriculum	Structured; Sequential and Ordered	Structured, some flexibility; Non-sequential	Unstructured; Spontaneous; Non-sequential
Assessment	Exams/Written Assessments	Learning is not usually evaluated	Learning is not evaluated
Location	Usually at school	Usually out of school	Everywhere
Motivation	Extrinsic motivation; Compulsory	Mostly intrinsic motivation; voluntary	Intrinsic motivation; voluntary
Instructor	Teacher-led	Led by guide or teacher	Usually learner-led

Table 4 – Differences in education styles.
(Modified from Eshach, 2007)

2.3.1 Informal Education

Although learning is typically recognized as a classroom occurrence, there are many learning experiences that can occur in other settings as well. These are widely referred to as informal education. Because there are a wide variety of these experiences, researchers have attempted to define informal education in two different ways. In a review by Hofstein and Rosenfeld (1996), informal education is considered to be any activity which occurs outside of the school environment, is not expressly designed to fit as a part of a strict curriculum, and is generally a voluntary activity. In a later review by Eshach (2007), however, the scope of informal education is restricted to learning that occurs in spontaneous situations of everyday life. This includes routine daily events such as learning new information at a job, in the home, or playing with friends. Following this definition,

informal education is considered to be highly unstructured and generally does not involve assessment of any kind.

2.3.2 Formal Education

Formal education is typically described as the highly-structured method by which students learn in the traditional classroom setting. This style of education typically follows a strict curriculum that outlines specific topics that must be conveyed to students by the teacher (Eshach, 2007). This paradigm of teaching places an emphasis on the teacher to convey knowledge to the students and ensure that the material is understood and comprehended. Complementary to the strict set of topics specified by the curriculum, assessment methods for formal learning focus on measuring the factual knowledge that students have obtained following instruction. Performance on such assessments typically requires rote memorization of facts or equations (Etling, 1994).

DRAWBACKS OF FORMAL EDUCATION

The rigid curriculum found in formal education greatly reduces the flexibility afforded to both teachers and students. This is especially true in curricula that focus on all students learning science at an equally advanced level. In an effort to ensure that the class keeps pace with the curriculum, many less advanced students could fall behind while more advanced students are frustrated with the slow pace (Eshach, 2007). This not only has a negative effect on the students' ability to learn the material but can also negatively impact their interest in the subject. These advanced students no longer find the subject interesting because it moves too slowly and instead ignore the material being presented. The same happens for the less advanced students, albeit for the opposite reason. These students are unable to keep pace with the material being presented. Since they are unable to understand the material being presented they become frustrated and eventually give up. Once again, the students' interest in the material is lost. Clearly, the traditional formal

education methods have some issues which can negatively affect the learning and interest of some students.

BENEFITS OF FORMAL EDUCATION

Despite the drawbacks of formal education mentioned, this style is used widely and consistently as a method of teaching. Clearly, there are benefits to utilizing formal education. One such benefit is that it is consistent and easily quantifiable. The combination of lecture and testing provide a consistent method to determine whether or not students are learning the material. The material can be presented consistently between classes and very similar exams can also be issued. Thus, learning can be tracked easily from class to class and year to year (Etling, 1994). In addition, formal education can be very efficient. A single teacher can teach many students in a single classroom with minimal need for materials. While formal education can have a tendency to lose the interest of the most advanced and least advanced students, it typically works well for the average students. For these students the material is typically presented at an appropriate pace and they are able to learn a sufficient amount of the material. This is very important for public schools which may often run on tight budgets and must justify costs to the tax payers of their area (Eshach, 2007).

2.3.3 Non-Formal Education

Learning that is not part of the formal classroom activities but occurs in a structured manner, is categorized as non-formal education. This type of education includes structured science programs (such as the CSIRO programs) that are not part of the formal curriculum (Eshach, 2007). The expectations for learning in non-formal education are often placed on the student, not on the teacher. The students are free to develop their own set of learning objectives, but some structure can be used to help students achieve a minimum amount of learning. With this focus on learner based objectives, the student is able to choose an area of focus which suits their interests. As a

result, much of the information learned is relevant to the student, allowing the information to be readily used in their everyday lives. Another important aspect to consider is that non-formal education focuses on learning information and how pieces of information relate to each other. This is in contrast to formal education which assures that a certain amount of material is taught, but less focus is placed on ensuring the material is actually learned (Etling, 1994).

BENEFITS OF NON-FORMAL EDUCATION

Non-formal education is believed to have several benefits over formal education in terms of increasing students' interest in and attitude toward science. A study by Jarvis and Pell (2002) investigating the affective (i.e., attitudinal) effects of a structured but non-formal museum visit demonstrated that motivation, interest, and enthusiasm all increased following the visit. Students 10-11 years of age attended a museum visit regarding the Challenger disaster, the famous space shuttle catastrophe. Although field trips may sometimes be considered detrimental to student attitudes towards science, 24% of students developed a more positive attitude towards pursuing a scientific career¹. Researchers hypothesized that the settings of non-formal education are less intellectually intimidating and as a result, students feel at liberty to explore the topics on their own and set their own pace of learning. This is especially true for girls, who otherwise might feel shy in participating and engaging in what has long been viewed a male subject area (Jarvis and Pell, 2005)².

Non-formal education has also been shown to improve student attitudes towards science as well as student comprehension of the underlying concepts. The emphasis in non-formal education on real-world situations and events has been shown to enhance student appreciation for science in a social context. Students not only show an increased interest in science, but also gain a greater understanding of why it is important to their lives. An increased understanding of the concepts

¹ See Drawbacks of non-formal education for a discussion of negative effects of non-formal education.

² See Section 2.5.1 for a discussion of the differences in science education between boys and girls

behind a non-formal education program has also been demonstrated (Hofstein and Rosenfeld, 1996). Students attending structured field trips to museums, for example, demonstrated an enhanced understanding of the concepts present in exhibits than their peers who did not visit the museum.

DRAWBACKS OF NON-FORMAL EDUCATION

While museum visits and other non-formal education style programs have many benefits, there are also some drawbacks that accompany non-formal education. Any learning experience can be heavily influenced by the circumstances that surround it. This is particularly relevant for non-formal education programs since many of these programs occur outside of the classroom. When students are attempting to learn, they may confront a variety of “novelty” factors, which expose them to situations, material, and environments outside of their routine learning paradigm. These factors can hinder the full and complete experience of a non-formal education program. Following Hofstein and Rosenfeld (1996), these novelty factors can be divided into three categories to account for the different elements of novelty that can be experienced by a student: cognitive, geographical, and psychological. Cognitive novelty describes the new skills and concepts that students will attempt to learn. Uncertainty with these new concepts can be intimidating to some students and can be detrimental to the learning experience if the students are excessively nervous. Geographical novelty corresponds to the new environment in which many students are asked to learn when participating in non-formal programs. Students in an unfamiliar environment can often feel anxiety which inhibits their learning process. The last important factor is associated with the student perception that a non-formal education program is more of an adventure than a learning experience. Distracted by new sights, sounds, and information, students may have their attention diverted from the purpose of the activity and therefore may not gain as great an understanding of the material. Reducing these novelty factors can be accomplished by providing preparation for students prior to

non-formal learning experiences. Teachers can provide this preparation by giving the students a walkthrough of the planned activities. Another way to prepare for the experience is to give an assignment to be completed during the program. This reinforces the idea that the trip is a learning experience. Providing this preparation can familiarize students with their upcoming program and facilitate a more positive and fulfilling learning experience (Hofstein and Rosenfeld, 1996).

2.3.4 Flexibility in Teaching Styles

One point to consider is the extent to which flexibility can be present in different educational styles. Although it is obvious that informal and even non-formal education is characterized by flexibility, formal education is often considered to be inflexibly dedicated to a curriculum. However, formal education is not entirely inflexible. Formal education is characterized by its adherence to a clear set of outcomes and guidelines for *what* information should be taught. Flexibility in the formal educational style, however, is present in *how* the material is taught. While some teachers can choose to strictly adhere to the lecture style teaching that is characteristic of formal education, many also branch out and employ non-formal styles of teaching in their classrooms. Teachers are welcome to try alternative styles of teaching, by including group projects, in-class laboratories and demonstrations within their lesson plans (Colardyn, 2004). However, Australian schools and teachers are pressured to have students learn specific concepts¹. This constraint can take away much flexibility from how teachers are able to communicate objectives to students. Given this added constraint, teachers are more likely to take part in a formal education style of teaching to ensure that all necessary topics are covered according to the requirements of the curriculum. Chris Krishna-Pillay of the CSIRO said that their organization is able to accurately

¹ See Section 2.5.3 for a discussion of the Australian science curriculum.

predict week to week the topics that a school will be covering based solely on the requirements of the curriculum (personal communication).

An important factor to consider in assessing non-formal education programs is the relationship between the material presented in class and the material presented in these programs. If the subject matter of the program compliments the material being presented as part of the official curriculum then the two experiences can build on each other. However, the program can still be a success if the material covered is not directly related to the formal curriculum. In particular, the CSIRO's *Forensic Frenzy* program provides an example of a program which stimulates student interest in science by exposing them to a topic which is not covered by the formal education curriculum. The formal curriculum does not cover forensics; however, the program is successful partly because it exposes the students to subject matter that they would not otherwise encounter (Krishna-Pillay, personal communication, 2010).

2.4 Science Curricula

The science curriculum is an essential element of science education. It provides both the purpose and outline of what students should understand, accomplish, and appreciate after a certain amount of education. Developing and implementing a science curriculum is a complex and multi-faceted endeavor that requires careful thought and constant evaluation and change. One fundamental consideration of many science curricula involves providing an education such that individuals are sufficiently literate in science to operate productively in a technologically advanced society. This is particularly pertinent as a wider range of issues and decisions resulting from technological advances arise (Osborne and Dillon, 2008).

2.4.1 Accommodation of Student Variety

Any science curriculum must deal with accommodating a wide variety of student skill levels and interests. Since students all have different abilities and attitudes towards science, it can be particularly challenging to develop a course of study that effectively accommodates as many students as possible. Although a variety of student interests and aptitudes exist, curricula must focus on two distinct groups of people: those who will pursue careers in science and those who will not. The former must be sufficiently prepared to enter the scientific fields and must have sufficient knowledge to perform well in post-secondary scientific studies. Those who will not pursue science professionally do not need as rigorous a technical background, but must be scientifically literate in order to operate in a technological world (Osborne and Dillon, 2008). Ways to tackle this dichotomy have been explored in some experimental curricula, and general consensus holds that it is difficult to develop one course of study that caters to both sets of demands (Millar, 2005). An experimental course called the *Twenty First Century Science* course developed in the United Kingdom utilized a two track system for secondary school students. In this case, both groups were

accommodated by developing a base science curriculum with an optional advanced track to prepare pre-professional science students adequately for their future (Millar, 2005). In addition to the disparity between students who will or will not be pursuing a career in science there is also conflict in how girls and boys learn science.

GENDER DIFFERENCES AND THEIR AFFECT ON STUDENT INTEREST IN SCIENCE

Science has traditionally been known to be a male dominated career. Tucker et al. (2008) conducted a study of learning style differences between boys and girls in the United States. The study concluded that in their fourth year of schooling, male and female students are both equally interested in science subjects; however by year eight approximately twice as many male students show an interest in this subject. It is imperative to influence students' interest in science from an early age since by year eight, career expectations significantly influence actual career outcomes (Tai, 2006). These year eight career expectations ultimately influence the gender gap currently seen in the science field. Thus, it is important that students are influenced and interested in science from a very early age.

A study performed by Osborne and Dillon (2006) indicated five science items in which boys and girls are most interested (Table 5). This stark contrast immediately raises the question of whose interests are best served by the formal education curriculum. While boys appear to be more interested in topics better suited to the non-formal education curriculum (experimenting with chemicals, gazing through telescopes), girls appear to be more interested in topics suitable to be taught using the formal education curriculum (study of the medicine behind cancer, studying diseases which students cannot safely interact with). This dichotomy is another issue that must be addressed during the design of the curriculum.

Boys	Girls
Explosive chemicals How it feels to be weightless in space How the atom bomb functions; Biological and chemical weapons and what they do to the human body; Black holes, supernovae and other spectacular objects in outer space.	Why we dream when we are sleeping and what the dreams might mean Cancer – what we know and how we can treat it How to perform first aid and use basic medical equipment; How to exercise the body to keep fit and strong; Sexually transmitted diseases and how to be protected against them

Table 5 – Top five science items of interest for boys and girls.
 (Osborne & Dillon, 2006)

AGE DIFFERENCES AND THEIR AFFECT ON STUDENT INTEREST IN SCIENCE

In addition to gender differences, differences in student ages (and their year in school) are thought to be important factors relating to a student’s interest in science. The main result of these findings is the strong difference in science interest between students before and after the age of 14. A study by Osborne (2003) stated that student interest in science declined after the age of 14. Earlier research by Hodson and Freeman (1983) corroborated this finding, and expanded further to state that students from ages 10-14 have formed or are forming a majority of their opinions about science. Some evidence in the study suggested that students remain committed to these early views about science later in their educational career. In another study carried out in Australia (Dekkers and DeLaeter, 2001), it was found that many students decide their career preferences as early as primary school. Research by Blatchford (1992) suggested that positive attitudes toward science are important, because many scientists made early decisions about their career. As a result, age is an important factor to consider when investigating interest in science.

2.4.2 Effect of Curriculum Presentation

Even if a course of study can adequately educate the groups of people it serves, the manner in which students are educated is also critical to its success. Because of the large amount of factual knowledge that must be conveyed in science courses, the dynamic of the curriculum is often viewed as an information conduit between the teachers and students. In this view, information held by the teacher is simply conveyed in a routine fashion to the students. Students are routinely engaged in copying lecture notes from the board or Microsoft PowerPoint presentation and trying to grasp the flow of information that is transmitted to them. Since this method can have a tendency to disengage students from the lesson being presented, new science curricula attempt to focus on increasing student engagement and interest in the subject matter. This can be accomplished through more interactive, and potentially non-formal, education styles. In interactive programs, students can gain a greater appreciation for the process by which they are acquiring the scientific knowledge in addition to learning scientific information itself. Interest in science can also be enhanced by demonstrating the wide variety of career opportunities to students who study science (Osborne and Dillon, 2008).

Designing a school curriculum is a difficult and daunting task which must follow a careful process. The ideal design of science curricula would consider many of the factors described previously. The final execution of science education, however, is not guaranteed to follow the design described in papers and documents. Rather, effective science curricula must not only be well-designed, but also well-executed and continuously assessed. This continual assessment ensures that the intended curriculum matches the enacted curriculum and the resulting attained curriculum. The intended curriculum consists of the written goals, objectives, and concepts of what should be taught in the classroom. The manner in which the intended curriculum is taught develops the enacted curriculum. The student experiences the attained curriculum, which reflects what has actually been understood and learned. Ensuring that all three of these curricula are as close to the desired

outcomes as possible is essential in ensuring a curriculum's success (Osborne and Dillon, 2008). The process of curriculum enactment is depicted in Figure 4. The flowchart describes how the typical curriculum is implemented. An intended curriculum is first developed and then tested in certain schools. A specific learning experience is created by the teacher and then based on the amount of information actually learned by the students; the program is then evaluated and reformulated.

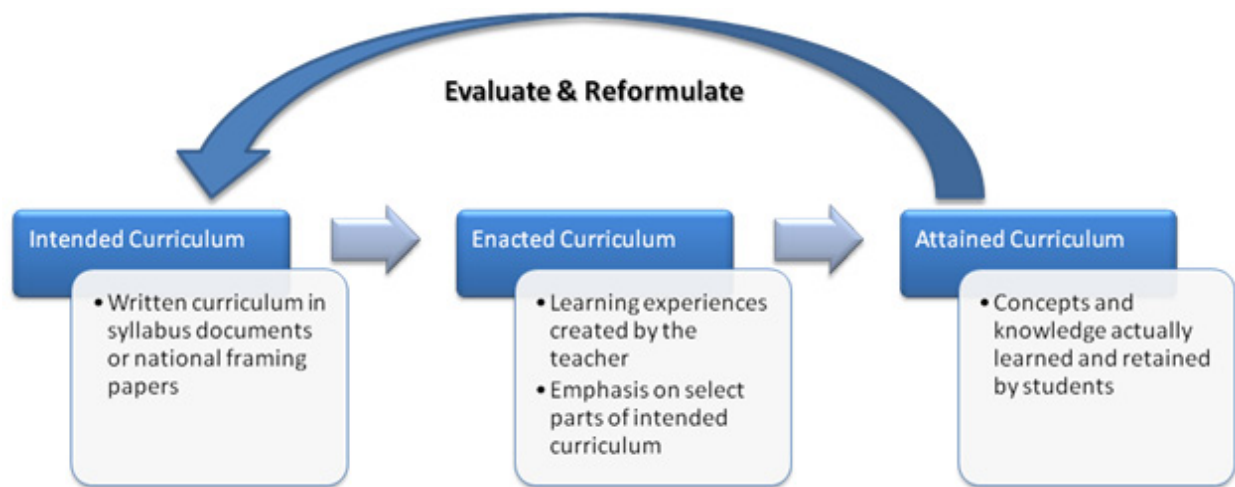


Figure 4 – Evaluation and reformulation of curricula.

2.4.3 Science Curricula in Australia

At its outset, the National Curriculum Board of Australia defines science as a “dynamic, forward-looking, collaborative human endeavor arising from our curiosity and interest” (National Curriculum Board, 2009). The Board also recognizes, however, that the goal of science is not simply to obtain answers to important questions, but to develop appreciation of the process by which knowledge is obtained. In this process, enthusiasm, frustration, and an acknowledgement of uncertainty are all normal and important components of developing a better scientific understanding of the world. In its execution, the Australian science curriculum aims to “provide students with a solid foundation in science knowledge, understanding, skills and values on which further learning...can be built” (National Curriculum Board, 2009). In this respect, the intended curriculum aims to ensure students not only learn while in the classroom, but also become prepared to learn in their careers and in their everyday lives. The national curriculum authority in Australia, the Australian Curriculum Assessment and Reporting Authority (ACARA), focuses on ensuring that the science curricula is both developed and reviewed annually. Their regulatory powers include not only the ability to create the curriculum framework, but also to create standard methods of assessment to determine how well the curriculum is being learned by students (ACARA, 2010).

The design of the science curriculum attempts to provide sufficient flexibility to accommodate students who do not easily grasp concepts and those that need an additional challenge. This desire for flexibility, however, must be balanced with the necessity that all students learn basic content in scientific subjects.

The structure of the curriculum is defined by three distinct “strands” of scientific information. The first is science understanding, and pertains to the basic concepts, skills, and information a student must know about certain topics. The term “science inquiry skills” refers to what a student should be able to do with new scientific situations such as analyzing data and

observations. Finally, science as a human endeavor focuses on student appreciation of the process by which scientific knowledge is obtained and of its relevance to their lives and society.

As students progress through the Australian curriculum, they are classified into distinct age groups that focus on different ideas in each of the three core strands of science education.

Although the curriculum for each age group has similar core components, the students' understanding of each component changes as they progress through their schooling. Table 6 details the curriculum goals for each age group.

Grade Level	Years K-2 5-8 yrs old	Years 3-6 8-12 yrs old	Years 7-10 12-15 yrs old	Years 11-12 15-18 yrs old
Main Focus	Observing and being aware of the surrounding world	Understanding systems, recognizing relationships, and applying the scientific method	Develop core understanding of scientific disciplines and science in society	Focus on specific disciplines to gain an in-depth knowledge
Science Understanding	<ul style="list-style-type: none"> •Classifying Objects •Living vs. Non-living organisms •Forces of motion •Changes on the Earth •Objects in the sky 	<ul style="list-style-type: none"> •Properties/uses of materials •Forces and motion •Life cycles of organisms •Changes on earth and in space 	<ul style="list-style-type: none"> •Forces, motion, and energy •Acids and bases •Elements and compounds •Chemical reactions •Cells, human body •Theory of Evolution •Plate Tectonics 	<ul style="list-style-type: none"> •Increased knowledge: <ul style="list-style-type: none"> ▪Physics ▪Chemistry ▪Biology ▪Earth Science
Science Inquiry Skills	<ul style="list-style-type: none"> •Explore, wonder, and be curious •Ask questions •Observe and describe •Use evidence to support ideas 	<ul style="list-style-type: none"> •Determine questions and predictions for testing •Plan/conduct simple investigations •Collect, analyze, and present data •Discuss results and draw conclusions 	<ul style="list-style-type: none"> •Formulate scientific hypotheses for testing •Analyze and test theories based on available evidence •Explain/summarize patterns in data using concepts 	<ul style="list-style-type: none"> •Increase inquiry skills •Focus on discipline specific inquiry skills •Learn methods specific for a discipline
Science as a Human Endeavor	<ul style="list-style-type: none"> •Recognize aspects of science in everyday life •Identify work associated with science in the community •Care for the environment 	<ul style="list-style-type: none"> •Consider how science is used in work/leisure •Become aware of science-related careers •Recognize the effect of science on our environment •Be aware of the historical nature of scientific ideas 	<ul style="list-style-type: none"> •Be aware of contemporary issues and challenges in science •Apply scientific knowledge to make informed/ethical decisions on issues •Be aware of the science and research of Australian scientists •Appreciate that science can be a rewarding career •Appreciate diversity in those who have contributed to science 	<ul style="list-style-type: none"> •Continue to increase awareness of the social implications of a particular discipline

Table 6 – Core concepts of the Australian science curriculum (Modified from Australian Curriculum Board, 2009).

2.5 Attitude toward Science

Although the CSIRO's programs are based on scientific information, one of the CSIRO's objectives is to generate a more positive attitude towards science for students participating in the program (CSIRO, 2010). Consequently, the attitude with which students learn and experience science is an important factor that should be considered in educational assessment. Research has indicated that a student's decision to pursue a career in science is heavily influenced by his or her attitude towards science (Eshach, 2007). Since the decision to pursue careers in science can be heavily influenced by early attitude, it is important to consider this attitude towards science perhaps just as much as understanding their comprehension of the subject matter. Formal education programs are not intrinsically focused on fostering a positive attitude towards science, instead focusing on ensuring that the material is conveyed to the students. This can discourage students, as research demonstrates that there is a positive link between students' performance in the classroom and the resulting attitude towards science (Eshach, 2007). Therefore, even studies primarily focused on student performance in the science classroom should focus, at least to some extent, on the attitude of the student.

If attitudes toward science are to be considered in student assessment, the factors influencing attitude should be considered. A notable observation is that students show a declining interest in science as they enter their teen years (Eshach, 2007). Another interesting trend indicates that students show a marked difference in their attitudes towards science in school and their attitudes toward general science that they encounter. In many of these cases, students enjoy science outside of the classroom more than the material they learn in a formal setting. As a result of these observed patterns, many factors have been hypothesized to influence a student's attitude toward science. Some of these factors include the teaching style, the curriculum content itself, and the

learning environment (Osborne, 2003). Gender has been a significantly studied topic in regard to feelings towards science, but there has been a lack of clear connections between gender and scientific attitude (Liu, 2005)⁴. Eshach's (2007) study investigating the impacts of non-formal education demonstrated that the preparation, follow-up activities, and actions of the teacher before, during, and after the non-formal experience were essential in affecting student attitudes. This relates to the effort needed to mitigate the effects of the "novelty" factors found in a non-formal learning environment. In order for the maximum benefit to be realized from non-formal education the teacher must not only address these "novelty" factors by preparing students for the program and providing an activity to reinforce the learning during the program or visit, but also take time to discuss the experience with students afterwards in order to cement the learning.

In order to shape positive attitudes towards science among students, some researchers have tried creative methods of redesigning teaching styles and curricula. In a study by Hulleman and Harackiewicz (2009), the science curriculum was designed to enhance the connection between the science that students learned in their classes and that which they experienced in their daily lives. This design proved especially successful for students who self-identified as not expecting to perform well – their grades and interest in science improved significantly. The effect was less pronounced for students with high expectations of their performance in science. Researchers have also investigated the effects of non-formal education on students. Studies surveying students before and after their visits to museum exhibits demonstrated not only an increase in positive attitudes towards science, but also that these "[a]ttitudes [were] maintained to a certain extent for several months" (Eshach, 2007). Other benefits observed included a better understanding of how science fits into a larger social picture (Eshach, 2007).

4. See Section 2.5.1 for a discussion of the relationship between gender and interest in science.

2.6 Assessment Tools

In order to properly assess students' attitudes towards science, it is necessary to understand the proper tools for this study and how to use them. Surveys, interviews, and observations are commonly used assessment tools to collect data for the purpose of analysis. All of these techniques have distinct advantages and disadvantages.

2.6.1 Overview of Previous Studies

A number of previous studies investigating non-formal education have been conducted in a variety of settings. One study conducted by Boisvert and Slez (1994) used observational tools to investigate the links between learning and engagement while interacting with exhibits at the Boston Museum of Science. Approximately 150 subjects were observed over a period of time using a scoring rubric focused on assessing different qualitative behaviors of subjects while at the exhibits. A study by Prokop et al. (2007) investigated a non-formal education program for biology using primarily attitude and interest surveys both before and after the program. A study of a longer term high school biology program was investigated by Paris et al. (1998) using a combination of surveys, observations, interviews, and case studies. A study demonstrating modifications to existing science attitude and interest surveys to develop new assessment instruments was performed by Adams et al. (2006). Each of these studies provides important information on the process of creating and modifying surveys. This information is useful guidance for the development of evaluation techniques for the CSIRO's programs.

A good overview of assessment guidelines is provided in Bitgood (1988). The guidelines provide an overview of types of factors that should be considered when conducting studies in order to collect valid data (Table 7). Other important factors in designing studies include the types of studies that can be conducted (for example, observations and assessment in the field versus a

controlled environment). The guidelines also cite the use of surveys, observations, and interviews as key methodologies in extensive studies.

Type of Validity	
Content	Sample population representative of target population
Predictive	Results can be used to predict behaviors of other participants
Construct	Ensuring assessment tools are measuring the desired attributes (i.e. do questions obtain the information they need to accurately?)
Recording	Ensuring assessment tool does not influence responses
Convergent	Degree to which assessment tool provides results similar to other tools assessing same aspects
Discriminant	Degree to which an assessment tool produced different results for different concepts
Ecological	If using simulations of the actual program environment, do simulations match environment?

Table 7 – Factors affecting validity of surveys.
To be considered when designing assessment tools. Adapted from Bitgood (1988).

2.6.2 Interviews

Interviews are a common method used to obtain information from one individual at a time. In an interview, the interviewer works directly with the respondent. Interviews are generally believed to be an accurate way to obtain data as any necessary clarifying questions can be asked. The interview has one significant advantage over the survey – the interviewer is able to ask follow-up questions depending on the responses from the respondent. The anonymous survey does not allow for follow-up questions. The interview does have a number of disadvantages. Interviews demand much more time from the respondent and the interviewer. Since most respondents believe their time is valuable, many may be reluctant to engage in such a time consuming activity. In addition, interviews have the potential to be threatening towards the respondent as they can sometimes feel put on the spot by the questions. Another disadvantage is that the interviewer must be very well trained and prepared to conduct an interview. While face-to-face surveys require some training and careful planning, interviews require much more work. An interviewer must be unbiased and must be particularly careful about asking leading questions (Trochim, 2006).

2.6.3 Observations

Whereas surveys are able to provide information about program participants typically before and after a program, observations can be made throughout the course of the program to obtain a better understanding of behavioral characteristics of participants. Furthermore, the use of rubrics can be used to classify qualitative traits into quantifiable results that can be correlated to factors such as change in scientific attitude or learning during the education experience. The study conducted by Boisvert and Slez (1994) used a naturalistic approach of observation, which consisted of observing participants to see how they interacted with their environment. The observations were non-obtrusive, meaning that observations were taken without interfering with the experience of the subject. Approximately 150 subjects were observed for their time spent at an exhibit and their interactions with the exhibit. Although Boisvert and Slez (1994) cited Guba and Lincoln (1989) as their basis for observational rubric design, many of the recorded parameters correspond to those found in Bitgood (1988). This suggests that many of the parameters assessed in the Boisvert and Slez study typify the parameters studied in non-formal education assessment. Some of the possible parameters suggested by Bitgood (1988) include:

- Visual attention to the exhibit/activity
- Time spent on the activity
- Attentiveness to the activity
- Interaction among groups in activities
- Path of movement throughout multiple activities

Many of these parameters were cast into scoring rubrics which could be used to record quantitative data for qualitative attributes. This allowed the researchers to mathematically correlate behavior to the quality of the exhibit experience for participants.

A study performed by Bamberger and Tal (2008) described the importance of performing observations in addition to administering surveys. In accordance with Rennie and Johnston (2004), Bamberger and Tal (2008) contend that surveys are the best way to assess how an individual perceives an experience, as observations are unable to accurately determine the perceptions of a participant.

2.6.4 Surveys

The survey is one of the most common methods of assessment. There are a number of ways to administer a survey including through postal, telephone, face to face, or online formats. Many people believe that surveys should ask brief closed ended questions, but on occasion surveys will have open-ended questions (Trochim, 2006).

A face-to-face survey has been proven to be one of the most effective types of surveys. Specifically, a face-to-face survey where the responder is asked to fill out the survey immediately is proven to be the most effective. When administering surveys it is imperative that the time of the recipients be respected. Most recipients believe themselves to be busy and believe their time to be valuable. It is for these reasons that most participants are much less likely to respond if given a mail in survey. If the participant is given a survey to fill out in front of the administrator, they are likely to try to finish it immediately (Sierles, 2003). The CSIRO already utilizes a mail-in survey to assess their programs but their response rate is very low. The goal of in person surveys is to receive a much higher response rate. The face-to-face survey is the method utilized for the CSIRO program since the target audience was only 30 students at a time and the higher response rate associated with the face to face survey led to more accurate conclusions.

A variety of surveys dealing with assessing the affective natures of science education have been developed and validated. These surveys typically investigate student attitudes towards science,

but can also focus on how interested students are in pursuing science both in the classroom and as a career. Due to the wide variety of survey methods that exist, it has often been recommended that any study attempting to discern scientific attitudes employ several different attitude surveys to achieve consistent results (Lederman et al., 1998). The surveys which made up the basis for those used in this project were the Test of Science Related Attitudes; the Inventory of Science Attitudes, Interests, and Appreciation; and the Views on Science-Technology and Society. These surveys are covered in the following sections.

TEST OF SCIENCE RELATED ATTITUDES (TOSRA)

Developed in the late 1970s and early 1980s in Australia, the Test of Science Related Attitudes (TOSRA) is designed to be an inventory of student attitudes towards a variety of aspects of the scientific field. Primarily, the test determines how likely students might be to pursue a career in science and how they view science in our society. The test has a total of seventy questions covering seven broad categories, as depicted in Table 8. The test is designed to have a Likert-type scale, which assesses the level to which students agree with certain statements on the test (from Strongly Disagree to Strongly Agree).

Category	Description
Social Implications of Science	Student understanding of the impact of science on society
Normality of Scientists	Students views on the lifestyles of scientists and their work
Attitude to Scientific Inquiry	Disposition towards asking questions, being curious, and exploring to seek answers
Adoption of Scientific Attitudes	Exhibiting a scientific method of thinking and systematically approaching problems
Enjoyment of Science Lessons	Extent to which students enjoy learning science in school
Leisure Interest in Science	Extent to which students are interested in science outside of the classroom
Career Interest in Science	Likelihood of student continuing to pursue science in higher education and as a career

Table 8 – Core categories in the TOSRA
(Based on Fraser, 1981).

Validation studies were conducted for TOSRA in the late 1970s, and included a random sampling of year 7-10 students in Sydney, Australia. The test underwent modification to adjust questions that were either unclear or did not provide the appropriate information needed to address a particular category (Fraser, 1981). Studies were also conducted both in Australia and the United

States to assess the ability of the TOSRA to produce consistent results across cultures (Fraser, 1981). Studies performed by Khalili (1987) showed that the test produced reliable results when used in the United States. A sample TOSRA may be found in APPENDIX E.

INVENTORY OF SCIENCE ATTITUDES, INTERESTS, AND APPRECIATION (ISAIA)

Developed by Swan (1966), this test focuses on not only understanding student attitudes towards science, but also looks at teaching factors that had an impact on student achievement. Factors considered include the style of presentation, the extent to which textbooks are used, laboratory time, and other related factors thought to have an impact on student achievement. Questions relating to student attitudes and interest are similar to those found in TOSRA. Statements relating to science are assessed by students on a Likert-type scale ranging from Strongly Agree to Disagree. These statements include questions relating to students' interest in following the scientific method, pursuing a science career, and their views on scientists and their work (Swan 1966).

The ISAIA, in conjunction with the Metropolitan Advanced Science Test (MAST), was administered in Montana to secondary school students in the late 1960s. The MAST provided results on student aptitude that were used in conjunction with results from student interest and attitude from the ISAIA to determine what correlations exist among student attitude, interest, and aptitude (Swan, 1966).

VIEWS ON SCIENCE-TECHNOLOGY AND SOCIETY (VOSTS)

Developed in the late 1980s in Canada, the VOSTS was developed to provide an in-depth assessment of students' views on the interactions between science, technology, and society. Although this test, like the TOSRA and ISAIA, attempts to determine student views on science, it uses additional questions posed in a different style to gain a greater depth of understanding. The test consists of over 100 statements, followed by multiple choice answers. These answers detail a

reaction to the previous statement, and the choice of statement helps provide insight into an individual's view on science. The test can be useful because the multiple choice answers provide some rationale behind the opinion stated in the answer; however, there is also no opportunity for students to provide their own rationale (Lederman et al., 1998).

DEVELOPMENT OF FURTHER SCIENCE ATTITUDE SURVEYS

Other studies, including that of Adams et al. (2006), used a number of existing science attitude and interest tests to develop their own instrument to suit the purposes of their study (physics students). Starting with the Maryland Physics Expectation Survey (MPEX), Views about Science Survey (VASS) and the Epistemological Beliefs Assessment about Physical Science (EBAPS), the research team reviewed the statements from each survey. The statements were then reworked to include a wider breadth of topics, make the statements as clear and concise as possible, and also make the statements applicable to students that may not have taken physics. The final assessment tool consisted of several statements that were rated by students on a Likert-type scale. The survey component of the study conducted by Paris et al. (1998) used a similar methodology, but started with different scientific attitude and interest tests.

The study performed by Prokop et al. (2007) used a pre- and post-test survey format to assess change in desired parameters. Similar to the study of Adams et al. (2006), this study developed assessment tools based on review and modification of existing science and attitude surveys. Assessment of student concepts was accomplished using multiple choice tests. A study by Bamberger and Tal (2008) used participant surveys, but also used categories to classify open responses.

2.6.5 Concept Mapping

When analyzing student aptitude in science, it is important to consider not only the factual information they have learned, but also the conceptual knowledge which they have gained. Whereas traditional exams and quizzes are very good at assessing factual knowledge, a technique known as concept mapping can be useful in determining the concepts which students have learned and how they link them together. Concept mapping is a technique that allows students to construct visual images depicting the linkages between key concepts for a particular subject unit. For example, students studying the classifications of organisms would draw a map depicting not only the different categories, but also how these categories relate to one another. A sample concept map created by a student can be found in Figure 5.

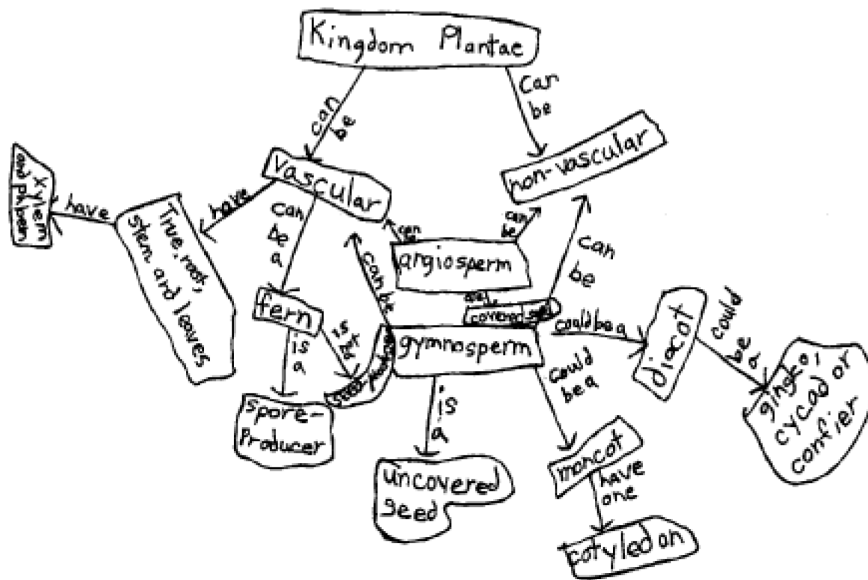


Figure 5 – Sample concept map – Plant Classification
(From Rice et al, 2005).

Techniques for assessing concept maps focus primarily on evaluating the concepts which are included on the map and how they are linked. The scoring rubric developed by Rice and colleagues

(2005) first considered that the proper concepts were on the map, with the list of expected concepts distilled from the course curriculum and the material taught in class. The next layer of scoring focused on assessing linkages between concepts. Correct linkages between concepts were rewarded with points, whereas incorrect or missing linkages deducted points from the total score. Validation of the concept mapping technique was performed by concurrently analyzing student performance on the concept mapping exercise and multiple choice tests (Rice et al., 2005).

Although concept mapping is a good technique to determine the conceptual learning of students, it is important to consider the complexity of the exercise. When concept mapping was studied by Rice et al. (2005), students were asked to complete numerous concept mapping exercises over the course of the school year, thereby learning how to complete the exercise. Despite results indicating that a majority of the students viewed concept mapping as a useful exercise, the technique also took up a significant portion of assessment time (Rice et al., 2005).

One way to avoid the large amount of time required to have students prepare concept maps is to apply the principles to free response questions. This works by taking the unique answers generated by students on free response questions and categorizing them. Once the answers have been categorized the relationships between the categories can be analyzed by using the principles of concept mapping. This allows researchers to determine the trends within the responses as well as how they relate to each other without requiring the extended period of time necessary for a student to draw a completed concept map.

CHAPTER 3: METHODS, RESULTS, AND ANALYSIS

Worldwide, interest and enrollment in science has declined. The decline in science enrolment for Australian higher education typifies the worldwide issue. In this social context, the CSIRO offers non-formal science education programs on a wide variety of science subjects. Although these programs have been popular, the CSIRO wishes to develop a method of assessing their programs' successes in increasing student interest in science and fostering a positive attitude towards science. A variety of techniques, including surveys, interviews, and observations were used to assess the extent to which the CSIRO's programs improve student interest and attitude regarding science.

We evaluated the effects of non-formal education programs on student interest in and attitude toward science. We worked with Chris Krishna-Pillay, Cath McLaren, and other CSIRO liaisons to develop assessment tools and arrange visits to schools which participated in the CSIRO programs. We developed surveys, observations, and interviews which contributed to an ongoing, long term study relating to the CSIRO's non-formal education programs, and evaluated the integrated results of these surveys, observations and interviews. The team worked on this project from March 11, 2010 to May 4, 2010. Our work with the CSIRO contributed to the advancement of the programs and assisted the CSIRO in their efforts to address the broader social context of declining enrollment in science programs in Australian post-secondary schools. In order to complete our study, we executed the following five objectives:

1. Developed a set of surveys, observations, and interviews to determine:
 - o The effects of the CSIRO's non-formal education program on student interest in and attitudes toward science; and,
 - o The engagement and enthusiasm of students while participating in the CSIRO programs,

- If and to what extent the subject matter of the CSIRO programs integrates with the subject matter being presented in the formal science education curriculum,
2. Implemented surveys, observations, and interviews developed for students and teachers participating in the CSIRO programs,
 3. Developed tools and methods for the storage and analysis of data in an electronic form,
 4. Analyzed the results of our surveys, observations, and interviews to evaluate the effect of the CSIRO programs on student interest in science,
 5. Provided recommendations to the CSIRO on how their programs can better achieve their goals of furthering student interest in science and educating students in the program material by identifying key elements of the CSIRO programs which contribute to or hinder their success.

These five objectives formed the backbone of this study. The methods for their completion, their outcomes, our analysis, and the resulting recommendations comprise the remainder of this chapter.

3.0 Develop a System for Evaluation of the CSIRO Programs

The first objective of the project was to develop a system which could be used to evaluate student interest in and attitude toward science. Assessment techniques included student surveys, student observations, and teacher interviews. These three data collection tools were selected by the previous WPI assessment team (Donahue et al., 2010) as appropriate methods to gather data. Following a review of their methodology, we felt that these data collection techniques were appropriate for our study. Accordingly, we continued their use, adjusting them as necessary.

3.0.1 Methodology

The development of the tools used in our analysis required a critical review of those developed by the previous WPI team to determine which components yielded valuable data. In addition, we determined what valuable information was not being collected by the tools they developed. Thus, we began by reviewing the previously developed survey, observation, and interview schemes modifying them as needed.

SURVEYS

The previous WPI team focused much of their efforts on the development of surveys. They began by drafting the first three surveys for the *Forensic Frenzy* and *Biodiversity* programs. The previous team denoted the pre-program, first post-program, and one week follow-up surveys PR, P1, and P2 respectively. We have continued this numbering scheme for the one month follow-up survey, denoting it P3. The surveys they developed included standardized questions in which students ranked their interest in and knowledge of science; open response questions in which students responded to questions relating to the field of science used in the program; and demographic questions in which students indicated age, gender, and family background. Full versions of the previous WPI team's surveys can be found in their report (Donahue et al., 2010).

The previous WPI team then tested the surveys with the CSIRO educators. The presenters gave comments on how to improve the surveys and the previous WPI assessment team adjusted their surveys accordingly. The surveys were then administered to students in the *Forensic Frenzy* (5 sections) and *Biodiversity* (4 sections) programs. These results were then analyzed by the previous WPI group. The results of their analysis coupled with their comments on the effectiveness of the surveys created the basis from which our team could perform continued survey development.

We began developing our surveys by reviewing the comments left by the previous WPI team. Questions which they indicated did not yield useful data were removed. Those questions which the previous WPI team indicated were useful but needed adjustment were changed accordingly. Questions which the previous team indicated had worked were kept the same in order to ensure consistency of the data for analysis, a detailed explanation of the outcome of this process can be found on page 54.

Following the review of the previous team's work, we added questions based on research prior to our arrival at the CSIRO. The questions follow a significant body of research into the appropriate development of surveys to assess student interest in science. Lederman et al. (1998) mentions twenty-five studies conducted within the United States between 1954 and 1992 that evaluate students' attitudes and interests in science.

Interest and attitude questions modified from the TOSRA, ISAlA, and VOSTS, as well as questions from the previous WPI teams' surveys were combined into the surveys to be administered to the CSIRO program participants. Identification of the questions involved separating survey questions into those that measure interest and those that measure attitude. Attitude elements in this case would be defined as questions concerning the attitudes of students toward scientists and science in society and interest elements would be questions concerning student interest in learning science and pursuing a scientific career. The questions were then combined, reworded, and tailored for

administration to students. Finally, the questions were recombined to create the surveys that were then administered to students in the CSIRO programs.

Following the review and final development of surveys for the *Forensic Frenzy* and *Biodiversity* programs, the surveys were then adjusted for administration to students in the *Nanotechnologies*, *Cool Chemical Science*, and *Materials and Structures* programs. The use of both program-specific and non-program-specific questions meant that adjustment was only necessary for certain parts of the surveys. Questions that did not depend on the program were kept the same on all surveys. This allowed comparison across all the programs studied. However, those questions that did depend on the program were replaced with similar style questions which related the new program.

Finally, while the previous WPI team developed the first three surveys (PR, P1, and P2) this study necessitated the development of a fourth survey (P3) to be administered one month after the student's completion of the program. These surveys were developed from the previous three surveys. Questions similar to those on the first three surveys were still used to provide consistent data over the whole set. This included a similar distribution of program-specific and non-program-specific questions as found on the PR, P1, and P2 surveys.

OBSERVATIONS

In addition to the surveys, we used a system of observations to determine students' behavior during the programs. The previous WPI team developed a method for these behavioral observations. Their observation tool tracked student behavior during each of the three parts of the program: the opening presentation, the activities, and the closing presentation. The number of students seen to be exhibiting a behavior was noted for each portion of the program. Table 9 shows the rubric used by the previous team to collect observational data for an activity. The complete observation rubric developed by the previous WPI team can be found in Table 9.

Activity:	Students																													
Program Observations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Discussion (P or O or D)																														
Concentration																														
Enjoyment/Excitement																														
Boredom																														
Eagerness to Participate																														
Asking Questions																														
Confusion/Frustration																														
Physical Distractions																														
Completion																														
Misuse of Equipment																														
Read Instructions																														
Comments:																														

Table 9 – Observational checklist utilized by the previous WPI team.

Our observational methods were derived from those left by the previous WPI team. This consisted of observing the number of students exhibiting different behavioral characteristics, the level of student interest based on the activity, and the level of interest during different portions of the program. To complete this objective we started with the previous WPI team’s method of observing the opening presentation, activities, and closing presentation separately. We then test ran the observation method with one section of the *Cool Chemical Science* program. In some cases multiple behavior characteristics could be counted as a result of one action (i.e. misuse of equipment and physical distractions). Accordingly, we combined behavior categories which were counted as the result of just one action.

INTERVIEWS

The final component of our analysis was teacher interviews. The interviews were intended to gather the teacher’s opinions of the programs; why they booked them, what effects they expected them to have on students, and how they integrate with the curriculum. The previous WPI team developed interviews to be given to teachers at the same time as the surveys. The interviews are denoted in the same manner at the surveys with PR referring to the interview before the program, P1 referring to the interview immediately following the program, P2 referring to the interview

conducted one week after the program. Upon our arrival at the CSIRO we reviewed the interviews that had been left for us and made adjustments as necessary. Any and all adjustments were made with the goals of gathering the necessary data and maintaining consistency with the previous interview data kept in mind. Questions were reworded for clarity if necessary, deleted if they did not garner the data that we were seeking, and added if there was a portion of the goals which was not being addressed.

3.0.2 Results and Analysis

SURVEYS

Our review and revision process yielded an updated set of surveys comprising portions of the original surveys as well as questions added as a result of our analysis. The process was completed for all surveys left by the previous team. For example, the *Forensic Frenzy* P1 survey had some questions modified, some questions removed entirely, some questions added, and some questions kept as is. Table 10 details the questions which were added, removed, modified, or left unchanged. In addition, it classifies questions as program-specific and non-program-specific. This is an example of the change from the previous surveys to the new surveys. Table 11 details the information sought from each question on the *Forensic Frenzy* P1 survey. The information sought on the other surveys is similar to that sought from this survey. The complete selection of surveys left from the previous WPI team can be found in their report (Donahue et al., 2010). The surveys created by our team can be found in APPENDIX B.

Questions	Action taken	Question on New Surveys	Program-specific
Is science important?	No modification	Is science important?	No
Have you noticed any scientific achievements in the media (newspaper, radio, television, and internet) recently?	Question removed per previous WPI team comments		No
What do Forensic scientists do?	No modification	What do Forensic scientists do?	Yes
Name as many types of science as you can that might be used	Modified	What branches of science would Forensic Scientists use?	Yes
What crimes might Forensics be used to solve?	Modified	What crimes might Forensic Scientists Investigate	Yes
Do you plan to do VCE? If so, what subjects would you do?	No modification	Do you plan to do VCE? If so, what subjects would you do?	No
What subjects are you currently studying? (including electives)	Question removed per previous WPI team comments		No
What school subjects are you best at?	No modification	What school subjects are you best at?	No
Did you enjoy the CSIRO session on Forensics?	Question removed per previous WPI team comments		No
What, if anything, did you particularly like about CSIRO's program? Why?	No modification	What, if anything, did you particularly like about CSIRO's program? Why?	No
What, if anything, did you particularly dislike about CSIRO's program? Why?	No modification	What, if anything, did you particularly dislike about CSIRO's program? Why?	No
Table to rank interest in science media	Modified	Table remains, students now rank each media type as a whole instead of ranking examples of the media.	No
Table to rank each part of the CSIRO program	New question	Table to rank each part of the CSIRO program	No
Table of interest and TOSRA derived questions	New question	Table of interest and TOSRA derived questions	No

Table 10 – Changes from previous *Forensic Frenzy* P1 survey to current survey

Question	Purpose
Is science important?	Determine Students' opinion of the importance of science as well as the rationale behind their opinion.
What do Forensic scientists do?	Assess students' knowledge of Forensics.
What branches of science would Forensic Scientists use?	Determine where students believe forensics fits within science.
What crimes might Forensic Scientists Investigate	Assess students' knowledge of Forensics.
Do you plan to do VCE? If so, what subjects would you do?	Classify students by their future scholastic plans.
What school subjects are you best at?	Determine what students believe they are best at. This can be compared with interest to see if there is any correlation between aptitude and interest.
What, if anything, did you particularly like about CSIRO's program? Why?	Determines which portions of the programs students enjoyed most.
What, if anything, did you particularly dislike about CSIRO's program? Why?	Determines which portions of the programs students enjoyed least
Table to rank interest in science media.	Determine how students like to be exposed to science.
Table to rank each part of the CSIRO program	Determine which parts of the programs the students enjoy.
Table of interest and TOSRA derived questions	Quantitatively rank students' interest in and attitude toward science.

Table 11 – Purpose of questions on the *Forensic Frenzy* P1 survey

In addition to the revision of surveys from the previous team, we created new surveys based on the revised surveys for the *Nanotechnologies*, *Cool Chemical Science*, and *Materials and Structures* programs. These surveys retained the same non-program-specific questions as the corresponding *Forensic Frenzy* surveys but different program-specific questions were added based on the topics of the program. These questions were aimed to assess specific, unique components of each program. Examples of program-specific questions, as well as the rationale for asking them, for the P1 *Nanotechnologies*, *Cool Chemical Science*, and *Materials and Structures* surveys can be found in Table 12. All surveys developed by our team can be found in APPENDIX B.

Program	Question	Purpose
<i>Nanotechnologies</i>	What is nanotechnology?	Assess students' understanding and perceptions of nanotechnology.
<i>Cool Chemical Science</i>	What problems might Chemists try to solve?	Determine how students' believe chemistry fits into society.
<i>Materials and Structures</i>	Trusses are typically composed of what shape?	Directly assess that students' are taught about the structure of a truss.

Table 12 – Examples of program-specific questions

Finally, P3 surveys were created based on the PR, P1, and P2 surveys for each program. These surveys focused on assessing interest and attitude. Program-specific questions were still used to determine what, if anything was recalled from the program. The portions of the program that were still remembered one month later were likely to have indicated potential sources of interest and attitude changes. Examples of questions on the *Forensic Frenzy* P3 survey are:

- Rank “I am interested in science,”
- Rank “Science can make positive contributions to our lives,”
- Why is Forensics important?

The full *Forensic Frenzy* P3 survey as well as all other P3 surveys can be found in APPENDIX B.

These questions continue to assess student’s interest in and attitude toward science. In addition, the questions may indicate which parts of the program contribute to their interest and attitudes.

OBSERVATIONS

The review of the previous WPI assessment yielded an updated observation scheme which kept the basic design of the original while adding the ability to measure behaviors versus time. The categories developed by the previous team were kept mostly as is with some minor changes. A comparison of categories used by each team can be found in Table 13. In addition, Table 15 on page 64 details the student actions that were considered manifestations of each behavioral characteristic. The observation rubrics used by both the previous WPI team and our team can be found in their report (Donahue et al., 2010) and APPENDIX C, respectively.

Part of the Program	Previous WPI Team	Current WPI Team
Opening and Closing Presentations	Eye Contact	Eye Contact
	Discussion	Concentration
	Concentration	Boredom
	Enjoyment/Excitement	Eagerness to Participate
	Boredom	Confusion/Frustration
	Eagerness to Participate	Physical Distraction
	Asking Questions	Asking Questions
	Confusion/Frustration	
Activities	Physical Distractions	
	Discussion	Discussion
	Concentration	Concentration
	Enjoyment/Excitement	Enjoyment/Excitement
	Boredom	Boredom
	Eagerness to participate	Confusion/Frustration
	Asking Questions	Physical Distractions
	Confusion/Frustration	Read Instructions at start of activity
	Physical Distractions	Teamwork
	Completion	
	Misuse of Equipment	
Read Instructions		

Table 13 – Comparison of previous WPI team’s observational checklist with our checklist

In addition to modifying the characteristics observed, we added the element of time into the observations. The rubrics were modified to allow observations to be taken every five minutes during the program with the number of students exhibiting the behavioral trait at that time recorded.

This set up also allowed individual students to be tracked throughout the activities portion of the program. During the activity portion the activity which a student was working on could be noted as well as any of the behaviors which they were exhibiting. This allows analysis of each activity within a program by comparing the number of students exhibiting a behavior to the activity they are working on even though students may be working on the activities at different times. A picture of the observation rubric used during the activities portion of the program can be found in Table 14.

The observation rubrics developed and used can be found in APPENDIX C.

Program Observation Group 1	Students Exhibiting Behavior Characteristics									
	0	5	15	25	35	45	55	65	75	85
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Table 14 – Observation rubric for use during activities

The tracking of individual students throughout the activities portion of the program allowed the students to be classified by interest level. Behaviors of students exhibiting high levels of interest at the start can be analyzed separately from those who exhibit low levels of interest at the start. This can then be related to the activities they are working on to see if there is a relationship between interest and activity. Ultimately, this observation method allows the activities section of the program to be analyzed from many perspectives.

INTERVIEWS

The review of the previous WPI team’s interview forms yielded little change in their structure or content. The questions asked were found to cover the teacher’s opinions of the programs, including; why they booked them, what effects they expected them to have on students, how they integrated with the curriculum, and what could be done better. Thus, in order to maintain

consistency with answers from the previous assessments little was changed. Minor changes were made with regard to editing wording with no effect on the meaning of the questions. The only exception to this is the addition of the question “Why did you book this program?” to the one week follow-up interview. The addition of this question allowed us to determine the exact reason that the teacher had booked the program. Some examples of questions asked during the interviews are:

- How do you expect the program to fit with what you are currently covering in class?
- What topics in your science curriculum have you noticed are most engaging to the students?
- Do you plan to assess the students on the material covered?

Full copies of the interview forms can be found in APPENDIX D.

3.1 Administration of Surveys, Observations, and Interviews

The second objective of this study was to gather data by administering surveys, conducting interviews, and taking observations. This involved our attendance at multiple programs throughout the study period. Specific methods were used to ensure that consistent results were obtained and any difficulties or improvements that could be made were either implemented during the study or recommended for implementation in future studies.

3.1.1 Methodology

Data collection was accomplished by attending the CSIRO programs conducted both at the CSIRO-SEC in Highett, Victoria as well as at schools in the greater Melbourne, Victoria area. Surveys were administered during the programs as well as at set times following the program. Observations were taken during the program presentation. Interviews were conducted at the same times as the surveys. A full schedule of the programs covered in this study can be found in Section 3.1.2 on page 65.

SURVEYS

The surveys were initially administered prior to the opening presentation of the program. The surveys were scheduled for the five minutes immediately before and after the program's scheduled running time.

When administering the surveys one of us introduced our team while the other three distributed the surveys. Occasionally, we were split up to attend different programs, and in these cases at least two of us were present. The students were informed that the surveys were anonymous and that they would not be graded on their responses. They were informed that the survey would take five minutes; in addition, the students were informed when there was approximately one minute

left of the survey time. At the end of the survey time the surveys were collected and the main presenter began the program.

A similar process was repeated for the P1 surveys immediately after the program. However, in this case there was less emphasis on our introduction. We distributed surveys and again informed students that the surveys were anonymous and would not be graded. At the end of five minutes the surveys were again collected.

Follow-up surveys P2 and P3 were scheduled for approximately one week and one month respectively following the program. These surveys needed to be scheduled with the schools so that the students would be available to fill out the follow-up surveys. Thus, administration of the follow-up surveys was conducted in accordance with school schedules. The follow-up surveys were administered in a similar manner to the PR and P1 surveys. A brief introduction was given to remind students who we were and why we were there. Students were once again informed that the surveys were anonymous. The surveys were then handed out to students and collected five minutes later.

OBSERVATIONS

In making observations, the CSIRO workshops were divided into three distinct portions: introductory presentation, activity session, and final presentation.

The rubrics developed (see Section 0) were used to track the class's progress as a function of time. The class was split up into four groups so that each observer could observe an individual group of students within the class. Each observer then watched for manifestations of the behavior characteristics and at five minute intervals marked off the students exhibiting the behavior characteristics at that time.

The team also made sure to carefully calibrate themselves against one another to ensure that data would be consistent from one observer to the next. We did this by observing a *Materials and*

Structures program consisting of four students. Each team member individually observed all the students during the opening presentation, activity session and closing presentation. Immediately following the program the group then compared and discussed their observational data. There were few disagreements between observers. However, for each disagreement found the reasons behind it were discussed and a consensus was reached regarding the appropriate interpretation. This strategy allowed us to treat the data as consistent among observers. The original observation sheets from each observer can be found in APPENDIX M.

The activities portion of the observation also added tracking of individual students and their behavior in the program as a function of time. During this portion of the program the student groups were divided among the observers with each observer watching between two and four groups depending on the size of the class.

The final presentation program was set up identically to that of the initial presentation with progress being monitored as a function of time. During all observations we each had a copy of the behavioral cue sheet shown in Table 15. The complete observation rubrics for the introductory presentation, activity session, and final presentation can be found in APPENDIX C.

Behavior	Cue (s)
Discussion (P or O or N)	Talking to peers about program/activity at hand (P)
	Talking to peers but about topics other than program (O)
	Not talking to peers (N)
Concentration	Putting on blinders to outside stimulus; intensely watching
	Focused on activity; tuned in; tunnel vision
	Watching presenters perform experiments; brows furrowed
Enjoyment/Excitement	Audible excitement
	Wide eyed
	Smiling, laughing
	Looks of fascination
Boredom	Falling asleep
	Staring at clock
	Gazing off of the presentation
Confusion/Frustration	Quizzical looks
	Posing confused questions to peers
	Audible grunts, angered looks, discouraging looks
	Impatience
Physical Distractions	Phones, clothing, chairs, carpet, school supplies, etc.
Read Instructions at Start	Read instructions at beginning of activity
Teamwork (P or N)	Working positively together in a team (P)
	Working negatively together in a team (N)
Eye Contact	Maintain visual contact with presenter
Eagerness to Participate (Over Whole time)	Answering questions from presenter; hands shot up
	Volunteering during presentation w/ excitement
	Assertion of answers; pushy
Asking Questions	Ask presenter questions

Table 15 – Behavioral cues sheet
(Modified from Donahue et al., 2010).

INTERVIEWS

We conducted interviews with teachers during the administration of the surveys. Teachers were asked the short series of questions which we developed along with the surveys and observations. We allowed for follow up questions; however, the focus was on completing the questions present on the interview sheet. Time for interviews was generally limited to five minutes

as teachers wished to observe the program and we were all needed to take observations on the program.

3.1.2 Results and Analysis

Data were taken for a total of seven schools with a total of 326 students surveyed and ten teachers interviewed. Table 16 lists the details of each school included in this study. The reader may note that there are data missing for some schools. This section details the reasons for this missing data.

School	Program	Year	Date of Program	Date of Follow-up	Number of Students	Number of Teachers
Bayside Christian College	<i>Materials and Structures</i>	12	3/18/2010	3/24/2010	4	1 PR, P1, P2
Bentleigh Secondary College	<i>Materials and Structures</i>	12	4/13/2010	4/20/2010	16	1 PR, P1, P2
Emmaus College	<i>Forensic Frenzy</i>	9	3/19/2010	3/26/2010	107	2 PR, 1 P1, 1 P2
Malvern Central School	<i>Cool Chemical Science</i>	7	3/16/2010	3/23/2010	41	0
Mt. View Primary School	<i>Cool Chemical Science</i>	6	4/14/2010	None	49	2 PR
Mt. Eliza College	<i>Materials and Structures</i>	12	3/17/2010	None	19	1 PR
St. Aloysius College	<i>Nanotechnologies</i>	10	3/24/2010 3/25/2010	4/15/2010	90	3 PR, 2 P1, 2 P2

Table 16 – Schools included in this study.

DATA COLLECTION CHALLENGES & SOURCES OF ERROR

While on the whole our data collection methods worked well, there were, as with any study, factors which hindered the collection of complete and accurate data. In some cases these factors could be mitigated by adjustments to our processes, and, in these cases appropriate adjustments were made. However, in some cases these factors were beyond our control. Issues of both kinds are to be expected in a study and we have done our best to work within the limitations of our data

collection methods. The following sections detail the issues encountered during the data collection process and, where applicable, the actions taken to mitigate the effects on our analysis.

Surveys

Administration of the surveys yielded valuable information. However, a few issues affected their usage. The first issue was copying. The first set of surveys asked for students' names which would then be removed to ensure that the results remained anonymous. Despite being told that the names would be removed, students talked with each other and copied answers from one another. Replacing the name field with a field for date of birth diminished the level of copying while still allowing us to group all surveys taken by each student.

Another issue encountered while administering surveys was the length of the surveys. While the surveys were designed to take five minutes to complete, in many cases students took longer than five minutes to complete them. This resulted in either the survey time running over that allotted or students turning in surveys before they were able to respond to all the questions asked. This was especially the case for some of the younger students for whom the vocabulary used was more challenging than for the older students. This was generally addressed in our study by allowing students a few extra minutes to complete the surveys.

A final issue that surfaced was administering the P2 and P3 follow-up surveys. School schedules varied widely and scheduling follow-up surveys was often problematic. This was especially the case around the school holidays. During the weeks of March 29 to April 9, 2010, most public and private schools were on holiday for two weeks. This meant that any programs presented during the preceding week could not have P1 follow-up surveys until at least 2 weeks after the program. A slightly different issue also arose with the P3 follow-up surveys. The time period for data collection was very short as our time at the CSIRO was limited to seven weeks. Therefore, programs that were not surveyed within the first two weeks of the study were not due for P3 surveys

until the data collection time had finished. The combination of this time restraint and the scheduling difficulties with schools meant that we were unable to administer any P3 surveys. As a result, we were only able to analyze the PR, P1, and P2 surveys.

Observations

Observation of students was generally very successful. However, we did encounter some difficulties in this part of the study. While we took time to calibrate our observations so that we were taking consistent data, every individual observer has his or her own perceptions. Thus, some inter-observer variation was unavoidable.

Another issue while taking observations was keeping consistent observation times among all four of us. While we attempted to synchronize our observations to one clock there were some variations in the exact timing of the observations. This was especially true when an observer was responsible for observing more than one group of students as they completed the program. When observing more than one group the first group was observed at the change-over to five minutes; however, the next group was not observed until observations were completed on the first group. Thus, observations of all students were not made at the same time. However, as long as the groups were observed in the same order at each observation point then they would have been observed every five minutes; though still at different points in the program. The only solution to this would have been to have enough observers that each observer was responsible for one group of students or possibly for one student. For obvious reasons this would have been impractical and would likely have proven to be distracting to students. Additionally, it is unlikely that the small variations in observation time had a significant impact on the data collected.

A related issue was keeping track of the students as they moved around the room during the activities. With only four of us to watch as many as thirty students, it is possible a student might have been missed in a count. While we did not notice this to be an issue, there were a few instances

in which students left the classroom during the program which changed the total number of students counted. Ultimately, this is an unavoidable consequence of observing human subjects in an uncontrolled environment. As with the timing of observations, the only way to fully address this issue would have been to assign one observer to each student. Likewise, this would have been impractical, very disruptive to the students participating in the program, and would likely have a much larger effect on the data as the students would be constantly aware that they were being observed.

Interviews

While valuable information was gathered through teacher interviews, there were still issues associated with the process. Since the interviews were conducted while the surveys were being administered they were limited to approximately five minutes in length. This time constraint limited the ability of the interviewer to ask follow-up questions because, for comparability, all the questions on the sheet needed to be covered.

In addition, some teachers were busy taking care of their classroom or attending to students and declined to answer the interview questions. This reduced the already limited sample size of teacher interviews. As such, we were only able to conduct P1 interviews with ten teachers. This problem was further exacerbated during the follow-up interviews. When returning to survey students for the P2 follow up the teachers were often not available to be interviewed. As such we were only able to conduct P2 interviews with five teachers.

A final observation regarding conducting of interviews is that some teachers preferred to take the interview sheets and simply fill them out themselves. Teachers who did this tended to provide more detail in their answers and the data were more useful. Thus, it may make sense for future studies to replace the teacher interview with a teacher questionnaire. This would allow

teachers to provide information when it is more convenient for them and may provide better, more detailed answers.

3.2 Development of Data Storage Frameworks

3.2.1 Methodology

Upon the receipt of data from surveys, observations, and interviews, it was necessary to develop tools by which data could be easily stored and analyzed. The completion of this objective was particularly important not only for the execution of our own study, but also for storing data in a format that could be easily analyzed in future studies. By developing appropriate and efficient methods by which data could be entered and stored we were able to perform our analysis while preserving the data for use by future studies.

An important consideration when developing these tools was the wide variety of data types resulting from the surveys, observations, and interviews. Surveys contained both quantitative data from student-ranked questions and qualitative data from open-response questions. Although observational data assessed qualitative attributes of student behavior in the program, the resulting data were largely quantitative. Interviews provided purely qualitative data from teacher responses to the given questions. In order to accommodate the different data types, three separate methods of data storage were developed.

SURVEY DATA

The surveys developed to assess the four CSIRO programs in this study provided a significant amount of data to be entered. Furthermore, the presence of both quantitative and qualitative (open-response) questions provided the unique challenge of how to store both types of data in a manner that was both easy to enter and easy to analyze. Initially, we investigated the

possibility of using the data storage tools developed by the previous WPI assessment team.

Developed using Microsoft Access, the existing database utilized three separate tables to store data separated by the PR, P1, and P2 surveys. As a result, all three tables contained data from all of the programs they analyzed. Although the data were divided into different tables by the test type (PR, P1, and P2), all students were given a unique number used to identify their records throughout all tables. A visual depiction of the database's framework can be found in Figure 6.

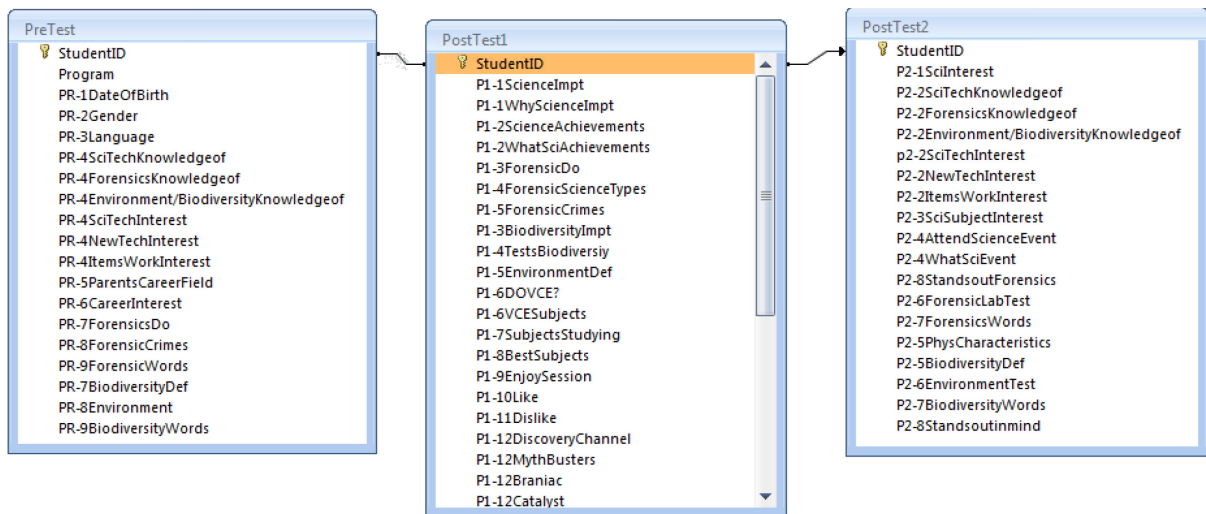


Figure 6 – Database architecture of the previous assessment team. Data were separated by test type, with questions from different programs placed into the same tables.

While assessing the existing database, we discovered several disadvantages regarding its ability to store data collected by our surveys. One of the notable drawbacks was the lack of a single table into which all data could be entered. The use of a single table to store data for all surveys and programs would easily allow for a single student's records to be available. Furthermore, the existing database was designed based on the survey questions of the previous assessment team. In order to use the existing database for our surveys, a significant amount of restructuring would have been needed in order to accommodate new questions. The combination of these two drawbacks led to

the decision to design a similar database that would both accommodate the questions of our surveys and store data in one single table to allow records for an individual student to be easily linked.

To ensure a useful, efficient, and user-friendly survey database, several key points were followed:

- The database should store all records in a single table. One student's records would be stored in a single row for easy access and analysis.
- To facilitate analysis, common questions between different programs should be consolidated into single fields for each question.
- Records should have a unique identifier that quickly describes the school of the student and the program in which they participated.
- New records must be able to be entered. Existing records should be searchable and should be able to be updated if a student completes additional surveys (i.e. a student completes a P2 survey one week after completing the PR and P1 surveys)
- Interfaces should allow for users to enter data both efficiently and accurately.

In order to address these key design specifications, we investigated two programs in which we could build the database: Microsoft Access and Microsoft Excel. Initial evaluation of Microsoft Access indicated that it could provide easy-to-use interfaces and would allow a user to easily lookup, enter, and update records. The biggest drawback to Microsoft Access was its inability to store data in a single table. As a result, developing the database in Microsoft Access would require that multiple tables be used to store data separated either by program or by test type. Either option would have required linking the tables together, a process which would have made it difficult to easily analyze the data between surveys or programs.

Developing the database in Microsoft Excel provided significantly more options for customization. All data could be stored in a single table and easy-to-use interfaces could be developed for use in inputting and updating data from the surveys. These interfaces could be developed to resemble the actual surveys, facilitating data entry from the raw survey data into the electronic database. Records for new students could be entered directly from the user interfaces, and existing records could be searched and updated if necessary. This functionality, although highly

customizable, also required extensive programming using Visual Basic for Applications (VBA). Sufficient programming knowledge in VBA afforded the ability to develop the database in Microsoft Excel to take advantage of the high level of customizability.

Once Microsoft Excel was chosen as the design platform, there were several main elements that needed to be developed:

- Back End Table (BET): Stores all fields entered from the surveys. This includes all raw data and was not intended to be user friendly, but rather to serve as the main place for data to be stored.
- Graphical User Interfaces (GUI): Main method of interaction between users and the BET. These interfaces were designed for each survey for each program and looked similar to the surveys to facilitate data entry.
- Main Table (MT): Designed to be a user-friendly version of the BET used for analysis.

A significant portion of the programming required dealt with the linkages between the user interfaces and the BET. This programming was necessary to ensure that data entered into fields on the user interface forms would be appropriately entered into corresponding fields in the back end table. Additional programming was required to search for existing records and allow the user interface to display all existing data and allow for new data to be entered.

Development of the Back End Table

To begin the process of developing the database in Microsoft Excel, the design of the back end table was developed. This process required a review of questions on all surveys to determine which questions were shared between surveys. Determining these questions helped reduce the total number of fields needed to store data from all programs and help facilitate later analysis. Questions that were unique to a certain program (i.e. *Forensic Frenzy*, *Materials and Structures*, etc) would be placed into their own fields. The table architecture afforded the ability to have a single student's records stored in one row of the table. To ensure that each student could be easily searched and updated after their initial responses had been entered; a scheme for developing unique identification codes

was developed. A student’s unique identifier included a series of letters and numbers that corresponded to the program in which they participated, their school, and a unique number. For example, a student participating in the *Forensic Frenzy* (FF) program at Emmaus College (EC) that was the tenth entry into the database would have the record FF-EC-10. This unique identifier would be later used to search and update records. A general schematic of the table’s architecture is detailed in Table 17.

Student Identification			Pre-Test		
Program	School	Student ID	Combined Questions	Forensic Frenzy	Materials and Structures
FF	EC	FF-EC-1			
FF	EC	FF-EC-2			
FF	EC	FF-EC-3			
MS	BCC	MS-BCC-4			
MS	BCC	MS-BCC-5			

Table 17 – General architecture of the BET. Contains fields for *Forensic Frenzy* and *Materials & Structures*. Shaded fields represent the presence of data for a particular student.

Developing Graphical User Interfaces

Although the BET provided the best framework for storing all data within Microsoft Excel, it was not the easiest format by which data could be manually entered from the surveys into the database itself. Several GUIs were developed in order to provide a user-friendly means by which data could be entered from the surveys into an electronic format. To make the surveys easier to enter, the user interfaces were designed to look similar to actual surveys. In order to allow for a single student’s records to be displayed in a single form, interfaces were developed for each program, with multiple tabs available for different tests. All available data for a single student could then be entered and viewed in a single GUI. An example GUI is shown in Figure 7.

Figure 7 – GUI for *Materials and Structures* program.

By switching through the page tabs, all of the data available for this student could be viewed and updated.

To make the process of selecting the right interface (i.e. selecting the right program) and searching for records easier, two additional interfaces were developed. The new record interface allowed the user to select the program, school, and date of birth for a student, and would open the appropriate interface into which data could be entered (Figure 8). The student search interface allowed the user to input the student’s program, school, and number to retrieve all records available (Figure 9).

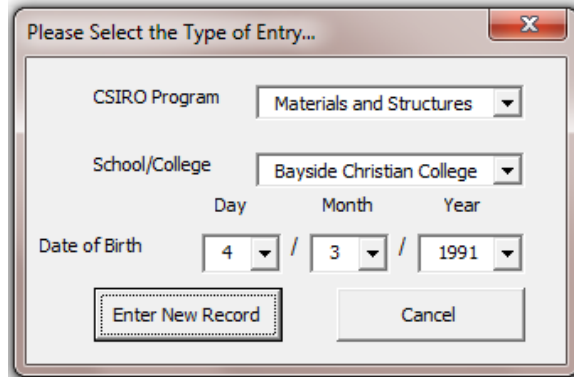


Figure 8 – GUI to enter a new student record.
 Upon entering the program, school, and date of birth for a student, the appropriate interface was opened to allow for data entry.

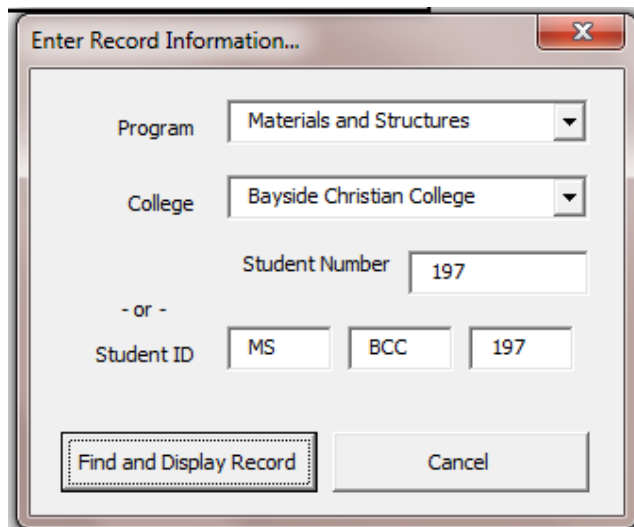


Figure 9 – GUI to search all records for an existing student.
 If the student record was found, all data previously entered for the student would be loaded into the appropriate user interface.

A significant portion of the programming required in developing the databases dealt with allowing data from the user interfaces to be entered into the back end tables, and vice versa. Although most of the code was written expressly for this purpose (taking data from the interfaces and entering into the Microsoft Excel tables, or vice versa), much of the code written for the new record and search records interfaces were designed to search existing records and show the appropriate interfaces to the user. All program code may be found in APPENDIX N.

Main Table

Since the BET was able to store all entered data, it was not a convenient way to analyze the data. To help facilitate data analysis, a main table was developed to display many of the fields most used in later analysis. The main distinction of the MT from the BET was that its design allowed for fields to be easily sorted and prepared for entry into data analysis programs. In addition, this table displays only the categorized responses to free response questions, the uncategorized answers are left in the BET only. For example, if only records for the *Materials and Structures* program were needed for an analysis, the MT could be easily used to display only these records. An abbreviated sample of the MT is shown in Table 18.

Student Identification			Pre-Test							
			Combined Questions			Forensic Frenzy		Materials and Structures		
Program	School	Student ID	Q1	Q2	Q3	Q1	Q2	Q1	Q2	Q3
FF	EC	FF-EC-1								
FF	EC	FF-EC-2								
FF	EC	FF-EC-3								
MS	BCC	MS-BCC-4								
MS	BCC	MS-BCC-5								

Table 18 – Sample MT.

This table contained fields used in data analysis, and could be easily sorted and filtered depending on analysis needs. Grey fields indicate the presence of data.

Overall Database

The combination of the BET, GUIs, the MT, and the programmed code helped create the final database product that was used to facilitate the processing of data from the handwritten survey form into one suitable for data analysis. Throughout this entire system, the data flow was designed to run from the actual surveys, through the database, and finally into an output form suited for analysis. Figure 10 describes how each part of the program contributed to this overall data flow.

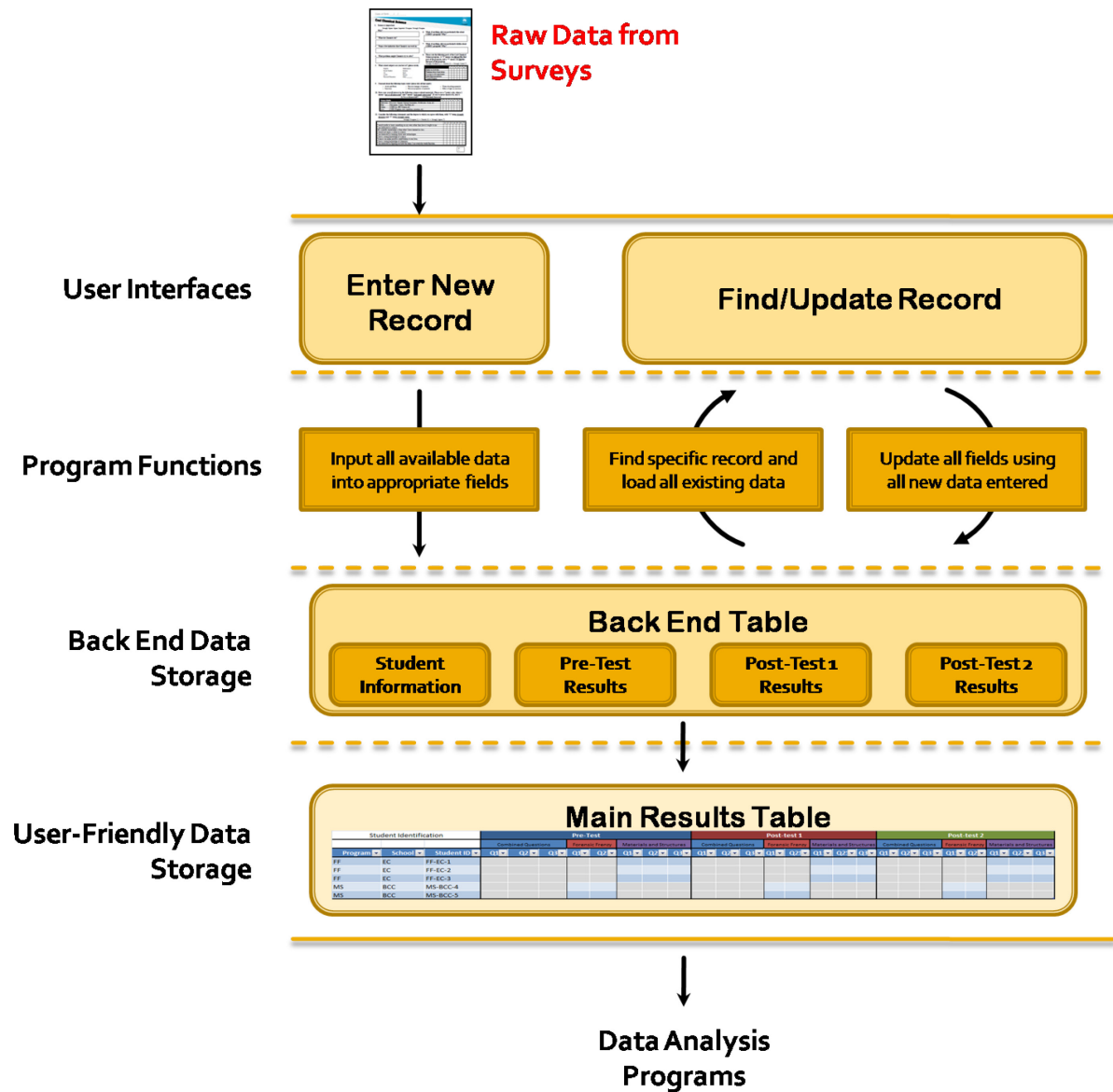


Figure 10 – Relationship between interfaces, program code, and tables in the developed database. All elements would work together to take data from the handwritten survey data (Enter New Record) to a form suitable for analysis (Main Table).

OBSERVATIONAL DATA

In addition to developing tools to store data from surveys, tools to store observational data also needed to be developed. Although most of the data regarding qualitative observations was, in fact, quantitative, the structure of the observation rubrics was very different from the structure of the surveys. Accordingly, a database designed to facilitate the easy input and analysis of

observational data was developed. Observational data was separated both by program and the three distinct parts of the CSIRO programs: initial presentation, activities, and closing presentation.

Tables were developed to store observational data from different parts of the program, and different sheets were used to separate data from different programs.

Although data were collected in a manner that allowed behaviors of individual students to be monitored, the data storage tool developed for observations was in a format requiring total counts of students displaying a given behavior at a given time. This required that raw data on the observation rubrics be consolidated into total counts for behaviors before entering the results into the appropriate tables. A sample table, displaying the total counts for students, is shown in Table 19.

St. Aloysius (3)										
3/25/2010										
Opening Presentation	Number of Students Displaying Characteristic									
Minutes into program	0	5	10	15	20	25	30	35	40	Comments
Eye Contact	22	19	23	18	22	22	20			
Concentration	17	13	15	11	13	19	17			
Boredom	1	9	2	4	4	2	1			
Eagerness to Participate (Over Whole Time)	4	3	1	0	0	0	0			
Confusion/Frustration	0	2	2	1	1	0	0			
Physical Distractions	2	7	3	5	3	2	1			
Asking Questions	0	0	0	0	0	0	0			

Table 19 – Sample table for observations.

The table stored observational results as total numbers of students displaying different behaviors for a given time period. A separate table was made for the opening presentation, activities, and final presentation for.

Since a single program typically included observational results from multiple classes, results from individual classes were combined to provide overall program data for the initial presentation, hands-on activities, and final presentation. Accordingly, three combined tables would exist for each program: one containing all data for the initial presentation, one for the hands-on activities, and one for the final presentation. Based on this architecture, observational results could be easily viewed either by program or by class.

INTERVIEWS

Whereas data from surveys and observations required databases to store the large amounts of quantitative or qualitative data, results from teacher interviews provided a much smaller dataset that was purely qualitative. In order to preserve an electronic record of teacher interviews, raw responses were typed into the interview questions form in Microsoft Word. The written record of interviews could then be used in analysis.

3.2.2 Results and Analysis

SURVEYS

Upon completion, the database met all of its design specifications, most notably succeeding in providing an efficient and accurate way in which data for several hundred surveyed students could be entered and recalled. All results could be stored in a single table, which made it easy to store and recall a single student's records for all surveys they completed. The consolidation of questions common throughout different programs (such as similar questions on all PR surveys) provided a useful format into which student responses could be entered and later used for analysis. This was particularly useful in the Main Table, where results to common questions across all programs could be easily viewed and used for analysis.

The GUIs developed for the program not only provided an efficient means of entering data, but also provided a means for consistently accurate data entry. Since the GUIs were designed to have a similar layout to the actual survey forms, it was easy for users to read data from survey forms and accurately enter it into the interface. The interfaces also made it very easy to enter in data from multiple surveys for a single student. The ability to search through records and update them facilitated the process of entering survey data for students at multiple times. This was particularly

useful when entering data from the second post-test, which would not be entered until a week after the student's P1 and P2 surveys were already entered.

Although the database achieved its design specifications, there are several notable drawbacks observed during the database's design and use. The database itself was highly customizable, but its customization required extensive knowledge of VBA. Although the interfaces can be easily designed, an extensive amount of programming knowledge and time is required to develop the functions of searching and entering data. The process of developing this code, coupled with developing all of the other database parts, made the database development a time consuming process. On a similar note, expanding the database beyond its current capability would require at least a basic knowledge of programming in VBA.

OBSERVATIONS

The database used to store observational results provided a concise and efficient manner in which results could be consolidated and investigated either by class or by program. The architecture of the current database tracked student behaviors by time, not by activity (such as a specific experiment performed in the program). Tracking students by activity would require additional development of the observations database. Since the observations database did not require programming for its functionality, little to no knowledge of VBA would be required for this expansion.

Since results for observations were tracked by time, problems were encountered when the same program (i.e. *Nanotechnologies*) would run for different lengths of time. This would be a particular issue when analyzing the end of a particular program segment (hands-on activities, for example), as some classes would have data at these final time periods, while others would not. This would provide the appearance that significant numbers of students stopped exhibiting certain behaviors at the end of the program, while in reality their program just did not last as long as the

others. To solve this problem, results were only recorded up to the time of the shortest program element when the results were placed into the combined table. In other words, if a certain class only had hands-on activities lasting for 30 minutes whereas another class's lasted for 35 minutes, results in the combined table would be recorded up to 30 minutes. This method was only applied when results from multiple classes were combined – results for individual classes are still preserved.

INTERVIEWS

Recording interview results in the interview questions template provided a good way of preserving interview records. Unlike survey results, the interview results could not be easily sorted or filtered to view certain responses. Despite this fact, the small number of interviews conducted in comparison to the number of surveys administered made it simple enough to go through the responses manually for analysis. Accordingly, the method used to store interview records was appropriate for the data type and quantity.

3.3 Analysis of Surveys, Observations and Interviews

After developing tools by which data could be easily stored and analyzed, we were able to move on to the next objective of analyzing the surveys, observations and interviews. The MT provided an excellent way to conduct analysis. The robust, easy to read, and easy to sort MT proved to make data easier to analyze.

3.3.1 Methodology

SURVEYS: QUANTITATIVE DATA

We used a number of statistical tests to check for correlations as well as overall distributions in the data gathered from the surveys. A frequency analysis was used to determine the distribution of data by number of responses. For example, the frequency analysis was used when analyzing what

students believed they learned during the program. These data were represented in the form of pie charts, histograms with normal curves, and bar charts. Next we used paired samples t-tests to analyze survey questions for student's responses. For example, we used paired samples t-tests to see if student interest changed as a result of the program. The t-test yields a test statistic (t-value) and a significance level (p-value). For our purposes, we considered that a p-value of less than 0.05 indicated that the two data sets are statistically different. When analyzing PR, P1 and P2 surveys, we ran three t-tests comparing PR to P1, P1 to P2 and PR to P2. In order to avoid pseudo-replication of data, it was necessary to use the paired samples t-test. A paired samples t-test assumes that the same subjects have been asked two different questions. In order to analyze survey questions between two different groups, such as male and female students, we used independent samples t-tests. Similar to the paired samples t-tests, these tests also yielded test statistics and significance levels. Again, we considered a p-value of less than 0.05 to indicate that the two groups were significantly different. Finally, we used a bivariate Pearson analysis to test if there was any significant correlation between two fields. Any bivariate Pearson analysis was also accompanied by a scatter plot to see the variance in data and see if the correlation was positive or negative.

Through the use of these tests we were able to make a number of statistical comparisons. The comparisons, programs considered, and the types of tests used to analyze the data are summarized in Table 20.

Analysis Conducted	Programs	Test Conducted
Self Ranked Interest vs. TOSRA	All programs combined	Bivariate Pearson analysis
Interest in Science and Technology	All programs combined All programs individually	Frequency analysis with a histogram
Combined TOSRA Score	All programs combined	Frequency and histogram
Change in Interest in Science and Technology	All programs combined	Paired sample t-test
Change in TOSRA Score	All programs combined	Paired sample t-test
Interest in Science vs. Pursuit of Science	All programs combined	Frequency analysis with a pie chart
Forms of Science Media found Interesting by Students.	All programs combined	Frequency analysis with a bar graph
Male vs. Female Interest in Science and Technology	All programs combined	Independent sample t-test
Male vs. Female Rankings of the Programs	All programs combined	Independent sample t-test
Change in Interest at a Given Age	All programs combined	Paired sample t-test
Comparison of Interest in Science with Respect to Age	All programs combined	Independent sample t-test
What do Students Believe they Learned in the Program?	<i>Nanotechnologies</i> <i>Cool Chemical Science</i> <i>Forensic Frenzy</i>	Frequency analysis with a bar graph
Importance of a Strong Central Theme	<i>Cool Chemical Science</i> <i>Forensic Frenzy</i>	Paired sample t-test

Table 20 – Summary of analyses conducted

Surveys: Open-Ended Responses

For the open response questions, the large variation in student responses would have made statistical analysis nearly impossible on raw responses. However, review of these responses indicated that responses often fell into general groupings that captured the main point of the student's response. As a result, we developed categories for all open-response questions based on the student responses. This post-hoc creation of categories ensured that all student responses could be appropriately classified into categories that accurately reflected the main topic of the student's responses. Pre-hoc creation of categories may have resulted in categories that did not accurately

capture the main topic of student responses. It is important to note, however, that development of categories in a post-hoc manner allows the categories to be skewed towards certain responses. To reduce this, categories made by one team member were reviewed and revised by all remaining team members to ensure that categories were not favoring certain responses over others.

Understanding the limitations of post-hoc categorization, we did not perform any rigorous statistics on these results apart from frequency analyses. This provided us with a general idea of student responses to certain questions, but would not run the risk of providing statistical results that may have been invalid or misleading.

BEHAVIORAL OBSERVATIONS

We also analyzed the observation results collected while observing the students. We looked at three observational characteristics:

- Concentration
- Boredom
- Confusion/Frustration

Concentration was chosen as it can be an indication of whether or not the program is engaging. Boredom shows the opposite of concentration, depicting whether or not the students are losing interest in the program. Finally, confusion/frustration depict whether or not the students are unsure of the material being taught in the program and can also indicate engagement in a program. We investigated and analyzed the opening presentation, activity session and closing presentation. We also graphed these three observational characteristics with respect to time for each program to see overall trends with the program. Graphs were generated using SPSS.

INTERVIEWS

Finally, we also analyzed the teacher interviews in order to determine teacher opinions of the program in addition to student opinions. The teacher opinions were then qualitatively analyzed for the purpose of comparing student results to teacher opinions of the program. We were specifically

considering whether or not the program fit into the teacher's curriculum, whether the students were asked to complete a follow up activity and the reasons why teachers booked these programs.

3.3.2 Results and Analysis

SURVEYS

Self Ranked Interest vs. TOSRA

We first compared students' self ranked interest vs. their TOSRA combined score. We asked four TOSRA questions on the student surveys (APPENDIX E). Additionally, the questions resulting in student interest and TOSRA scores were asked on the PR, P1, and P2 surveys. All three of these tests were analyzed simultaneously. The TOSRA asks about student interest and attitude toward science; thus, it was interesting to compare the students TOSRA score to their own ranking of their interest in science. A combined TOSRA score is calculated by adding the scores of student responses to the questions ranking students' positive attitude toward science and subtracting the scores of student responses to the questions ranking students' negative attitude toward science. Based off our surveys, student TOSRA scores can fall in between a range of -12 to +12 with 0 representing the score of a student who is neutral toward science. A bivariate Pearson analysis was used to determine if there was any correlation between these two fields. We found a significant correlation between these two fields however the data suggest high variability ($p < 0.001$, $r = 0.433$, $N = 797$, Figure 11). This further suggests that if a student is interested in science then they are likely to also have a positive attitude towards the subject.

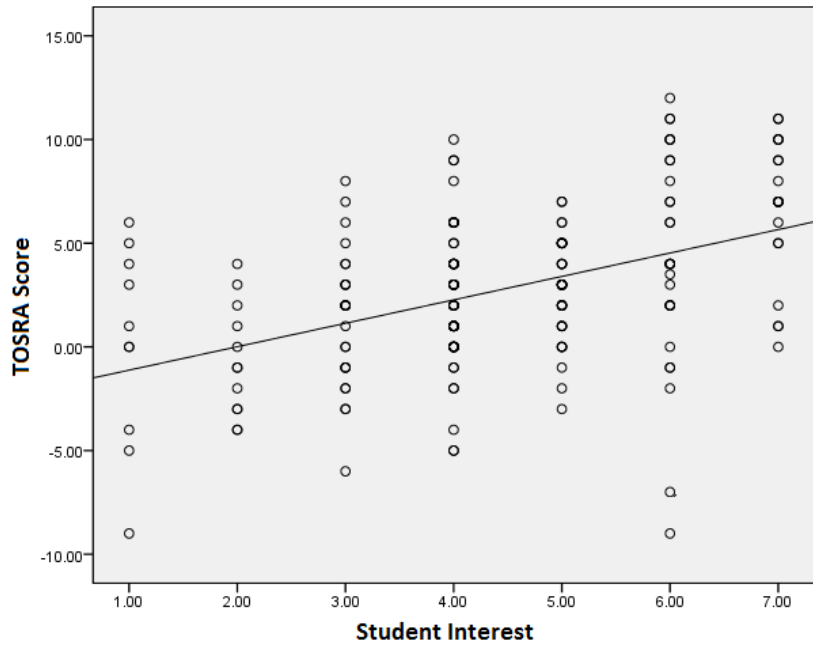


Figure 11 – Student interest vs. TOSRA score

Interest in Science and Technology

Using SPSS, we created a histogram with a normal curve of student interest in science and technology (Figure 12). Students were asked to rank their interest on a scale of 1-7. The following results were analyzed from the PR survey so that student interest could be gauged prior to participation in the programs.

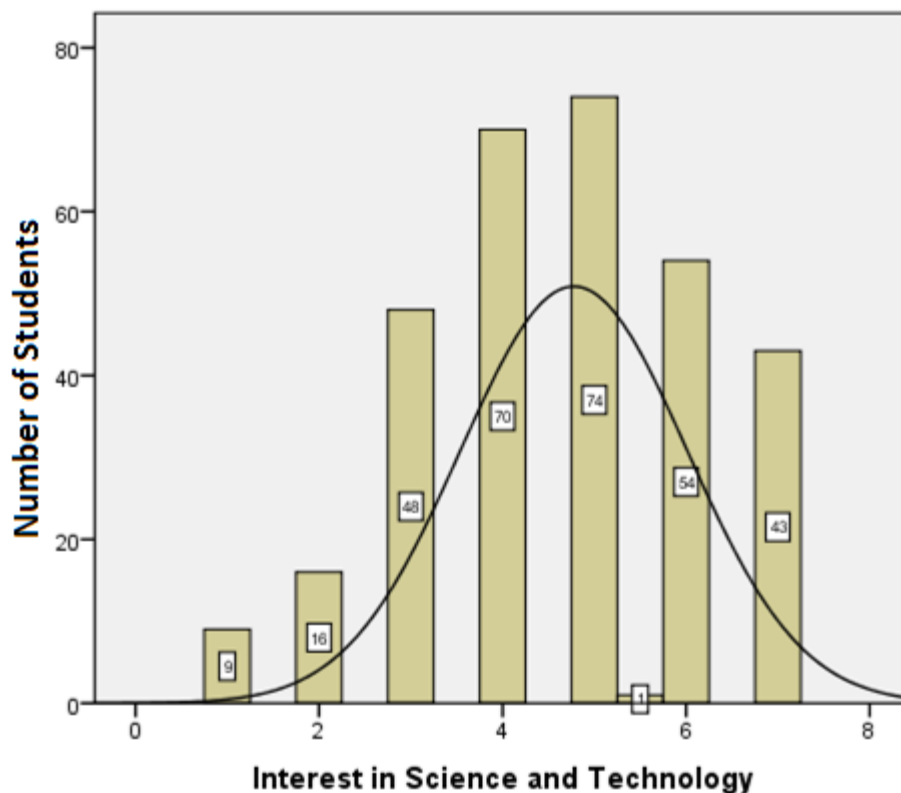


Figure 12 – Student interest in science and technology

The mean score for N=315 participants was 4.65 with a SD of 1.364. This histogram shows the student distribution of interest in science. We also looked at the distributions for each individual program to see how general student interest changed between the different classes and age levels. The four programs we analyzed were *Cool Chemical Science*, *Forensic Frenzy*, *Nanotechnologies*, and *Materials and Structures*. The histograms with normal charts for these programs can be found in

APPENDIX F. Table 21 summarizes the mean, standard deviation, and total number of student responses.

Program	Age of Students	\bar{x}	STDV	N
<i>Cool Chemical Science</i>	12-14	5.39	1.31	87
<i>Forensic Frenzy</i>	14-15	4.01	1.58	99
<i>Nanotechnologies</i>	15-16	4.52	1.41	90
<i>Materials and Structures</i>	17-18	4.95	1.41	39
All Programs	12-18	4.65	1.53	315

Table 21 – Statistical data regarding student interest in science and technology

These data suggest that students in years 6 and 7 may have a generally higher interest in science and technology than the typical student. This is to be expected since students at this early age do not yet have a firm grasp of what science is and how it is used in our everyday lives. Additionally, these data also suggest that students in the advanced VCE physics classes (*Materials and Structures* program) may have a higher interest in science. This again is to be expected since students choose to take this class and are not required to take it by the school curriculum. Students deciding to take such an advanced physics class are likely to be interested in the subject and the data we collected also suggests this to be true. More analysis regarding student interest relating to age can be found on page 98. In addition to the distribution of self ranked interest, we were also interested in looking at the distribution of combined TOSRA scores.

Combined TOSRA Score

Using the student survey responses to the TOSRA questions from the PR survey, (APPENDIX G) we created a histogram with a normal curve of the students' combined TOSRA score (Figure 13). This histogram shows a normal distribution of 311 students with a mean of 3.24, and SD of 3.98. A student who has an impartial attitude towards science would have a combined TOSRA score of 0. This histogram shows that the average student participating in the CSIRO's programs has a slightly positive attitude towards science.

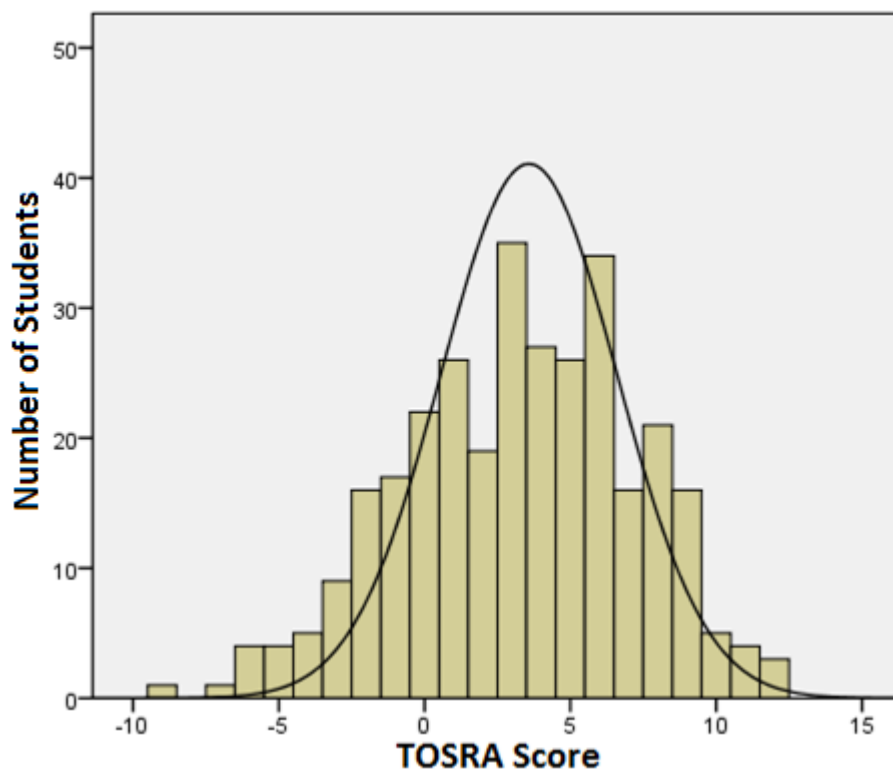


Figure 13 – Combined TOSRA score for all students

Additionally, we were also interested in looking at the combined TOSRA score among every program. The full histograms for each program can be found in APPENDIX G. A summary of the data presented by the histograms is summarized in Table 22. Much like self-assessed student interest; the combined TOSRA score for the students in the *Cool Chemical Science* and *Materials and Structures* programs are greater than that of the students in the *Nanotechnologies* and *Forensic Frenzy* programs. This can again be attributed to the same factors. Students at an early age are unsure of what involvement with science entails. Likewise, students in the advanced physics classes will already have a positive attitude of science or else would be less likely to enroll in the class. A full breakdown as to why students choose to enroll in the VCE physics curriculum can be found in APPENDIX H. Once we knew the breakdowns of both the TOSRA and student interest in science we then investigated whether there was a statistically significant change in interest after completion of the program.

Program	Age of Students	Mean	STDV	N
<i>Cool Chemical Science</i>	12-14	4.9	3.59	84
Forensic Frenzy	14-15	1.84	3.85	99
Nanotechnology	15-16	2.71	3.96	89
Materials and Structures	17-18	4.46	3.59	39
All Programs	12-18	3.24	3.98	311

Table 22 – Statistical data regarding combined TOSRA score

Change in Interest in Science and Technology

One of the CSIRO’s main objectives is to positively influence student interest in science and technology. We tracked a student’s interest in science and technology throughout the PR, P1, and P2 surveys. We analyzed the PR, P1 and P2 surveys for each student and tracked them to see if there was a significant difference in student interest between the two surveys. A paired samples t-test was conducted in SPSS so that student interest could be tracked as a result of the programs. Mean responses for the PR tests ($\bar{x} = 4.652$, SD = 1.583) and the P1 tests ($\bar{x} = 4.831$, SD = 1.641) were significantly different ($t = -2.148$, $p = 0.033$, Figure 14). Consequentially, mean responses for the P1 tests and the P2 tests ($\bar{x} = 4.431$, SD = 1.549) were not significantly different ($t = 1.818$, $p = 0.071$). Finally, the PR test and the P2 test mean responses were also not significantly different ($t = 1.274$, $p = 0.204$). This shows that the data for the results concerning the P2 survey are inconclusive. A more complete P2 data set would be necessary in order to draw conclusions regarding the effect on student interest one week following the programs. Data on the change in student interest in science following participation in the *Cool Chemical Science* and *Forensic Frenzy* programs can be found on page 104.

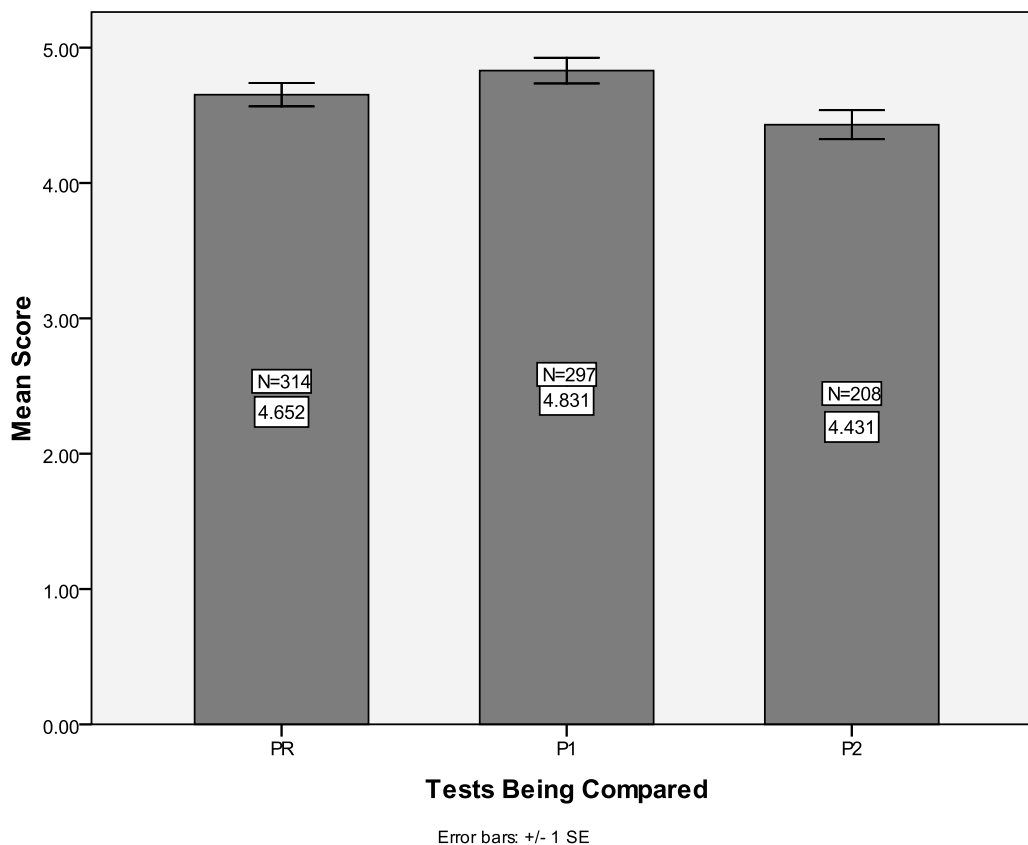


Figure 14 – Change in student interest between PR, P1, and P2 surveys for all assessed programs

Change in TOSRA Score

In addition to the change in interest, we also looked at the change in students' combined TOSRA score over the PR, P1 and P2 surveys. This test was done to see if student attitudes toward science are significantly changed as a result of the program. A paired samples t-test was performed to see if student interest significantly changes as a result of the program. Mean responses for the PR tests ($\bar{x} = 2.75$, $SD = 3.550$) and the P1 tests ($\bar{x} = 0.262$, $SD = 3.412$) were significantly different ($t = 6.996$, $p < 0.001$, Figure 15). Likewise, mean responses for the P1 tests and the P2 tests ($\bar{x} = 4.418$, $SD = 1.513$) were also significantly different ($t = -17.820$, $p < 0.001$). Finally, the PR test and the P2 test mean responses were also significantly different ($t = -6.972$, $p < 0.001$).

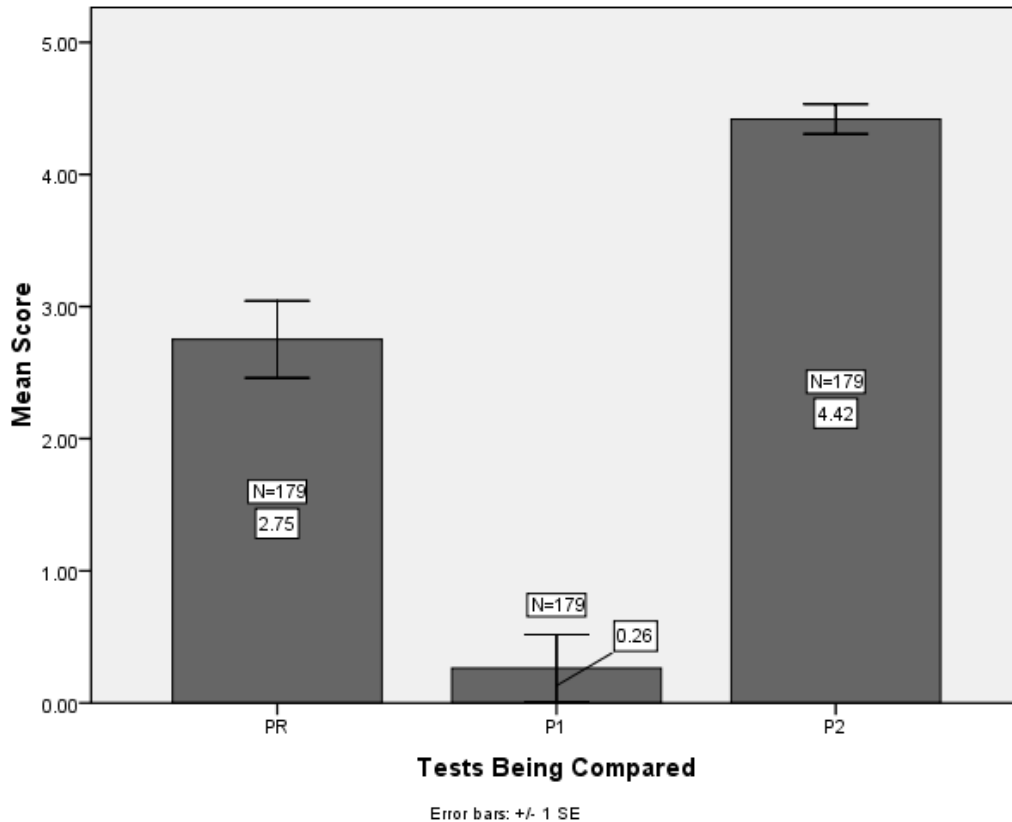


Figure 15 – Change in combined TOSRA score; comparison of means and SE.

However, looking at the data closer indicates a large variance in the mean. The full 70 question TOSRA is meant to gauge student interest and attitude toward science, however, with only a limited amount of time; only four TOSRA questions were administered per survey. The PR, P1 and P2 tests all contained TOSRA questions which were similar but not identical. While we hoped that the TOSRA questions would yield identical results, contrary to our expectations the specific questions made a difference. Judging by the variance in the mean student scores we have concluded that this test is inconclusive. These results must be considered inconclusive as we cannot determine whether there were actually significant differences in TOSRA scores or if the questions were simply recording dissimilar information.

Interest in Science vs. Pursuit of Science

To better understand the scientific demographic participating in the CSIRO programs, we classified students into one of six cohorts based on their interest in science, desire to seek scientific information, and their ability to find and understand information if they look for it. These cohorts correspond to a state-wide public study conducted by Quantum Market Research (2007) in Victoria entitled “Community Interest and Engagement with Science and Technology in Victoria”. This study surveyed Victorian citizens 19 years of age and older to determine their interest in and attitude toward science. In much of the Victorian study’s analysis, participants were divided into one of six groups based on science interest, desire to seek information, and ability to find and understand information. These categories are as follows:

- Interested in science, do not seek information about science
- Interested in science, do seek information about science, but do not find/understand the information
- Interested in science, do seek information about science, and find/understand the information
- Neutral about science, do not seek information about science
- Neutral/Not Interested in science, do seek information about science
- Not interested, do not seek information about science (Quantum Market Research, 2007).

By understanding how the distribution of the CSIRO program participants compares to the distribution found in the Victorian study, the CSIRO can better understand their target audience.

Similarly to the Victorian study (Quantum Market Research, 2007), we were also interested in determining the distribution of students in these six categories. Students were asked to answer questions which would then classify them. Figure 16, from the *Forensic Frenzy* P2 survey shows the three questions used to classify students into these groups. These three questions are taken from the Victorian study (Quantum Market Research, 2007) so that our data would be comparable.

1. Which best describes your interest in science?

- | | | |
|--|---|---|
| <p>General Interest (tick one)</p> <ul style="list-style-type: none"> <input type="radio"/> I am <u>interested</u> in science. <input type="radio"/> I am <u>neutral</u> about science. <input type="radio"/> I am <u>not interested</u> in science. | <p>Seeking Information (tick one)</p> <ul style="list-style-type: none"> <input type="radio"/> I <u>do</u> seek information about science. <input type="radio"/> I <u>do not</u> seek information about science. | <p>Understanding (tick one)</p> <ul style="list-style-type: none"> <input type="radio"/> I <u>do</u> understand/find the information I seek. <input type="radio"/> I <u>do not</u> understand/find the information I seek. |
|--|---|---|

Figure 16 – Questions asked to classify students into cohorts based on Victorian study

Using these questions, we were able to classify students into one of these six cohorts. While clearly there are more than six cohorts associated with these questions, the Victorian study was only concerned with the six statistically most interesting groups. The other six groups require contradictory answers to the questions (i.e. *not* interested in science, but *do* seek information about science). A summary of the percentage of students in each category can be found in Figure 17.

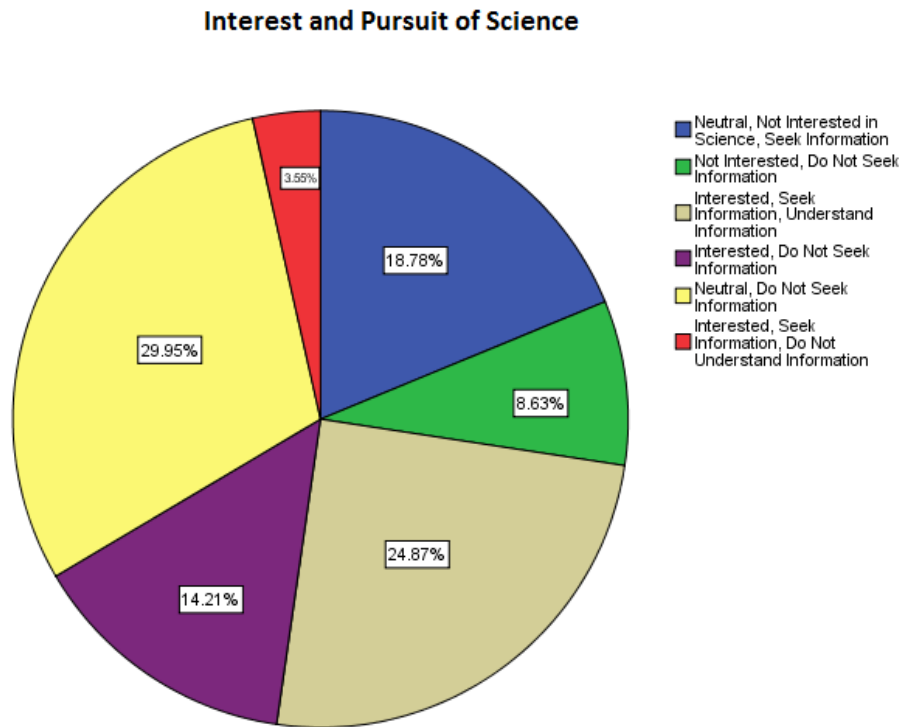


Figure 17 – Percentage of students in each cohort.

The data provided important results which illustrate to the CSIRO the types of students present in its programs. Knowledge of this distribution may allow the CSIRO to focus on certain

types of students in their effort to increase interest in science. This distribution varied from the Victorian study (Quantum Market Research, 2007) and a summary of the percentages from our study in comparison to the study can be found in Table 23.

Category	Victorian Study ⁵	Our Analysis
Neutral or Not Interested in Science, Seek Information	8%	18.78%
Not Interested, Do Not Seek Information	19%	8.63%
Interested, Seek Information, Understand Information	27%	24.87%
Interested, Do Not Seek Information	23%	14.21%
Neutral, Do Not Seek Information	8%	29.95%
Interested, Seek Information, Do Not Understand Information	16%	3.55%

Table 23 – Comparison of cohorts in the classroom to that of the adult population of Victoria. (Quantum Market Research, 2007)

The Victorian study focused on adults over the age of 19. However, our study focused on students between the ages of 11 and 18. Knowing the distribution of these cohorts will allow the CSIRO to more effectively target its programs to the cohorts represented by the Victorian study.

Forms of Science Media found Interesting by Students.

Using these cohorts we then looked into more specific categories related to the cohorts. Of particular interest to the CSIRO was determining where students search for science information. In keeping consistency with the previous WPI assessment team, our P1 survey asked the students to rank how interested they were in the different forms of science in the media (Live, Online, Print, or TV). It is important to note that the longitudinal changes of responses to this question were not of interest to the CSIRO. Rather, a snapshot of the general interest of students in different media was most important. Students were asked to rank their interest on a 1-7 scale. Using a frequency analysis we created a cluster bar chart of the students seeking and not seeking information vs. the type of science media which they are interested in. The cluster bar chart can be seen in Figure 18.

⁵Note: Percentages add to 101% on original Victorian study.

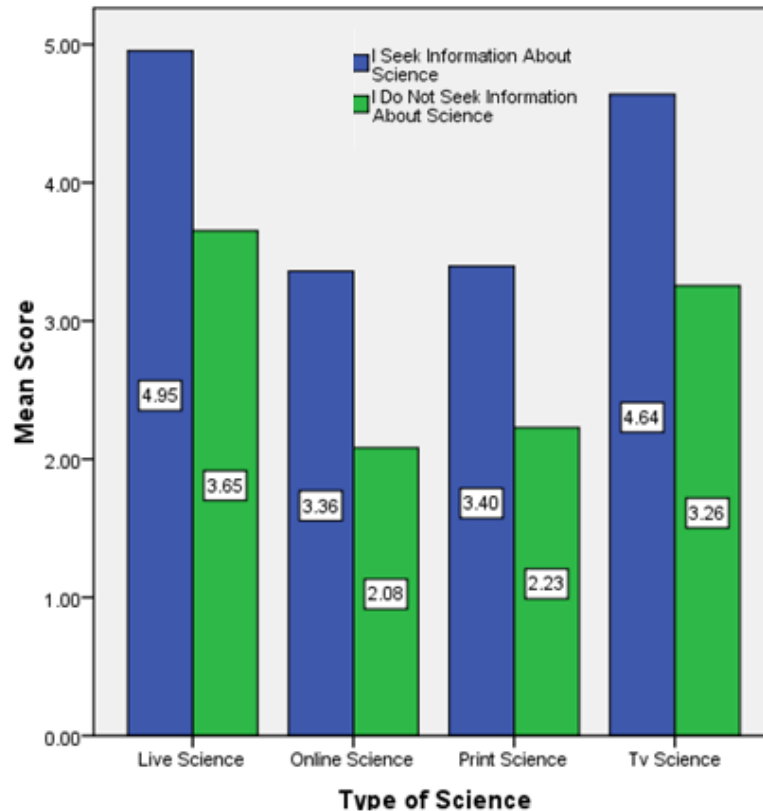


Figure 18 – Students seeking information vs. the type of science media they are interested in

This graph shows that both the students seeking and not seeking information about science are most interested in live science followed by TV science, then print science and finally online science. As expected, the graph also shows that students that seek information are more interested in the various media types than those who do not seek information. This graph demonstrates to the CSIRO the sources which students typically consult for science information.

Male vs. Female Interest in Science and Technology

Osborne and Dillon (2006) indicated that boys and girls find distinctly different topics in science interesting. This observation raises the possibility that the CSIRO programs may affect male and female students’ interest in different ways. Accordingly, we analyzed male and female interest in science and technology. We were interested to see if there was any statistically significant difference between male and female interest before the start of the program, immediately following the

program and a week following the program. We analyzed the results of the PR tests, P1 tests, and P2 tests with three independent samples t-tests. The results and summary of the data provided by these tests is shown in Table 24.

Test Conducted	N	\bar{x}	STDV	T-value	P-value	Significantly Different
Male PR	142	4.866	1.493	2.419	0.016	Yes
Female PR	169	4.446	1.548			
Male P1	133	4.925	1.682	1.084	0.279	No
Female P1	160	4.716	1.614			
Male P2	102	4.569	1.634	1.045	0.297	No
Female P2	121	4.331	1.485			

Table 24 – Male vs. female interest in science.

The data suggest that girls are initially less interested in science; however, up to a week following the program there is no significant difference between male and female interest in science. These results suggest that the programs are able to affect female students in such a way that their interest increases to be comparable to that of the male students. Additionally, the data also show that this interest is not simply a temporary affect on the students but lasts for at least one week.

Male vs. Female Rankings of the Programs

After investigating whether there was any significant difference in interest between the two genders, we were also interested in determining whether the two genders ranked their overall impression of the program higher following the programs. This would tell us whether or not one gender enjoyed the program significantly more than the other. For this test, we conducted another independent samples t-test. Mean responses for male rankings of the program ($\bar{x} = 5.6367$, STDV = 1.228) and female rankings of the program ($\bar{x} = 5.555$, STDV = 1.292) suggested no statistical difference ($t = 0.536$, $p = 0.592$, Figure 19). While female students may not rank the program significantly higher, the male vs. female interest data suggest that programs are affecting female students more with regard to interest in science than they are affecting male students.

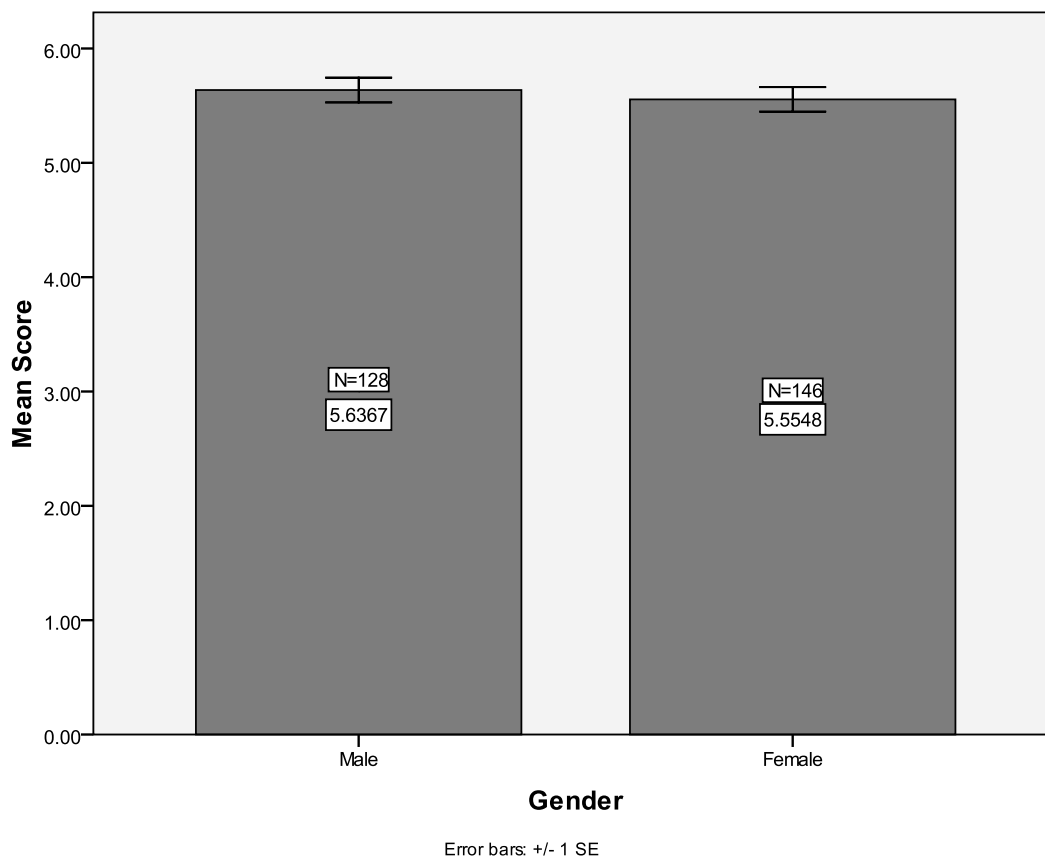


Figure 19 – Student ranking of programs by gender

Change in Interest at a Given Age

Science programs have been shown to affect students differently with age (Osborne, 2003; Hodson and Freeman, 1983)⁶. We were interested to see if student interest between the programs changed differently among the different age groups. For this analysis we divided students into two different age groups: 11-14 year olds and 15-18 year olds. These age groups were selected to complement studies conducted by multiple researchers such as Osborne (2003), and Hodson and Freeman (1983) which claimed a difference in student opinions of science before and after the age of 14. For this test we conducted paired samples t-tests for each age group as they progress through

⁶ See Section 2.5.1 for more information regarding this study.

the program. We conducted a total of six paired samples t-tests analyzing the PR test to the P1 test, the P1 test to the P2 test and the PR test to the P2 test for both age groups of students. First we conducted three t-tests on the 11-14 year old students comparing the three survey results. Mean responses for the PR tests ($\bar{x} = 5.2136$, $STDV = 1.376$) and the P1 tests ($\bar{x} = 5.413$, $STDV = 1.446$) were not significantly different ($t = -0.810$, $p = 0.420$, Figure 20). Consequently, mean responses for the P1 tests and the P2 tests ($\bar{x} = 4.51$, $STDV = 1.617$) were significantly different ($t = 2.742$, $p = 0.009$). Finally, the PR test and the P2 test mean responses were also significantly different ($t = 3.093$, $p = 0.003$). The significant decrease from the P1 to the P2 survey can be the result of a variety of sources including teacher follow ups, subsequent classroom experiences and interactions with their peers. At this time the reason behind this significant drop in student interest cannot be fully determined and only speculations can be made.

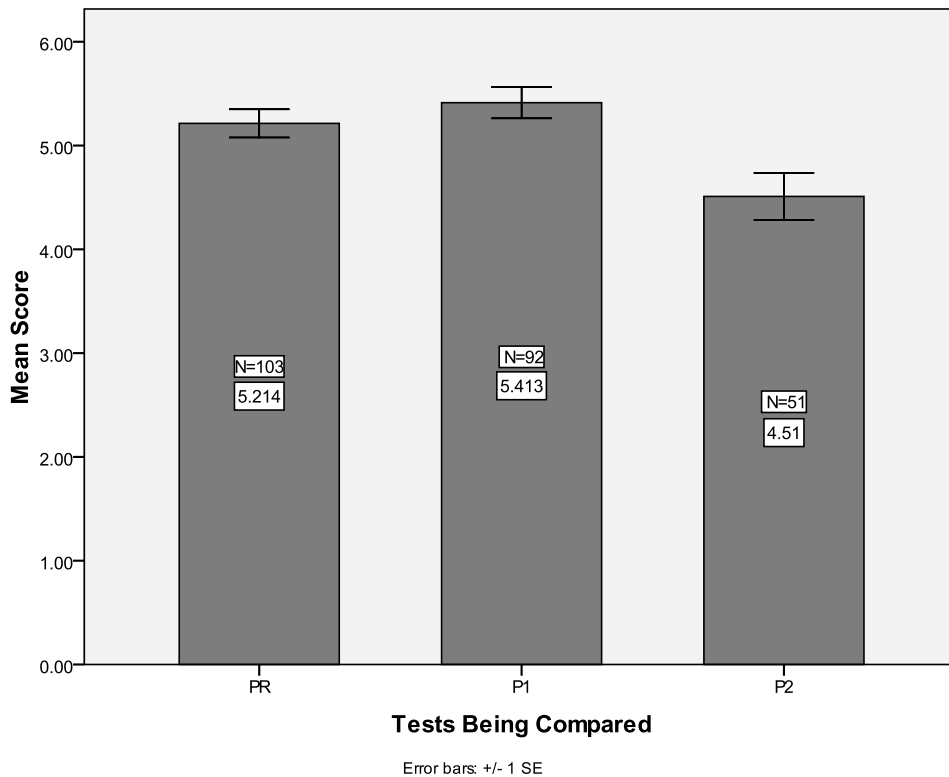


Figure 20 – 11-14 year-old students rank of science interest

Next we looked at students in the 15-18 year old age group. Mean responses for the PR tests ($\bar{x} = 4.3662$, $STDV = 1.585$) and the P1 tests ($\bar{x} = 4.57$, $STDV = 1.679$) were not significantly different ($t = -1.767$, $p = 0.079$, Figure 21). Likewise, mean responses for the P1 tests and the P2 tests ($\bar{x} = 4.4118$, $STDV = 1.515$) were not significantly different ($t = 0.513$, $p = 0.609$). Finally, the PR test and the P2 test mean responses were also not significantly different ($t = -0.155$, $p = 0.877$).

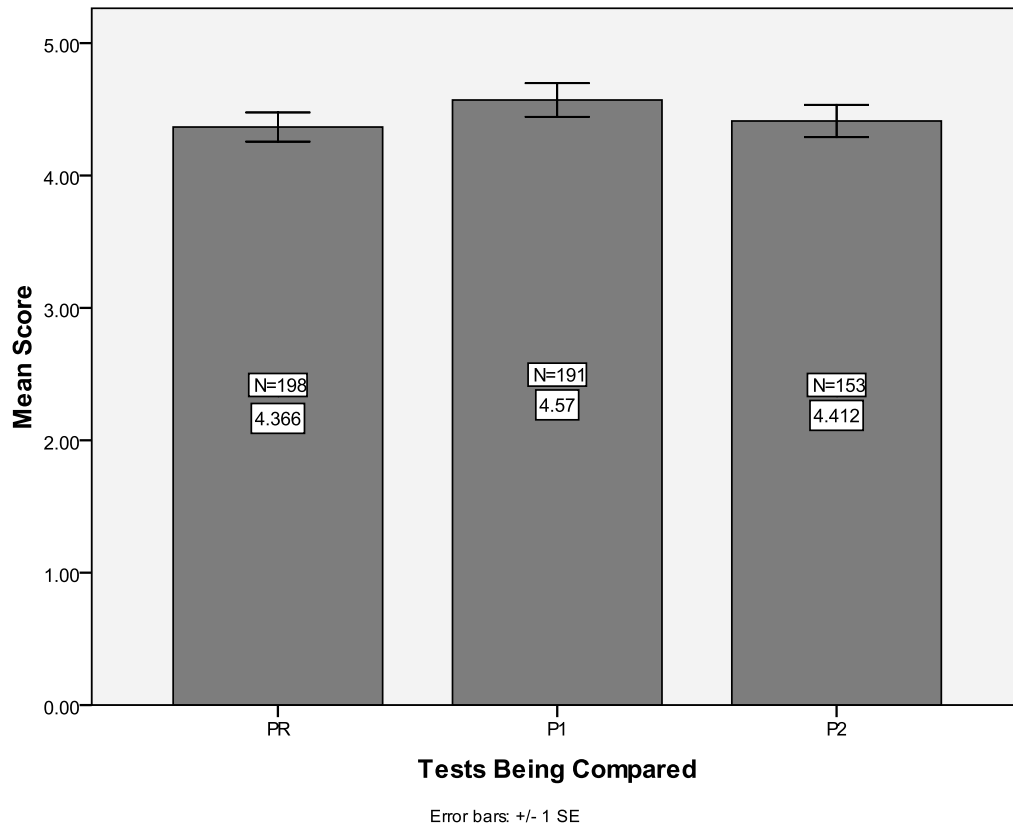


Figure 21 – 15-18 year-old students rank of science interest

These results are consistent with Hodson and Freeman (1983) which suggest that student opinions about science are generally made up before the age of 14. Also we noted that these results show that the programs are not showing any significant difference in interest in science when dividing the groups up into different age groups. These results may seem inconsistent with the results found about the overall trend with the program. These data suggest that student interest does not increase

due to the programs, however, this is only due to the lower number of total student responses for each category. The programs, when looking at student interest as a whole, still significantly increase student interest.

Comparison of Interest in Science with Respect to Age

We were also interested in determining whether student interest in science changes with respect to age. Osborne (2003) writes that students under the age of 15 are significantly more interested in science than students 15 years of age or older. Using responses from the PR surveys, we used independent samples t-tests to determine whether or not there was any statistically significant difference between students aged 11-14 and students aged 15-18. Mean responses for interest rankings of the programs by 11-14 year olds ($\bar{x} = 5.214$, $STDV = 1.377$) and 15-18 year olds ($\bar{x} = 4.366$, $STDV = 1.558$) suggested a strong statistical difference ($t = 3.239$, $p = 0.001$, Figure 22). These results are consistent with Osborne’s study (2003).

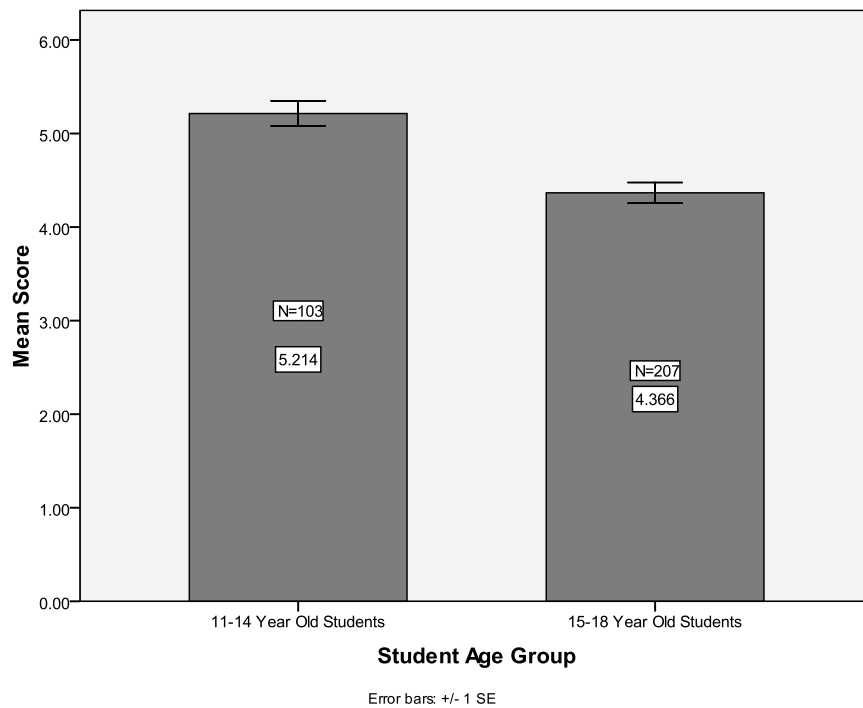


Figure 22 – Student interest vs. age group

What do Students Believe they Learned in the Program?

In addition to influencing student interest in science, the CSIRO aims to introduce students to specific scientific concepts within each program. Each program is designed to have between six to nine concepts introduced to them as a result of the program. We asked the students on the P1 survey whether or not they believed they were taught the topics which the CSIRO intended to cover. We then conducted a frequency analysis on this data and plotted these results in a bar graph. A full description of the topics covered in each program can be found in the teacher manuals located in APPENDIX L. The bar graph for *Forensic Frenzy* can be seen in Figure 23.

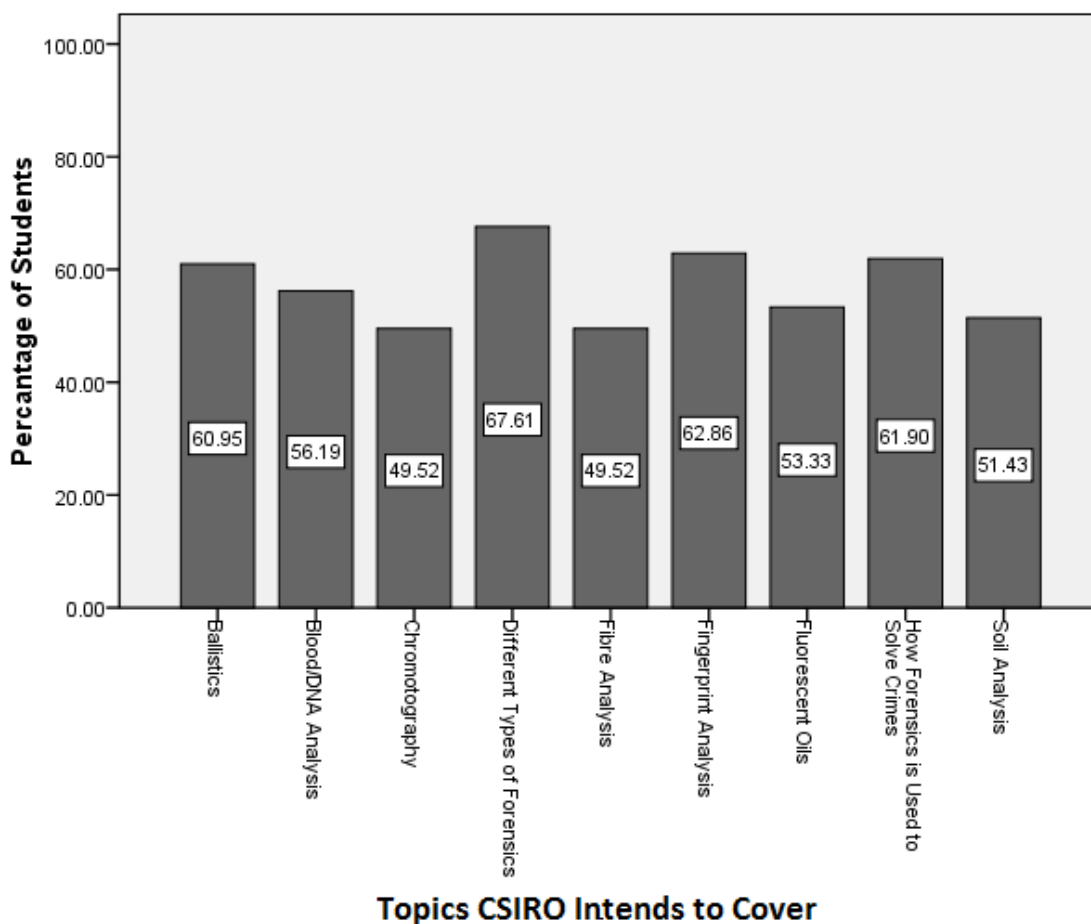


Figure 23 – Topics students believe they learned in the *Forensic Frenzy* program.

This figure shows that between 30% and 50% of students did not feel that the CSIRO covered every topic in the program. Fibre analysis, soil analysis, and chromatography, specifically,

are three topics which only about 50% of students believe were taught to them during the CSIRO presentation. We made a similar graph for the *Nanotechnologies* program shown in Figure 24.

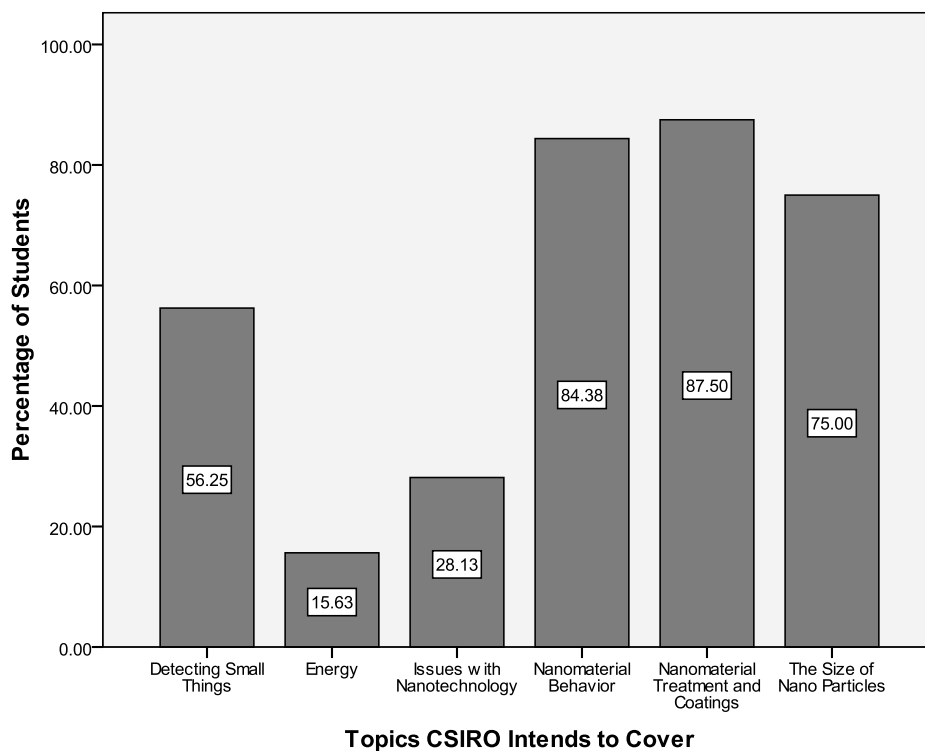


Figure 24 – Topics students believe they learned in the *Nanotechnologies* program

Very few students in the *Nanotechnologies* program believed they were being taught about energy or issues with nanotechnology. Additionally, just over half the students believed they were being taught about “detecting small things”. Finally we looked at the *Cool Chemical Science* program to see the topics that students believed they were being taught. A similar bar chart for *Cool Chemical Science* can be found in Figure 25.

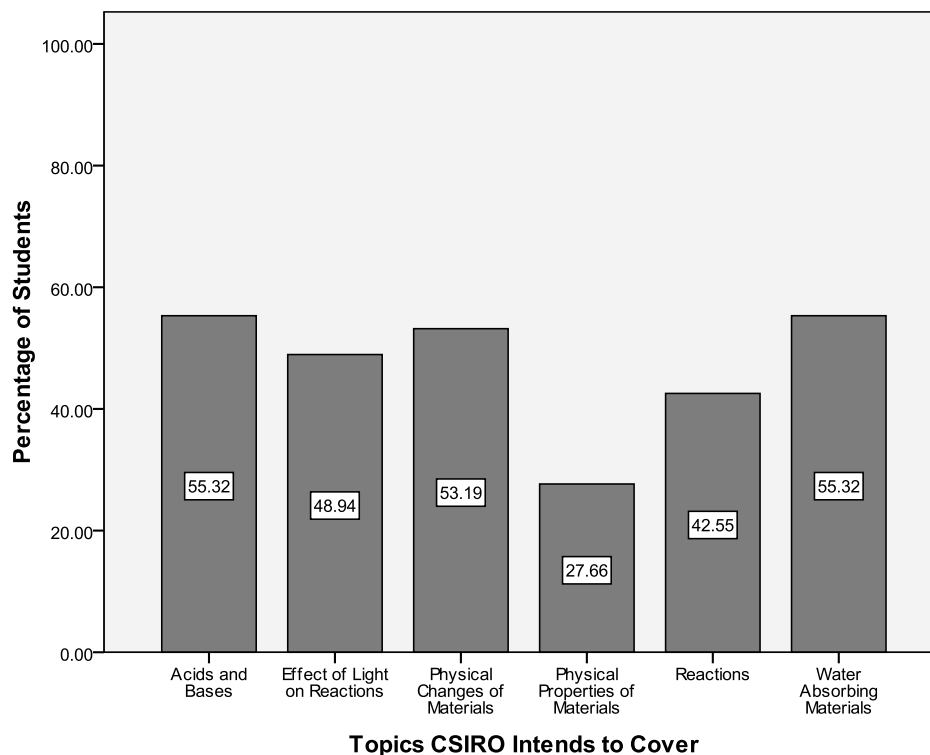


Figure 25 – Topics students believe they learned in the *Cool Chemical Science* program.

This chart again shows that students do not believe they are being exposed to all the topics intended to be covered by the program. Many students do not feel they are being taught physical properties of materials and reactions, however, the CSIRO programs are intended to teach them these concepts. This may show that students do not fully understand what they are being taught or that they are simply not retaining the information.

Importance of a Strong Central Theme

We concluded survey analysis by looking at a suggestion detailed in the report by the previous WPI assessment team (Donahue et al., 2010). The previous WPI team suggested that a strong central theme similar to the one in *Forensic Frenzy* is crucial to engage and positively influence student interest in science. We were interested in assessing student interest for the students having gone through the *Forensic Frenzy* program. We only looked at the results from the PR and P1 survey to determine the immediate effects of the program. A paired samples t-test was conducted to

investigate the effects of the program. Mean responses for the PR tests ($\bar{x} = 4.05$, $STDV = 1.581$) and the P1 tests ($\bar{x} = 4.041$, $STDV = 1.670$) were not significantly different ($t = 0.579$, $p = 0.564$, Figure 26).

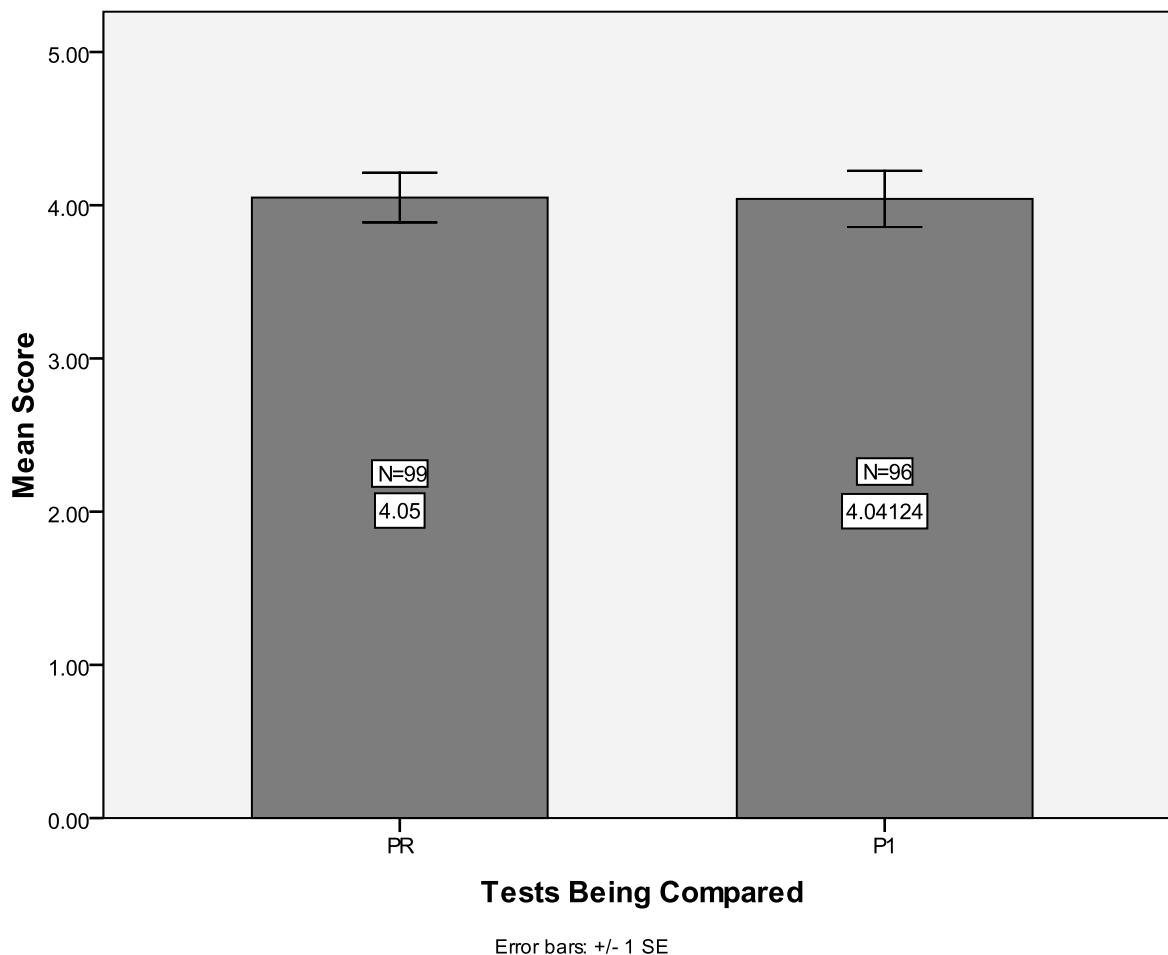


Figure 26 – *Forensic Frenzy* student interest

Consequentially, we also looked at a program which does not have a strong central theme. We chose to investigate the *Cool Chemical Science* program since students in these two programs fell in to the same age group. We again looked at the PR and P1 surveys and conducted a paired samples t-test to investigate the effects of the program. Mean responses for the PR tests ($\bar{x}=5.391$, $STDV = 1.306$) and the P1 tests ($\bar{x}=5.692$, $STDV=1.251$) were not significantly different ($t=-1.680$, $p=0.097$, Figure 27). These data suggest that presence of a strong central theme is a minor factor relating to

the programs' effect on student interest in science. These results, coupled with the previous WPI team's conclusions suggest that further investigation of the effects of a central theme may be warranted. If the study was carried out on a larger sample of students having gone through both programs more accurate results could be concluded regarding the importance of a strong central theme.

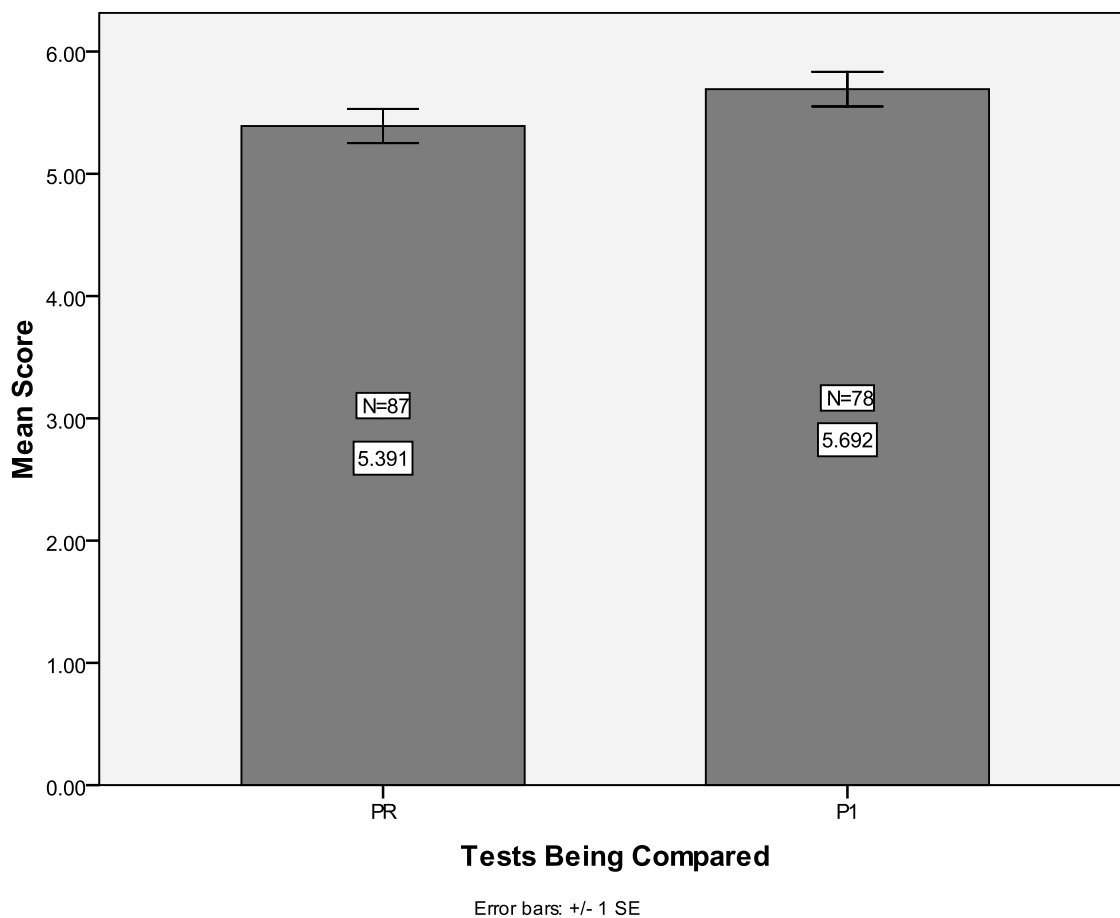


Figure 27 – *Cool Chemical Science* student interest

OBSERVATIONS

We also used our observational dataset to gain insight into the immediate effects of the CSIRO's programs. By determining the immediate effects of the programs we can analyze student's engagement in the programs. Specifically we analyzed students' concentration, boredom, and confusion/frustration during the program. These behaviors were chosen because they are good

indicators of students' involvement, engagement, and understanding of the programs. We also conducted ANOVA tests with post-hoc Tukey tests to see if there were statistically significant differences between the three different portions of the program. These tests resulted in pseudo-replication of data which did not provide fully conclusive results. These results can be seen in APPENDIX I

Nanotechnologies

Our observations of the *Nanotechnologies* program included 77 students in a total of 4 classes. Throughout the program, students displayed high levels of concentration, relatively low levels of boredom, and low levels of confusion/frustration. The distribution of these characteristics is shown in Figure 28.

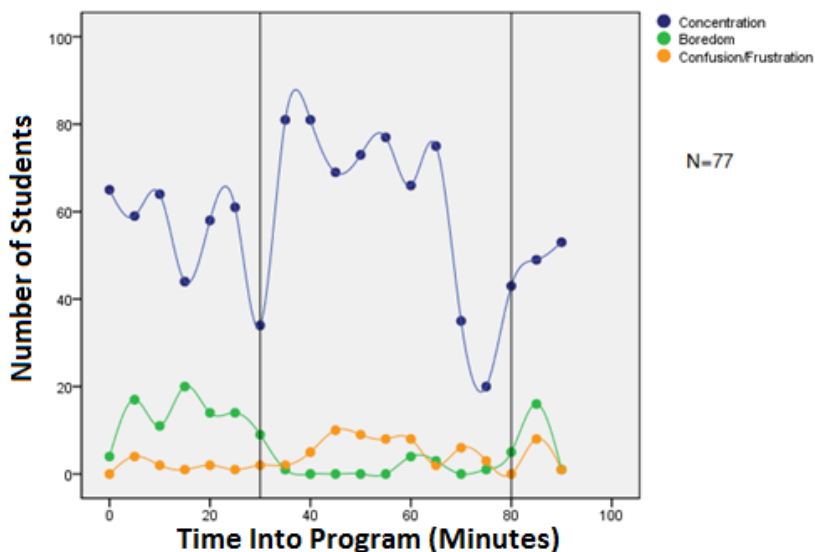


Figure 28 – Concentration, boredom, and confusion/frustration during the *Nanotechnologies* program. Data for four classroom visits pooled. The two vertical lines denote the beginning and end of the activities portion of the program.

This graph suggests a general trend that student concentration is higher during the activities portion of the program. Additionally, the graph also suggests that fewer students are bored once the activity section of the program begins. Finally, the data also show that students are more confused

or frustrated as a result of the activity section of the program. Initially it may seem that an increase in confusion/frustration is not a good thing, however, if students are significantly more confused or frustrated as a result of the activity this may indicate that students are paying more attention and are working through the issues presented in the activities. Activities are also inherently more likely to lead to signals of confusion because of the increased level of thought required to complete the activities. All three of these observational characteristics show that students are most interested and engaged in the hands-on portion of the *Nanotechnologies* program. The graph also shows that student interest spikes at every new section of the program and then steadily decreases.

Cool Chemical Science

Our observations of the *Cool Chemical Science* program included 48 students in a total of 4 classroom visits. The *Cool Chemical Science* program exhibited high levels of concentration and relatively low levels of boredom and confusion/frustration. The distribution of these three characteristics over the course of the program is shown in Figure 29.

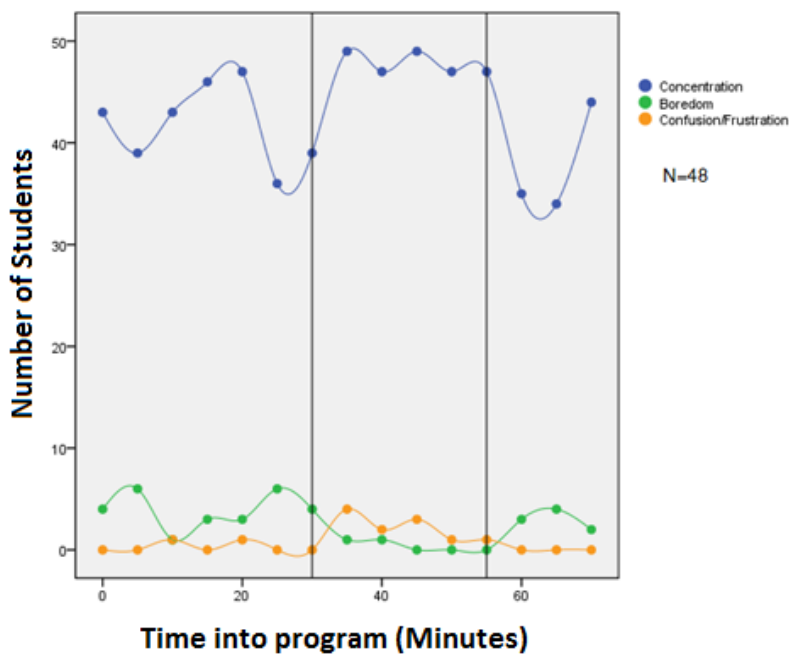


Figure 29 – Concentration, boredom, and confusion/frustration during the *Cool Chemical Science* program.

Data for four classroom visits pooled. The two vertical lines denote the beginning and end of the activities portion of the program.

This graph shows similar characteristics as the *Nanotechnologies* programs. Students seem to exhibit much higher levels of concentration during the activity session of the program. Additionally, boredom appears to decrease once students enter the activity section of the program. Finally, students are more confused or frustrated as a result of starting the activity section of the program. However, unlike the *Nanotechnologies* program student interest does not appear to steadily decline as the program elapses. In fact, students appear to become more engaged as time elapses in the opening section of the program with a quick drop at the very end. Students do not appear to lose interest during the activity session of the program and finally students appear to gain interest towards the very end of the closing presentation session of the program. This may show that the presenters capture the interest of the students during their presentations.

Forensic Frenzy

The *Forensic Frenzy* program consisted of 87 students in a total of 4 classes displaying high levels of concentration while also displaying relatively low levels of boredom and confusion/frustration. The student behavior as a function of time is shown in Figure 30.

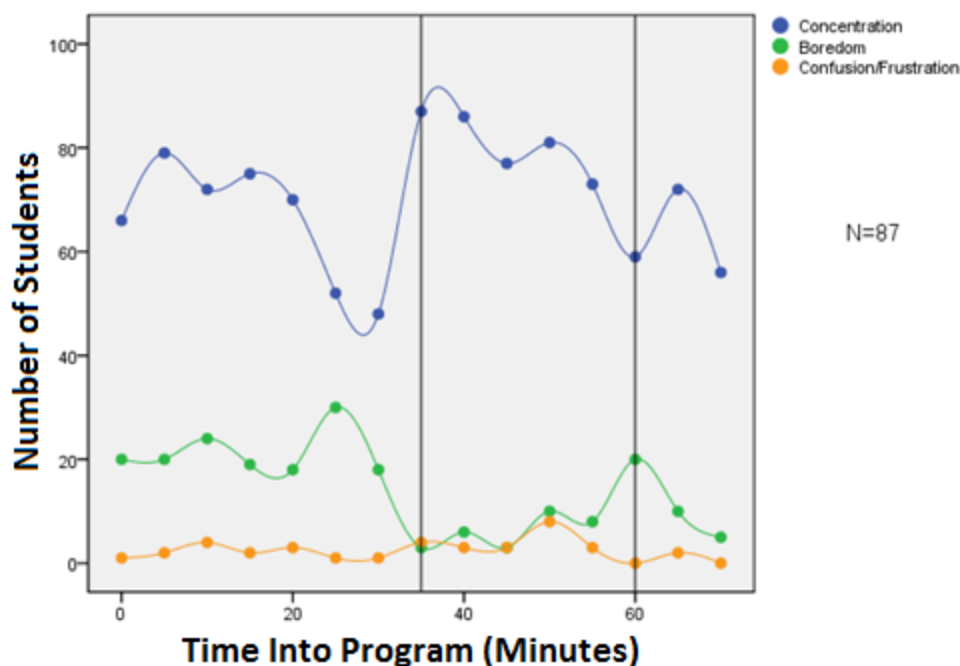


Figure 30 – Concentration, boredom, and confusion/frustration during the *Forensic Frenzy* program. Data for four classroom visits pooled. The two vertical lines denote the beginning and end of the activities portion of the program.

This graph again suggests that during the activity section of the program students are highly concentrated. Student boredom also seems to decline when students enter the activity section of the program. Finally, the graph suggests that confusion/frustration does not change due to the activity portion of the program. This may suggest that the activity portion of this program is not particularly difficult; however, students are still engaged by it. Finally, much like the *Cool Chemical Science* program, the graph also shows that student interest spikes at every new section of the program and then steadily declines.

Materials and Structures

The final program which the team analyzed, *Materials and Structures*, consisted of 36 students in a total 3 classes. The program showed an overall trend of high concentration levels and relatively low boredom and confusion/frustration levels. The distribution of these levels as a function of time is depicted in Figure 31.

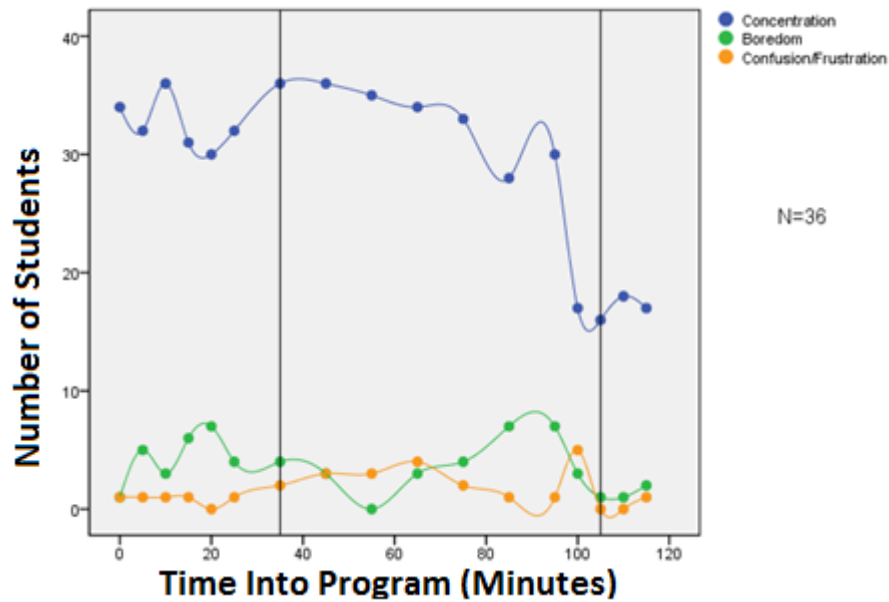


Figure 31 – Concentration, boredom, and confusion/frustration during the *Materials and Structures* program. Data for three classroom visits pooled. The two vertical lines denote the beginning and end of the activities portion of the program.

The final program, *Materials and Structures*, shows slightly altered trends. While student concentration is generally high, boredom is generally low and confusion/frustration is also generally low there does not appear to be a change between the opening presentation and the activity section of the program. Instead, there does appear to be a strong change between the activity session of the program and the closing presentation. As students progress through the program their concentration steadily declines and their boredom steadily increases. This shows that the students are losing interest and engagement in the program. By the time the students enter the closing presentation only half of them are still concentrating.

INTERVIEWS

Our final analysis dealt with analyzing teacher interviews. While the interviews offered no quantitative data, they did provide accurate depictions of what teachers thought about the CSIRO programs and their overall impression of how they believe student interest and attitude changes as a result of the program. Many teachers responded with more than one answer. For the purposes of our analysis we will not look at individual teacher interviews but rather at the total number of responses. We first looked at the question asking teachers how they expect the program to fit into their current curriculum. We received a total of ten responses to the surveys from nine teachers. Eight of the responses stated that the teacher is currently teaching the topic covered by the CSIRO program while two of the responses stated that the CSIRO allows the students to conduct experiments which they are unable to conduct in the classroom. This statistic tells us that all the teachers choose to book this program to compliment the school's current curriculum.

Teachers were also asked to describe what they thought were the most engaging topics to students. Every teacher interviewed responded that they believed that the hands-on topics were the most engaging portions of the program. Building off the previous interview question, these responses suggest that teachers are commonly booking the programs because they believe that students will enjoy the programs due to the hands-on activities. Additionally, the teachers believe that the programs will fit well into the curriculum.

When asked if the program was worth doing and if they would book another CSIRO program one teacher responded stating that "the program was completely worth doing, and that I would book another program." The CSIRO programs are fulfilling all of the teacher goals. They are engaging the students with hands-on work as well as complementing the curriculum.

3.4 Provide Recommendations to the CSIRO

The final stage of this project focused on providing recommendations on how the CSIRO programs can better achieve existing goals and providing recommendations on potential objectives designed to improve student interest in science. These recommendations were aimed at improving the degree to which the CSIRO programs achieve their overall goals by determining how major factors affect the success of the CSIRO programs. In order to provide comprehensive and effective recommendations, the team reviewed the results of its analysis detailed in Section 3.3.2.

Although a detailed analysis of surveys, observations, and interviews yielded numerous interesting results, it is important to classify these results into a form that can be used to provide recommendations. A variety of factors can influence the quality of a program in both positive and negative ways. Aspects of a program that increase student interest in science were classified as Impact Enhancing Elements (IEEs). Those that decrease student interest in science were termed Impact Hindering Elements (IHEs). Elements which have little effect on student interest in science were considered Impact Neutral Elements (INEs). By consolidating key points of our analysis, we were able to classify which IEEs, IHEs, and INEs were present in the CSIRO programs. Suggestions for new program objectives could then consider these elements.

Providing recommendations based only on our results, however, would have indicated lack of recognition that there is a larger context in which the CSIRO conducts their non-formal education programs. Namely, the CSIRO is not the only organization within the greater Melbourne area that conducts non-formal education programs relating to science. To provide recommendations that both improve the CSIRO's programs and helps them provide programs of a high caliber, it is important to consider the results of our own analysis as well as understanding how other programs address similar goals.

In order to obtain a different perspective on non-formal education programs, we contacted several local non-formal education programs dealing with science. Several of the local museums and organizations contacted included:

- Melbourne Aquarium
- ScienceWorks (Melbourne's Science Museum)
- Werribee Open Range Zoo
- Melbourne Zoo
- VSSE – Victorian Space Science Education
- Healesville Wildlife Sanctuary

Although many organizations returned our inquiries, only the Healesville Wildlife Sanctuary permitted us to observe one of their programs. We were invited to observe their *Zoo Keeper for a Day* program, which is a program the Sanctuary runs for year 9-12 students during school holiday periods. While at the sanctuary, we observed the program by taking detailed notes throughout the program and ensuring that we did not interfere with students participating in the program. During different activities, we also used the observation rubrics which we developed for the CSIRO programs to quantify different aspects of student behaviors. Following our visit, we were also able to obtain summary results from the feedback survey administered by the Healesville Sanctuary to their program participants. By comparing our observations of both the Healesville and the CSIRO programs, we were better able to make observations on how the CSIRO's program could be improved.

3.4.1 Results of the CSIRO Analysis

Our detailed analysis of the CSIRO programs yielded many key points that can be used to formulate recommendations:

- Over all programs, students displayed a significant increase in interest immediately after the program (when compared to their pre-program interest). However, student interest did

decline in the week following the program to a point not significantly different from their pre-program interest scores.

- When analyzing different age groups of students and their interest in science, it was found that interest in the 11-14 year old age group was still subject to variation. Students of this age showed no change in interest due to the program, but their interest did significantly decrease in the week following the program. Students 15-18 years old showed no change in interest across any of the survey time points.
- Cohorts based on science interest, desire to seek information, and ability to understand and find the information they look for were also investigated. Among the surveyed students, the cohort distribution was different from the distribution found in a study of adult Victorians.
- Males and females rated the programs equally. However, males were significantly more interested in science than females prior to the programs. After the programs, however, there was no significant difference following the program, suggesting that females may have been more affected by the program in regards to interest in science.
- Although different for some programs, students have significantly improved engagement when they begin the hands-on activities. Furthermore, student concentration steadily decreases as time progresses during the initial presentation.

Based on these results, it is possible to determine elements that will help improve the positive effects of the CSIRO programs. By coupling our observations of the CSIRO's program with those made of programs at the Healesville Wildlife Sanctuary, a more complete list of recommendations can be made.

3.4.2 Results from Healesville Visit

Our observations of the *Keeper for a Day* program afforded the opportunity to provide comparisons between the Healesville and the CSIRO programs. The key aspects of each program are summarized in Table 25:

	Healesville “Keeper for a Day”	CSIRO NFE Programs ⁷
Main Focus	Intended to show students what a typical day as a zookeeper would be like.	Encourage student interest in science.
Duration	Full Day – 6hrs (9am-3pm)	Typically 1.5 hours (except Materials and Structures)
Age Group	High School Students (Years 9-12)	Varies depending on program (typically Years 6-12)
Setting	Healesville Sanctuary	Classroom/Science Education Center (Highett, VIC)
Program Structure	<ul style="list-style-type: none"> • Introductory Presentation • Activities related to daily activities of a keeper • Final Wrap-Up 	<ul style="list-style-type: none"> • Opening Presentation • Experiments Related to Program Topic • Final Wrap-Up Presentation
Number of Activities	9-10 Activities	6-15 activities, depending on program
Organization of Activities	Entire group involved in one activity at a time	Multiple small groups of students work on different activities simultaneously
Approx. Length of Activities	10-20 minutes	5-20 minutes
Facilitators	2 facilitators	1 facilitator

Table 25 – Summary table of the Healesville *Keeper for a Day* program and the CSIRO programs. As an important note, the different CSIRO programs evaluated have a wide range regarding number of activities and approximate activity length.

⁷ CSIRO Non-Formal Programs. This includes programs covered in this study, including Forensic Frenzy, Cool Chemical Science, Materials and Structures, Nanotechnologies, etc.

The program we observed was attended by approximately 20 students, about half of whom were in Year 9 (with the rest being in Year 10-12). The program structure for *Keeper for a Day* was as follows:

- Introductory Presentation
 - Discuss the many roles of a keeper's job
 - Provide profiles of keepers and how they came to be in their current position
- Discovery Center
 - Interact with and feed one of the birds
 - Assist in making fake emu eggs (this is a task of regular keepers)
 - Interact with and pet other animals
 - Feed and clean insect cages
 - Discuss further aspects of a keeper's job
- Kangaroo/Wallaby Paddock Activities
 - Clean out kangaroo and wallaby pens
 - Interact with the public to teach them about kangaroos/wallabies
- Behind The Scenes – Nocturnal House
 - Talk with an actual keeper about how animals are cared for
 - Interact with more animals
- Behind the Scenes – Food Room
 - See how food is prepared for the animals
- Dingo Country
 - Make enrichment toys for the dingoes
 - View a “Meet the Keeper” presentation – learn about the dingo keeper
- Birds of Prey
 - Attend a final demonstration open to all zoo visitors
- Final Presentation/Surveys

A brief discussion with program facilitators indicated that the Healesville programs operate under a “connect-understand-act” mentality. In other words, they are looking to impact students beyond just the “wow” factor associated with seeing animals up close and also want students to gain a greater appreciation of the wildlife that surrounds them. Furthermore, the program is aimed at introducing students to what being a zookeeper is really like – including their tasks, thoughts, and how they work with others. It was this aim that was considered to be the main objective of the program.

One of the common themes seen throughout the Healesville program was the strong and constant relation of different activities to what an actual keeper does on a daily basis. Some of the activities, such as interacting with the public and cleaning pens, were actual moments when students performed nearly identical tasks to those completed by keepers. In other activities, such as interacting with the animals, the facilitators would consistently create connections to what keepers can experience in their jobs. For example, facilitators discussed how keepers can form emotional connections with their animals while the students themselves interacted with the animals.

The strong central theme is a particularly interesting observation, as several of the CSIRO programs studied did not possess this element of constantly relating program material to an actual role (such as being an actual scientist performing experiments). One of the CSIRO programs similar to the Healesville program in this regard is *Forensic Frenzy*, where students are asked to conduct a series of experiments to solve a murder crime, akin to the role of a forensic scientist. This is similar to the Healesville program where students are placed in the role of a zookeeper. The CSIRO programs such as *Cool Chemical Science*, on the other hand, allow students to perform a series of experiments but do not make a connection to being an actual chemist.

During our analysis, we investigated how the strong centrally-themed programs were able to impact student interest in science. Looking at change in interest for *Forensic Frenzy* (a program with a strong central theme); it was found that it did not significantly improve interest in science before and after the program. Investigation of *Cool Chemical Science* yielded similar results, suggesting that the strong central theme, at least in the context of the CSIRO programs, does not significantly impact student interest in science. However, additional investigation into the role of the strong central theme could help provide further insight into its effects.

While observing students during the Healesville program, it was very evident that many students were on task and focused during many of the activities. Some of the greatest periods of

excitement were seen while students were interacting with the animals. Throughout the program, several students asked multiple questions of the facilitators. Some students also made connections between information in the initial presentation and other activities (i.e. remembering a particular fact discussed in the presentation about an animal that they later saw in the sanctuary). A summary of qualitative observations can be seen in Figure 32.

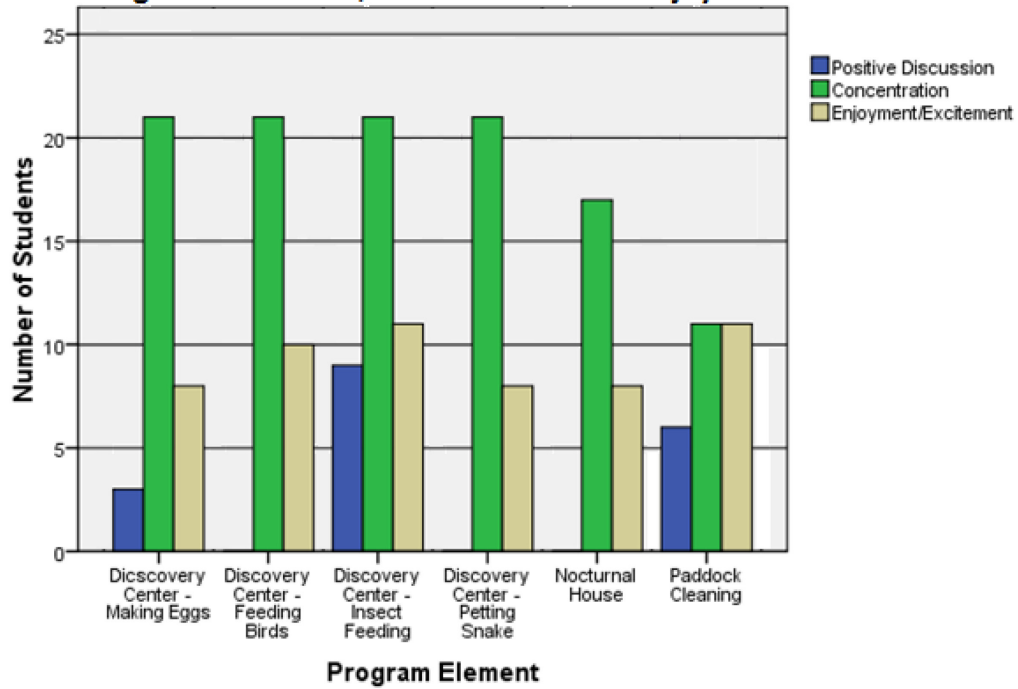


Figure 32 – Program related discussion, concentration, and enjoyment/excitement during the Healesville *Keeper for a Day* program.

Observations during these parts of the program were made approximately 5-10 minutes into a particular activity and reflect a snapshot of student behavior and reactions. Throughout many parts of the program, a strong majority of the students exhibited signs of concentration (i.e. staying focused on the task at hand). Levels of enjoyment and excitement were lower, but largely consistent throughout many parts of the program. It is important to note that almost every student showed signs of enjoyment and excitement when they interacted with an animal, but not necessarily throughout the whole activity. Levels of program related discussion varied with the type of activity

– activities that were largely presentations (nocturnal house, petting the snake, and the presentations of the Discovery center) did not experience any program discussion. During other activities, some student discussion was related to the program, with the remainder largely having no discussion. Student rankings of different activities on feedback surveys administered by Healesville program facilitators also provided insight on how students enjoyed various activities (APPENDIX J)

One of the possible reasons behind the high levels of interest and engagement throughout the Healesville program could be the context under which students participate. Student participants in the Keeper for a Day program are participating voluntarily during their holiday as opposed to the CSIRO programs, where students participate as part of class. Furthermore, when asked which students were interested in entering a career related to zoo-keeping, almost all students raised their hands. This indicates that many students were interested in zoo-related careers prior to program participation. As a result, this could have led to their greater excitement and concentration on tasks relating to zookeeper careers.

Results from feedback surveys administered by Healesville helped provide further information on student perceptions of the overall program. Students responded by ranking statements on a scale from 1-5, the average responses to the statements can be found in Figure 33. This indicates that students had an overall positive view on the program, and 95% of students indicated that they would recommend the program to a friend. Students strongly believed that the programs taught them more about being a zookeeper and how to become one, indicating that the program did a sufficient job of informing students on these topics.

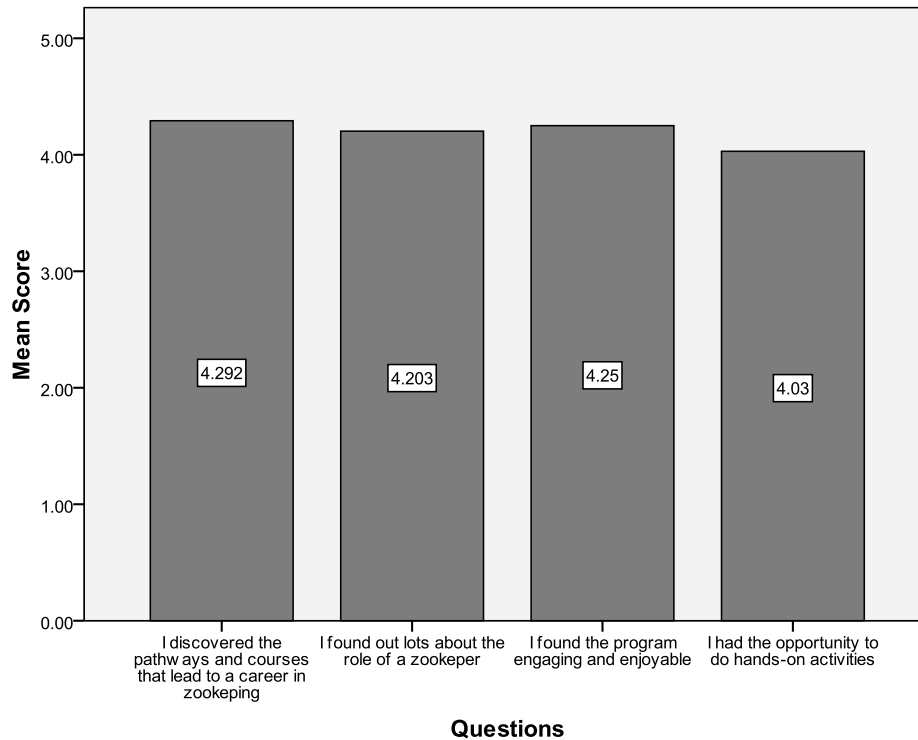


Figure 33 – Average student responses on feedback surveys administered by Healesville. Students were asked to rate the categories on a scale from 1-5, with 1 being strongly disagree and 5 being strongly agree.

Although differences do exist between the Healesville *Keeper for a Day* program and the programs being evaluated at the CSIRO, understanding how other non-formal education programs work in practice was a valuable experience. By critically evaluating what worked well at both the Healesville and the CSIRO programs, it is possible to provide recommendations on how to improve the CSIRO programs.

3.4.3 Impact of the CSIRO Program Elements

After reviewing both the CSIRO and Healesville programs, it was possible to develop a list of Impact Enhancing Elements (IEEs) and Impact Hindering Elements (IHEs). In addition, there are also a number of factors that seem to have little effect on program impact (Impact Neutral Elements). A summary of these different elements may be found in Table 26.

Element Type	Element	Rationale
Impact Enhancing Elements (IEE)	<ul style="list-style-type: none"> Targeting younger age groups 	Younger age groups were shown to have levels of interest that could change significantly.
	<ul style="list-style-type: none"> Hands-on activities 	Students displayed high levels of engagement during the CSIRO program activities. Students at Healesville also enjoyed hands-on interactions.
	<ul style="list-style-type: none"> Short duration activities 	Longer program parts experienced declining student interest in most programs.
	<ul style="list-style-type: none"> Targeting female students 	Results indicated that female participants can have their interest in science affected by the CSIRO programs.
Impact Neutral Elements (INE)	<ul style="list-style-type: none"> Strong central theme (being placed in the role of a scientist) 	Although present in the Healesville program, this element in the CSIRO programs was not shown to have a significant effect on student interest in science.
Impact Hindering Elements (IHE)	<ul style="list-style-type: none"> Targeting older age groups 	Older age groups did not experience changes in interest at any time point surveyed. Researchers have also claimed that science attitudes are largely determined by these older ages.
	<ul style="list-style-type: none"> Long presentations without demonstrations 	Students demonstrated steadily declining interest during presentations for both the CSIRO and Healesville programs. Demonstrations usually helped rekindle some engagement.
	<ul style="list-style-type: none"> Targeting male students 	Science interest among male students remained unaffected by the CSIRO programs.

Table 26 – Program elements that enhance, hinder, or are neutral to program impact.

Additional analysis from different student cohorts based on the Victorian study afforded the opportunity to understand the scientific demographic of students participating in the CSIRO programs. The distribution of cohorts among the students we studied was different from the distribution of cohorts found in the Victorian study. Understanding this distribution helps the CSIRO gain a better picture of what their target audience actually is. As a result, they can work to develop their programs in a manner that helps cater to the majority cohorts participating in the CSIRO programs. Based on the participant distribution, the largest number of students was neutral about science and did not seek information about science. The next largest group consisted of students who were interested in science, seek information, and understand it. Together, these two cohorts account for over half of the program participants. Unfortunately, these two groups are different in their interest towards science and their desire to seek information, making it difficult to find program improvements that will cater to both groups.

3.4.4 CSIRO Program Recommendations

The results of our study suggest that the CSIRO programs are meeting their specified goals to encourage interest in science. Students across all programs ranked their interest in science significantly higher immediately following the CSIRO program than prior to the program. Students' assessment of their interest, on average, did decrease in the week following the CSIRO program, but not significantly. This suggests that follow-up activities in the week following the program may be a factor in retaining student interest.

Further aims of specific programs to introduce students to specific concepts were also investigated in this study. For *Forensic Frenzy*, *Nanotechnologies*, and *Cool Chemical Science*, a list of topics that students should have learned throughout the program were compared to what students actually

thought they learned during the program. A list of the topics that were learned about least for each program is in Table 27.

Program	Topic
<i>Forensic Frenzy</i>	<ul style="list-style-type: none"> • Chromatography • Fibre Analysis • Soil Analysis
<i>Nanotechnologies</i>	<ul style="list-style-type: none"> • Energy • Issues with Nanotechnology • Detecting small things
<i>Cool Chemical Science</i>	<ul style="list-style-type: none"> • Physical Properties of Materials • Reactions • Effect of light on reactions

Table 27 – Topics with the least number of responses to the question "I learned about the following topics today."

With regard to program-specific goals about topics students will learn during the program, additional emphasis on the topics listed in Table 27 would likely help improve student understanding in these areas. In many cases, each of these specific topics was directly linked to experiments, but some topics were not as directly linked. Improving the linkages from topics to specific experiments could also help improve student understanding of important topics.

Other general program recommendations result from program changes that correspond to impact-related elements outlined in Table 27. By increasing the presence of Impact Enhancing Elements (IEEs) and working to decrease the presence of Impact Hindering Elements (IHEs), the CSIRO programs could potentially have a greater positive impact on students. Some of these elements, especially those related to gender and age, must be considered with care. Although the CSIRO programs were found to be more effective among females and younger age groups, it is not to say that the CSIRO programs should only target these groups. Rather, the CSIRO should be aware of these high impact groups to ensure that future changes do not bias programs away from these groups. Although the current structure of many CSIRO programs do not have many long and tedious activities, it is important to keep this element in mind when designing and modifying

program experiments and activities. The presence of a strong central theme in a program does not seem to increase its effectiveness on students. Although this element was seen in the Healesville program, our data did not suggest that the CSIRO should incorporate this element into their programs.

CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

4.0 Development and Implementation of Data Collection Methods

Our study developed and implemented a variety of assessment techniques. Working with materials from the previous WPI assessment team, we were able to develop surveys, observational rubrics, and interview questions to collect data. Following their development, these techniques were successfully implemented for four different CSIRO programs and a number of different schools and age groups. The implementation of these techniques, however, did reveal some minor drawbacks. To prevent students from copying responses on surveys, students were only asked for their date of birth as opposed to their name. Although designed for five minutes, some survey periods would last longer, indicating that surveys were too long. The proposed follow-up schedule also proved difficult to accommodate in busy school schedules, and only one-week follow-ups were feasible in many cases. During observational periods, keeping track of individual students provided data useful for further analysis, but was also difficult to execute in some hectic classrooms. Despite these drawbacks, the study yielded a large amount of useful data to be entered and analyzed.

4.1 Development of Data Storage Frameworks

In order to accommodate the large quantities of data collected, we successfully developed a database using Microsoft Excel. This database allowed for efficient and accurate entry of data from student survey forms into an electronic format to be prepared for analysis. To accommodate multiple surveys by one student, the database was able to effectively store all survey data from a single student in an easy-to-reference format using convenient interfaces. This facilitated entering survey results for a student at multiple times as they completed surveys. Functions for searching and

updating records helped in this process. Although the database development was successful in our study, the programming knowledge required for its expansion and the time-consuming nature of this process are important factors to consider.

4.2 Analysis of Data

The in-depth analysis of survey, observation, and interview results provided many insights into the impact of the CSIRO programs. Initial analysis investigated the impact of all CSIRO programs on student interest before, immediately after, and one week after the program. On a scale from one to seven, the overall mean score for initial interest in science was $\bar{x} = 4.65$, $STDV = 1.36$. Over the course of the programs, students displayed significantly higher interest in science immediately following the CSIRO programs ($t = -2.148$, $p = 0.033$). Student interest declined one week after the programs to a statistically similar level as immediately post-program interest ($t = 1.818$, $p = 0.071$). This indicates that the CSIRO programs may have a short-term effect on participants, but that the effect may fade away in the week following the program.

It is important to note that although the difference in interest level was statistically significant, the actual average difference between PR and P1 interest scores was 0.18 ($\bar{x}_{PR} = 4.652$, $SD_{PR} = 1.583$, $\bar{x}_{P1} = 4.831$, $SD_{P1} = 1.641$). Accordingly, it is relevant to consider whether this statistical change in students' interest translates into behavioral changes in their interest in science. Determining the nature of the results that led to this increase in science interest is important to understanding the behavioral significance of the result. By looking at the distribution of changes in interest scores (see APPENDIX F), a number of students exhibited no change in interest, with only a few more students exhibiting small increases than those with small decreases. Furthermore, the largest groups of students apart from those experiencing no change were groups that experienced

either slightly positive or negative change. It is possible to infer that the students only exhibit small increases in science interest, if any positive change is seen at all. Behaviorally, this would indicate that students who do experience positive increases in science interest only exhibit it to a limited degree. Although it is difficult to determine precisely how interest scores would translate into behavioral differences, it is likely that increase in interest scores do not lead to significantly improved behaviors for interest with regard to science.

To investigate student attitudes towards science, combined TOSRA scores from pre-program, immediate post-program, and one-week follow-up surveys were analyzed. Overall the students' TOSRA scores, on a scale from -12 to 12, ($\bar{x} = 3.24$, $STDV = 3.98$) indicated a slightly positive attitude toward science⁸. Figure 34 indicates how the average TOSRA score from surveyed students compares to the full range of possible TOSRA scores:

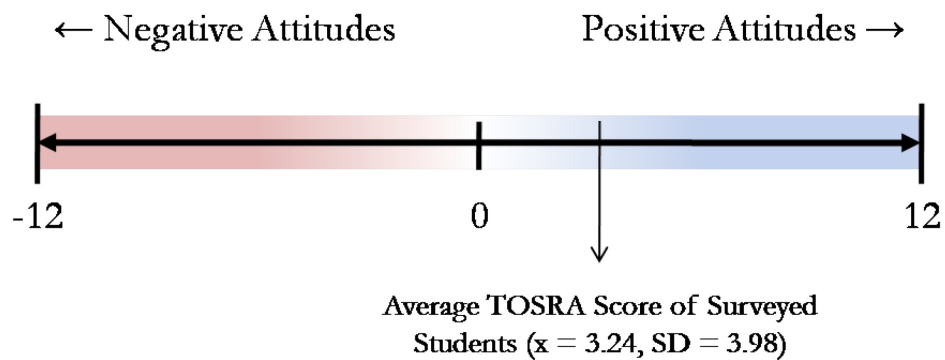


Figure 34 – Continuum of combined PR TOSRA scores. Scores range from -12 (strongly negative attitude towards science) to 12 (strongly positive attitudes towards science). A score of zero indicates a neutral view towards science.

After analyzing student interest over all programs, further investigation using cohorts yielded important results. Male and female students were shown to have significantly different interest in science prior to the programs, with boys having higher scientific interest ($t = 2.419$, $p = 0.016$). Both immediately following the program ($t = 1.084$, $p = 0.279$) as well as one week following the

⁸ Refer to page 82 for further details on TOSRA score determination.

programs ($t = 1.045$, $p = 0.297$), males and females showed no significant difference in interest, with female interest in science increasing. This indirectly suggested that the programs may be affecting girls positively more than it affects boys. When looking at program perceptions, however, both boys and girls ranked the overall program similarly.

Different age groups were also analyzed to determine the impact they experienced as a result of the CSIRO programs. It is important to note that the age groups investigated in this analysis participated in different programs. As a result, age was not the only independent variable present when investigating changes in interest. Removing these other variables, however, would have required that participants of different age groups experience identical programs. This type of controlled experiment would be unrealistic for the CSIRO to execute, as different programs are generally targeted to different age groups. With these limitations in mind, tentative conclusions and insight into the effect of age on the CSIRO program impact were made.

Based on the work of previous researchers, groups were divided into 11-14 years of age and 15-18 years of age. Students in the younger age group showed no significant change in interest following the program ($t = -0.810$, $p = 0.420$), but did show a significant decline in interest in the week following the program ($t = 2.742$, $p = 0.009$). This corroborated previous research in the field that suggested student opinions on interest in science are still being developed from the ages of 10-14. Students in the 15-18 year old age group showed no significant change in interest either immediately following the program ($t = -1.767$, $p = 0.079$) or a week following the program ($t = 0.513$, $p = 0.609$) suggesting that their interest in science might not be as affected by the CSIRO program as those in younger age groups. When comparing the two age groups based on pre-program interest in science, younger students exhibited significantly higher interest in science compared to older age groups.

Investigation into the strong central theme for the CSIRO programs was conducted on *Forensic Frenzy*, a program which places students in the role of a forensic scientist. Results indicated that the *Forensic Frenzy* program did not significantly improve interest among participants ($t = 0.579$, $p = 0.564$). Results from studying *Cool Chemical Science* (no central theme) suggest that the program also does not cause a significant interest in science immediately following the program ($t = -1.680$, $p = 0.097$). The nature of the results suggests that further study regarding the effect of the central theme is necessary. This could include investigating a larger number of students.

To compare the CSIRO's target audience to the general adult population of Victoria, respondents were divided into six cohorts based on varying interest levels in science and desire to seek scientific information. Compared to the cohort division among Victorians 19 years of age or older (page 92) the CSIRO's target population is different with regards to the distribution of cohorts. Students who were interested in and sought information about science, along with students of neutral interest that do not seek information about science comprise over half of the CSIRO program participants surveyed. This indicates that the CSIRO is mainly targeting students already interested in science, or students that do not have a strong opinion about science.

Observational data collected during the CSIRO programs yielded important results concerning each different section of the programs. Measures of student concentration and engagement significantly increased at the beginning of the hands-on activities portion of the program. Although some programs exhibited different behaviors, student levels of concentration and engagement either remained the same throughout the final presentation, or decreased. In each part of the program, however, student engagement and concentration steadily declined as time increased. These results suggest that shorter program activities would be best at maintaining student attention rather than increasing the length of activities.

Responses from teacher interviews indicated that teachers particularly liked the hands-on aspect of the CSIRO programs. We also determined that many of the teachers booked the CSIRO's programs for this reason. Many teachers also believed that the programs integrated well into their curriculum.

4.3 Recommendations to the CSIRO

The results of our study indicated that the CSIRO programs are generally successful in improving student interest in science for a short-term period. Based on investigation of cohorts within our study, we were able to determine several elements that enhance, hinder, or are neutral to the program's impact on student interest in science. These factors dealt with elements of gender, age, strong central theme, and temporal program structure. Based on these factors, program recommendations dealt with ensuring that programs can effectively target female students and students from ages 11-14. Ensuring that activities are not long and tedious and that no part of the program continues for an excessive period of time were recommendations based on observational conclusions. The presence of a strong central theme did not seem to have a significant effect on the program's impact, suggesting that its presence is not critical.

An appreciation for the degree of robustness in our analyses affords a greater understanding into the importance of our recommendations. The program recommendations were made based on a number of different analyses looking into how different independent variables (i.e. age, gender, etc) affected the CSIRO program's ability to impact student interest in science. Independent variables such as age, for example, were investigated from samples that included large ranges in age, schools, and programs. Accordingly, the results of this analysis could be considered more robust than the results of age analysis, which did not experience the same range of programs or schools. Further investigation into the effects of age on the impact of the CSIRO programs could be useful,

particularly with respect to investigating possible effects under more controlled settings.

Recommendations arising from observational studies were based on analyses across all programs, suggesting that the data from which tentative conclusions made were also reasonable. However, recommendations based on observational results were made from qualitative analysis, not rigorous statistical analysis. Resulting recommendations, therefore, are based on general observation trends. Further study using observational techniques should incorporate the ability to complete rigorous statistical analyses on resulting data. Although many of the recommendations in this study were based on robust methods, the success of implementing these recommendations cannot be determined in this study.

4.4 Recommendations for Further Study

Based on the findings of this study, there are several areas of further investigation that we recommend to the CSIRO. Some topics for further study result directly from and would build on our findings, whereas others are interesting factors relevant to the CSIRO programs not covered in this study. For each topic, a few potential research questions have been developed. Determining answers to these questions can help serve as a guide for the CSIRO as they continue to offer and improve their non-formal science education programs. Suggestions for investigation based on our experiences help provide a guide with which future research teams and the CSIRO can investigate these topics. Detailed lists of items for further research based on our findings and the CSIRO's goals can be found in Table 28 and Table 29, respectively.

Topic of Investigation	Research Questions	Rationale	Suggestions for Investigation
Strong Central Theme	<ul style="list-style-type: none"> • Does a strong central theme help increase a program’s impact on student interest in science? • Does the strong central theme help increase student knowledge of science? • Are students more engaged in the program as a result of the strong central theme? 	The presence of a strong central theme in the Healesville <i>Keeper for a Day</i> program prompted our investigation of the role of a strong central theme in the CSIRO’s programs. Analysis yielded inconclusive results, indicating that a more rigorous study focused on this element would be appropriate to determine whether it has a positive or negative impact.	Focusing a study on only two programs (one with a strong central theme and one without) could help in further determining the impact of a strong central theme. Based on our experience, a large sample sizes may yield more accurate results.
Gender and Program Impact	<ul style="list-style-type: none"> • Do males and females differ in their behavior throughout the program? 	Analysis of gender in this study provided recommendations based on survey responses. Understanding gender differences with regard to behavior during the program could be the basis for further recommendations.	In addition to further analyzing differences in survey responses, observations focused on male and female behavior throughout the program may determine whether different parts of the program affect males and females differently.
Age and Program Impact	<ul style="list-style-type: none"> • Are different age groups affected differently by similar programs? 	A study of program impact and age using similar programs provides a strong basis for recommendations. Results of our study indicated that age may be a notable factor affecting program impact, thus further study is key to providing further recommendations.	A study of different age groups participating in similar programs may further determine the importance of age with regard to program impact.
Topics Learned in the Programs	<ul style="list-style-type: none"> • To what extent do students learn specific topics related to the program subject? 	Having students learn topics related to the program is a tertiary goal for the CSIRO. Analyzing the <i>extent</i> to which students learned these topics could provide recommendations aimed at improving student learning during the programs.	In addition to asking whether students learned program-related topics, comprehension questions related to these topics could be asked.
Program Structure	<ul style="list-style-type: none"> • Do students exhibit <i>significantly</i> different levels of interest, boredom, etc during different parts of the program? 	Our study qualitatively investigated different behaviors over the course of the program. The ability to perform rigorous statistical analyses on observational results would provide greater support for recommendations based on observations.	Tracking individual students throughout the entirety of the programs would allow for statistical analyses to be appropriately conducted.

Table 28 – Topics for further study based on our findings

Topic of Investigation	Research Questions	Rationale	Suggestions for Investigation
Importance of Follow-up	<ul style="list-style-type: none"> Do activities/assignments related to the CSIRO program following their visit help increase student interest/knowledge of science or the subject? 	<p>Determining whether follow-up activities and assignments following the CSIRO's visit enhance the program's impact could be useful in providing suggestions for teachers.</p>	<p>Investigation of different classes experiencing identical CSIRO program with or without follow-up activities may determine differences in student interest and knowledge following the program.</p>
Conceptual Learning	<ul style="list-style-type: none"> Do the programs improve student comprehension of major concepts related to the program subject? 	<p>Determining the extent to which student comprehension of the topics within a program relate to their awareness of the overall program subject may assist the CSIRO in determining how students use the information learned in the programs to develop their understanding of the subject as a whole.</p>	<p>The use of concept-mapping in an in-depth study of students' understanding of concepts presented within the program and their relation to one another may suggest how students synthesize the information presented in the programs (i.e. link concepts together).</p>

Table 29 – Topics for further study based on the CSIRO's goals

4.4.1 Recommendations for Study Methodologies

Based on our experience, we would recommend that future studies using surveys design them in a way that allows for easy data collection, entry, and analysis. Our study used surveys that contained a mix of quantitative and open-response questions. When analyzing study results, survey results based on quantitative data provided robust results from which conclusions could be drawn. This is because these results provided raw quantitative results on which rigorous statistical analyses could be performed. Although open-response questions provide a lot of information, extracting useful inferences from them can be particularly challenging, because of the large variation in responses. Accordingly, the conclusions made from these results resulted from extensive statistical analyses. Performing this type of rigorous statistical analyses on raw open-response questions results would have been impossible, and the use of post-hoc categories provided difficulties with respect to obtaining accurate, unbiased results. Developing surveys containing multiple-choice questions to investigate the same topics, for example, could provide similar information to open-response questions. Based on our experience, responses to multiple choice questions would be much easier to analyze using statistical methods.

Our study of program structure focused on observational data collected throughout the course of the CSIRO programs. Analysis of these results was primarily qualitative, but rigorous statistical analyses on these results proved to be difficult. Although attempts at statistical analyses were made (see APPENDIX I), issues regarding pseudo-replication of data prevented us from drawing appropriate conclusions from the results. Full analysis using rigorous statistical methods would require tracking individual students throughout the entirety of the program for different behaviors. Further study using observational techniques could use this suggestion to collect appropriate data for rigorous statistical analysis.

Our experience with interviews revealed that teachers are not always able to participate in an interview. In addition, they appeared to offer more detailed responses when filling out the interview sheets than when asked the questions verbally. Thus, the use of questionnaires to gather teacher's opinions of the programs may provide more detailed and useful information.

Implementing these recommendations for research methodologies could provide future research teams with the ability to perform rigorous analyses on a greater number of areas relating to the impact of the CSIRO programs.

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APPENDIX A CSIRO Feedback Forms

I

PROGRAM EVALUATION



Your comments are valued and will help us continue to develop programs that are relevant to the needs of teachers. Your assistance by filling in this evaluation is greatly appreciated.

SCHOOL NAME: _____ POSTCODE: _____

TEACHER'S NAME (optional): _____

EMAIL (optional): _____

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

PROGRAM: _____

DATE OF PROGRAM: _____ NAME OF PRESENTER: _____

	strongly agree	agree	neutral	disagree	strongly disagree
1. The program was engaging					
2. The program was educational					
3. The program encouraged student participation					
4. The program related well to the curriculum/learning unit					
5. The program is likely to encourage students to think about a career in science					
6. The program helped students understand the value of scientific research					
7. The program format, activities were appropriate for this age group					
8. The program support materials were useful (if applicable)					
9. The program is likely to have a lasting positive impact on the students					
10. Program cost was appropriate					
11. I would use this program again					
12. This program was easy to book (booking teacher only)					
13. This program was easy to host (travelling programs) (booking teacher only)					

14. Overall score for Program out of 10; 10 = excellent, 5 = average, 0 = unacceptable / 10

15. What were the best features of the program?

16. What features could have been improved?

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

Please fax or mail to:
 The Manager
 CSIRO Education, Victoria
 PO Box 56 Highett Vic 3190
 Fax: (03) 9252 6256

APPENDIX B Surveys Developed by Our Team

Name: _____

Date of Birth: ___/___/____



1. Science is important.
Strongly Agree | Agree | Impartial | Disagree | Strongly Disagree

Why?

2. Which best describes your interest in science?

(Please tick one in each category)

- | | | |
|---|--|--|
| <p>General Interest (tick one)</p> <ul style="list-style-type: none"> <input type="radio"/> I am <u>interested</u> in science. <input type="radio"/> I am <u>neutral</u> about science. <input type="radio"/> I am <u>not interested</u> in science. | <p>Seeking Information (tick one)</p> <ul style="list-style-type: none"> <input type="radio"/> I <u>do</u> look for information about science. <input type="radio"/> I <u>do not</u> look for information about science. | <p>Understanding (tick one)</p> <ul style="list-style-type: none"> <input type="radio"/> I <u>do</u> understand/find the information I look for. <input type="radio"/> I <u>do not</u> understand/find the information I look for. |
|---|--|--|

3. Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)

	1	2	3	4	5	6	7
I would prefer to learn something on my own rather than have it taught to me.							
I am interested in science.							
My scientific knowledge is from what I have learned in class.							
I would not enjoy a career in science.							
I am interest learning about new technologies.							
I have a strong knowledge of science.							
Science can make positive contributions to our lives.							
I have a strong knowledge of the environment/biodiversity.							
I am more interested in science now than I was a month ago.							
I am interested in figuring out how the items I use everyday work/function.							

4. Do you plan to do VCE? If so, what subjects?

5. What has been your favourite topic in science?

6. What is biodiversity?

7. What is the environment? Please explain using your own words.

8. Why is biodiversity important?

9. What are some major problems/issues dealing with the environment today?

10. List 3 to 4 words/phrases that you associate with the environment/biodiversity.

<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>

1. Date of Birth: ___ / ___ / ____

2. Is English your first language? Yes ___ No ___
If not, what is? _____

3. Gender: ___ Male ___ Female

4. Thinking about your knowledge and interest in the subjects listed below, please rate each one on a 7 point scale where "1" means you have a low interest or knowledge, and "7" means you have a high interest or knowledge.

1 (the lowest) <----- 4(moderate) -----> 7 (the highest)

	1	2	3	4	5	6	7
Your knowledge of science							
Your knowledge of chemistry							
Your interest in science and technology							
Your interest in new technologies							
Your interest in how the items you use in everyday life function/work							

5. Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)

	1	2	3	4	5	6	7
It is better to be told scientific facts than to find them out from experiments.							
Science can help make our lives better.							
A job as a scientist would be interesting.							
I do not enjoy learning about science outside of school.							

6. Which best describes the field in which your parents work? Tick all that apply.

- Business
- Government
- Agriculture
- Science/Engineering
- Construction
- Tradesperson
- Health
- Education
- Other: _____

7. What are your current career interests? (Please tick all that apply)

- Business
- Government
- Agriculture
- Science/Engineering
- Construction
- Tradesperson
- Health
- Education
- Other: _____

8. What does a Chemist do?

9. What problems do Chemists help solve?

10. List a few words/phrases that you would associate with Chemistry:

30	
----	--

Date of Birth: _ / _ / _ _ _ _

Cool Chemical Science



1. Science is important.

Strongly Agree | Agree | Impartial | Disagree | Strongly Disagree

Why?

2. What do Chemists do?

3. Name a few industries that Chemists can work in:

4. What problems might Chemists try to solve?

5. What school subjects are you best at? (please circle)

- | | |
|--------------------|--------------|
| English | Mathematics |
| Social Studies | Science |
| Art | Sport |
| LOTE | History |
| Physical Education | Other: _____ |

6. What, if anything, did you particularly like about CSIRO's program? Why?

7. What, if anything, did you particularly dislike about CSIRO's program? Why?

8. Please rate the following parts of the Cool Chemical Science program. A "1" means you did not like that part of the program, and a "7" means you did like that part of the program.

Strongly Disliked (1) ← Neutral (4) → Strongly Liked (7)

	1	2	3	4	5	6	7
Hands-on Activities							
Thinking about observations							
Assistance with experiments							
Initial/final presentation							
Overall Program							

9. I learned about the following topics today (please tick all that apply):

- | | | |
|---------------------------------------|--|--|
| <input type="radio"/> Acids and Bases | <input type="radio"/> Physical changes of materials | <input type="radio"/> Water absorbing materials |
| <input type="radio"/> Reactions | <input type="radio"/> Physical properties of materials | <input type="radio"/> Effect of light on reactions |

10. Rate your overall interest in the following science-related materials. Please use a 7 point scale, where 1 means "not at all interested" and 7 means "extremely interested". If you've never heard of it, tick 0.

(1) Not at all interested ← → (7) Extremely Interested

Science Media	0	1	2	3	4	5	6	7
Television (Discovery Channel, National Geographic, Mythbusters, Scope, etc)								
Print (Newspaper, Cosmos, The Helix, etc)								
Online (CSIRO.au, ABC Science, etc)								
Live (CSIRO Programs, zoos, aquariums, museums, etc)								

11. Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)

	1	2	3	4	5	6	7
I would prefer to learn something on my own rather than have it taught to me.							
I am interested in science.							
My scientific knowledge is from what I have learned in class.							
I would not enjoy a career in science.							
I am interested in learning about new technologies.							
I have a strong knowledge of science.							
Science can make positive contributions to our lives.							
I have a strong knowledge of chemistry.							
I am interested in figuring out how the items I use everyday work/function.							

P
1

Date of Birth: _/ _/ _



1. Which best describes your interest in science?

(Please tick one in each category)

- | | | |
|--|---|---|
| General Interest (tick one) | Seeking Information (tick one) | Understanding (tick one) |
| <input type="radio"/> I am <u>interested</u> in science. | <input type="radio"/> I <u>do</u> look for information about science. | <input type="radio"/> I <u>do</u> understand/find the information I look for. |
| <input type="radio"/> I am <u>neutral</u> about science. | <input type="radio"/> I <u>do not</u> look for information about science. | <input type="radio"/> I <u>do not</u> understand/find the information I look for. |
| <input type="radio"/> I am <u>not interested</u> in science. | | |

2. Thinking about your knowledge and interest in the subjects listed below, please rate each one on a 7 point scale where "1" means you have a **low interest or knowledge**, and "7" means you have a **high interest or knowledge**.

1 (the lowest) <----- 4 (moderate) -----> 7 (the highest)

	1	2	3	4	5	6	7
Your knowledge of science							
Your knowledge of chemistry							
Your interest in science and technology							
Your interest in new technologies							
Your interest in how the items you use in everyday life function/work							

3. What has been your favourite topic in science?

4. What school subjects do you like best? (Please tick all that apply).

- | | | | | |
|---|-------------------------------|---|----------------------------------|---------------------------------------|
| <input type="checkbox"/> English | <input type="checkbox"/> Art | <input type="checkbox"/> Physical Education | <input type="checkbox"/> Science | <input type="checkbox"/> History |
| <input type="checkbox"/> Social Studies | <input type="checkbox"/> LOTE | <input type="checkbox"/> Mathematics | <input type="checkbox"/> Sport | <input type="checkbox"/> Other: _____ |

5. If you can, please name one experiment you did with CSIRO last week.

6. What stands out most in your mind about the CSIRO Cool Chemical Science program from last week?

7. List a few words/phrases that you would associate with Chemistry:

8. Consider the following statements and the degree to which you agree with them, with "1" being **strongly disagree** and "7" being **strongly agree**.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)

	1	2	3	4	5	6	7
It is better to be told scientific facts than to find them out from experiments.							
Science can help make our lives better.							
A job as a scientist would be interesting.							
I do not enjoy learning about science outside of school.							

P	
2	

Name: _____

Date of Birth: _/ _/ _

Cool Chemical Science



1. Science is important.
Strongly Agree | Agree | Impartial | Disagree | Strongly Disagree

Why?

2. Thinking about your knowledge and interest in the subjects listed below, please rate each one on a 7 point scale where "1" means you have a low interest or knowledge, and "7" means you have a high interest or knowledge.

1 (the lowest) <— 4(moderate) —> 7 (the highest)

	1	2	3	4	5	6	7
Your knowledge of science							
Your knowledge of chemistry							
Your interest in science and technology							
Your interest in new technologies							
Your interest in how the items you use in everyday life function/work							

3. Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)

	1	2	3	4	5	6	7
It is better to be told scientific facts than to find them out from experiments.							
Science can help make our lives better.							
A job as a scientist would be interesting.							
I do not enjoy learning about science outside of school.							

4. Do you plan to do VCE? If so, what subjects?

5. What has been your favourite topic in science?

6. What do chemists do?

7. What problems might chemists help solve?

8. What do you remember from the CSIRO Cool Chemical Science program?

9. List 3 to 4 words/phrases that you associate with chemistry.

Date of Birth: _ / _ / _ _ _ _

Forensic Frenzy



- Gender: Male Female
- Is English your first language? Yes ___ No ___
If not, what is? _____
- Thinking about your knowledge and interest in the subjects listed below, please rate each one on a 7 point scale where "1" means you have a low interest or knowledge, and "7" means you have a high interest or knowledge.

1 (the lowest) <--- 4(moderate) ---> 7 (the highest)

	1	2	3	4	5	6	7
Your knowledge of science							
Your knowledge of forensics							
Your interest in science and technology							
Your interest in new technologies							
Your interest in how the items you use in everyday life function/work							

- Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)

	1	2	3	4	5	6	7
It is better to be told scientific facts than to find them out from experiments.							
Science can help make our lives better.							
A job as a scientist would be interesting.							
I do not enjoy learning about science outside of school.							

- Which best describes the field in which your parents work? (Please tick all that apply)

- Business
- Government
- Agriculture
- Science/Engineering
- Construction
- Tradesperson
- Health
- Education
- Other: _____

- What are your current career interests? (Please tick all that apply)

- Business
- Government
- Agriculture
- Science/Engineering
- Construction
- Tradesperson
- Health
- Education
- Other: _____

- What does a Forensic Scientist do?

- What branches of science would Forensic Scientists use?

- What kinds of crimes do Forensic Scientists help solve?

- What are 4 words/phrases that you associate with Forensic Science?

P	
R	

Date of Birth: _ / _ / _ _ _ _

Forensic Frenzy



1. Is science important?
Strongly Agree | Agree | Impartial | Disagree | Strongly Disagree

Why?

2. What do Forensic scientists do?

3. What branches of science would Forensic Scientists use?

4. What crimes might Forensic Scientists investigate?

5. What school subjects are you best at?
(please tick all that apply)

- English
- Social Studies
- Art
- LOTE
- Physical Education
- Mathematics
- Science
- Sport
- History
- Other: _____

7. Please rate the following parts of the Forensic Frenzy Program:
Strongly Disliked (1) ← Neutral (4) → Strongly Liked (7)

	1	2	3	4	5	6	7
Hands-on Activities							
Thinking about observations							
Assistance with experiments							
Initial/final presentation							
Overall Program							

6. Do you plan to do VCE? If so, what subjects?

8. What, if anything, did you particularly like about CSIRO's program? Why?

9. What, if anything, did you particularly dislike about CSIRO's program? Why?

10. Rate your overall interest in the following science-related materials. Please use a 7 point scale, where 1 means "not at all interested" and 7 means "extremely interested". If you've never heard of it, tick 0.

	(1) Not at all interested	←	→	Extremely Interested (7)	0	1	2	3	4	5	6	7
Television (Discovery Channel, National Geographic, Mythbusters, Scope, etc)												
Print (Newspaper, Cosmos, The Helix, etc)												
Online (CSIRO.au, ABC Science, etc)												
Live (CSIRO Programs, zoos, aquariums, museums, etc)												

11. Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

	Strongly Disagree (1)	←	Neutral (4)	→	Strongly Agree (7)	1	2	3	4	5	6	7
I would prefer to learn something on my own rather than have it taught to me.												
I am interested in science.												
My scientific knowledge is from what I have learned in class.												
I would not enjoy a career in science.												
I am interest learning about new technologies.												
I have a strong knowledge of science.												
Science can make positive contributions to our lives.												
I have a strong knowledge of forensics.												
I am interested in figuring out how the items I use everyday work/function.												

P
1

Date of Birth: _/ _/ _

Forensic Frenzy



1. Which best describes your interest in science?

(Please tick one in each category)

- | | | |
|--|---|---|
| General Interest (tick one) | Seeking Information (tick one) | Understanding (tick one) |
| <input type="radio"/> I am <u>interested</u> in science. | <input type="radio"/> I <u>do</u> look for information about science. | <input type="radio"/> I <u>do</u> understand/find the information I look for. |
| <input type="radio"/> I am <u>neutral</u> about science. | <input type="radio"/> I <u>do not</u> look for information about science. | <input type="radio"/> I <u>do not</u> understand/find the information I look for. |
| <input type="radio"/> I am <u>not interested</u> in science. | | |

2. I learned about the following topics during the CSIRO Forensic Frenzy Program (tick all that apply):

- | | | |
|--|--|---|
| <input type="radio"/> Different types of Forensics | <input type="radio"/> Chromatography (with ink) | <input type="radio"/> Soil Analysis |
| <input type="radio"/> Fingerprint Analysis | <input type="radio"/> Blood/DNA Analysis | <input type="radio"/> Fluorescent Oils |
| <input type="radio"/> Fibre Analysis | <input type="radio"/> Ballistics (analyzing bullets) | <input type="radio"/> How Forensics is used to solve crimes |

3. Thinking about your knowledge and interest in the subjects listed below, please rate each one on a 7 point scale where "1" means you have a low interest or knowledge, and "7" means you have a high interest or knowledge.

1 (the lowest) <--- 4(moderate) ---> 7 (the highest)

	1	2	3	4	5	6	7
Your knowledge of science							
Your knowledge of Forensics							
Your interest in science and technology							
Your interest in new technologies							
Your interest in how the items you use in everyday life function/work							

4. What has been your favourite topic in science?

5. What school subjects do you like best? (Please tick all that apply).

- | | | | | |
|---|-------------------------------|---|----------------------------------|---------------------------------------|
| <input type="checkbox"/> English | <input type="checkbox"/> Art | <input type="checkbox"/> Physical Education | <input type="checkbox"/> Science | <input type="checkbox"/> History |
| <input type="checkbox"/> Social Studies | <input type="checkbox"/> LOTE | <input type="checkbox"/> Mathematics | <input type="checkbox"/> Sport | <input type="checkbox"/> Other: _____ |

6. If you can, please name one experiment you did with CSIRO last week.

7. What stands out most in your mind about the CSIRO Forensic Frenzy program from last week?

8. List a few words/phrases that you would associate with Forensics:

9. What physical characteristics can be used to identify a suspect?

10. Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)

	1	2	3	4	5	6	7
It is better to be told scientific facts than to find them out from experiments.							
Science can help make our lives better.							
A job as a scientist would be interesting.							
I do not enjoy learning about science outside of school.							

Name: _____

Date of Birth: _/ _/ _

Forensic Frenzy



1. Science is important.
Strongly Agree | Agree | Impartial | Disagree | Strongly Disagree

Why?

2. Which best describes your interest in science?

(Please tick one in each category)

- | | | |
|--|---|---|
| General Interest (tick one) | Seeking Information (tick one) | Understanding (tick one) |
| <input type="radio"/> I am <u>interested</u> in science. | <input type="radio"/> I <u>do</u> look for information about science. | <input type="radio"/> I <u>do</u> understand/find the information I look for. |
| <input type="radio"/> I am <u>neutral</u> about science. | <input type="radio"/> I <u>do not</u> look for information about science. | <input type="radio"/> I <u>do not</u> understand/find the information I look for. |
| <input type="radio"/> I am <u>not interested</u> in science. | | |

3. Consider the following statements and the degree to which you agree with them, with "1" being **strongly disagree** and "7" being **strongly agree**.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)

	1	2	3	4	5	6	7
I would prefer to learn something on my own rather than have it taught to me.							
I am interested in science.							
My scientific knowledge is from what I have learned in class.							
I would not enjoy a career in science.							
I am interest learning about new technologies.							
I have a strong knowledge of science.							
Science can make positive contributions to our lives.							
I have a strong knowledge of the Forensics.							
I am more interested in science now than I was a month ago.							
I am interested in figuring out how the items I use everyday work/function.							

4. Do you plan to do VCE? If so, what subjects?

5. What has been your favourite topic in science?

6. What do forensic scientists do?

7. Why is Forensics important?

8. What topics of science would a forensic scientist use?

9. List 3 to 4 words/phrases that you associate with Forensics.

Date of Birth: _ / _ / _ _ _ _

Nanotechnologies



- Gender: Male Female
- Is English your first language? Yes ___ No ___
If not, what is? _____
- Thinking about your knowledge and interest in the subjects listed below, please rate each one on a 7 point scale where "1" means you have a low interest or knowledge, and "7" means you have a high interest or knowledge.

1 (the lowest) ← 4 (moderate) → 7 (the highest)

	1	2	3	4	5	6	7
Your knowledge of science							
Your knowledge of nanotechnology							
Your interest in science and technology							
Your interest in new technologies							
Your interest in how the items you use in everyday life function/work							

- Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)

	1	2	3	4	5	6	7
It is better to be told scientific facts than to find them out from experiments.							
Science can help make our lives better.							
A job as a scientist would be interesting.							
I do not enjoy learning about science outside of school.							

- Which best describes the field in which your parents work? (Please tick all that apply)

- | | | |
|-----------------------------------|---|------------------------------------|
| <input type="radio"/> Business | <input type="radio"/> Science/Engineering | <input type="radio"/> Health |
| <input type="radio"/> Government | <input type="radio"/> Construction | <input type="radio"/> Education |
| <input type="radio"/> Agriculture | <input type="radio"/> Tradesperson | <input type="radio"/> Other: _____ |

- What are your current career interests? (Please tick all that apply)

- | | | |
|-----------------------------------|---|------------------------------------|
| <input type="radio"/> Business | <input type="radio"/> Science/Engineering | <input type="radio"/> Health |
| <input type="radio"/> Government | <input type="radio"/> Construction | <input type="radio"/> Education |
| <input type="radio"/> Agriculture | <input type="radio"/> Tradesperson | <input type="radio"/> Other: _____ |

- What is Nanotechnology?

- What topics of science does nanotechnology use?

- What are 4 words/phrases that you associate with Nanotechnology?

<input type="text"/>	<input type="text"/>
----------------------	----------------------

<input type="text"/>	<input type="text"/>
----------------------	----------------------

Date of Birth: _ / _ / _ _ _ _

Nanotechnologies



1. Is science important?
Strongly Agree | Agree | Impartial | Disagree | Strongly Disagree

Why?

2. What is nanotechnology?

3. What topics of science does nanotechnology use?

4. I learned about the following topics today (please tick all that apply):
 The size of nanoparticles Detecting small things (nanoparticles) Issues with nanotechnology
 Nanomaterial behavior Nanomaterial treatments and coatings Energy

5. What school subjects are you best at? (please tick all that apply)
 English Mathematics
 Social Studies Science
 Art Sport
 LOTE History
 Physical Education Other: _____

7. Please rate the following parts of the Nanotechnologies Program:
Strongly Disliked (1) ← Neutral (4) → Strongly Liked (7)

	1	2	3	4	5	6	7
Hands-on Activities							
Thinking about observations							
Assistance with experiments							
Initial/final presentation							
Overall Program							

6. Do you plan to do VCE? If so, what subjects?

8. What, if anything, did you particularly like about CSIRO's program? Why?

9. What, if anything, did you particularly dislike about CSIRO's program? Why?

	0	1	2	3	4	5	6	7
Television (Discovery Channel, National Geographic, Mythbusters, Scope, etc)								
Print (Newspaper, Cosmos, The Helix, etc)								
Online (CSIRO.au, ABC Science, etc)								
Live (CSIRO Programs, zoos, aquariums, museums, etc)								

11. Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

	1	2	3	4	5	6	7
I would prefer to learn something on my own rather than have it taught to me.							
I am interested in science.							
My scientific knowledge is from what I have learned in class.							
I would not enjoy a career in science.							
I am interest learning about new technologies.							
I have a strong knowledge of science.							
Science can make positive contributions to our lives.							
I have a strong knowledge of nanotechnology.							
I am interested in figuring out how the items I use everyday work/function.							

Date of Birth: _ / _ / _ _ _ _

NanoTechnologies



1. Which best describes your interest in science?

(Please tick one in each category)

General Interest (tick one)

- I am interested in science.
- I am neutral about science.
- I am not interested in science.

Seeking Information (tick one)

- I do look for information about science.
- I do not look for information about science.

Understanding (tick one)

- I do understand/find the information I look for.
- I do not understand/find the information I look for.

2. Thinking about your knowledge and interest in the subjects listed below, please rate each one on a 7 point scale where "1" means you have a low interest or knowledge, and "7" means you have a high interest or knowledge.

1 (the lowest) <--- 4(moderate) ---> 7 (the highest)

	1	2	3	4	5	6	7
Your knowledge of science							
Your knowledge of Nanotechnology							
Your interest in science and technology							
Your interest in new technologies							
Your interest in how the items you use in everyday life function/work							

3. What has been your favourite topic in science?

4. What school subjects do you like best? (Please tick all that apply).

- English
- Art
- Physical Education
- Science
- History
- Social Studies
- LOTE
- Mathematics
- Sport
- Other: _____

5. If you can, please name one experiment you did with the CSIRO Nanotechnologies program.

6. What stands out most in your mind about the CSIRO Nanotechnologies program?

7. List a few words/phrases that you would associate with Nanotechnology:

8. What is nanotechnology?

9. Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)

	1	2	3	4	5	6	7
It is better to be told scientific facts than to find them out from experiments.							
Science can help make our lives better.							
A job as a scientist would be interesting.							
I do not enjoy learning about science outside of school.							

P	
2	

Name: _____

Date of Birth: _/ _/ _

Nanotechnologies



1. Science is important.

Strongly Agree | Agree | Impartial | Disagree | Strongly Disagree

Why?

2. Thinking about your knowledge and interest in the subjects listed below, please rate each one on a 7 point scale where "1" means you have a low interest or knowledge, and "7" means you have a high interest or knowledge.

1 (the lowest) <— 4 (moderate) —> 7 (the highest)

	1	2	3	4	5	6	7
Your knowledge of science							
Your knowledge of nanotechnology							
Your interest in science and technology							
Your interest in new technologies							
Your interest in how the items you use in everyday life function/work							

3. Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)

	1	2	3	4	5	6	7
It is better to be told scientific facts than to find them out from experiments.							
Science can help make our lives better.							
A job as a scientist would be interesting.							
I do not enjoy learning about science outside of school.							

4. Do you plan to do VCE? If so, what subjects?

5. What has been your favourite topic in science?

6. What is nanotechnology?

7. Why is nanotechnology important?

8. What topics of science would nanotechnology use?

9. What do you remember from the CSIRO Nanotechnologies program?

10. List 3 to 4 words/phrases that you associate with nanotechnology.

P
3

Name: _____

Materials and Structures



1. Date of Birth: ___ / ___ / ____

2. Is English your first language? Yes ___ No ___
If not, what is? _____

Gender:
 Male Female

3. Thinking about your knowledge and interest in the subjects listed below, please rate each one on a 7 point scale where "1" means you have a low interest or knowledge, and "7" means you have a high interest or knowledge.

1 (the lowest) ← 4 (moderate) → 7 (the highest)

	1	2	3	4	5	6	7
Your knowledge of science							
Your knowledge of physics							
Your interest in science and technology							
Your interest in new technologies							
Your interest in how the items you use in everyday life function/work							

4. Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

	1	2	3	4	5	6	7
<i>Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)</i>							
It is better to be told scientific facts than to find them out from experiments.							
Science can help make our lives better.							
A job as a scientist would be interesting.							
I do not enjoy learning about science outside of school.							

5. Which best describes the field in which your parents work? (Please tick all that apply)

- Business
- Government
- Agriculture
- Science/Engineering
- Construction
- Tradesperson
- Health
- Education
- Other: _____

6. What are your current career interests? (Please tick all that apply)

- Business
- Government
- Agriculture
- Science/Engineering
- Construction
- Tradesperson
- Health
- Education
- Other: _____

7. List a few words/phrases that you would associate with materials and structures:

8. Why have you chosen to take this course? (please tick all that apply)

- Interest in the subject matter
- Improve chances of getting into university
- The material was challenging
- I needed an extra course
- I would like to pursue a career in this field
- Just for fun
- Parents urged me to take the course
- Other: _____

9. I have studied the following topics in class (please tick all that apply):

- Stress
- Elasticity
- Strain
- Toughness
- Creep
- Toughness

10. What quantities are used to calculate Young's Modulus (please tick all that apply):

- Strain
- Yield Strength
- Elasticity
- Stress
- Temperature

11. Please circle the more brittle material: Glass or Aluminum

12. What is the elemental shape within a truss?

P	
R	

Name:

Materials and Structures



1. Science is important.

Strongly Agree | Agree | Impartial | Disagree | Strongly Disagree

Why?

2. Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)

	1	2	3	4	5	6	7
I would prefer to learn something on my own rather than have it taught to me.							
I am interested in science.							
My scientific knowledge is from what I have learned in class.							
I would not enjoy a career in science.							
I am interested in learning about new technologies.							
I have a strong knowledge of science.							
Science can make positive contributions to our lives.							
I have a strong knowledge of physics.							
I am interested in figuring out how the items I use everyday work/function.							

3. What school subjects are you best at?

(please tick all that apply)

- English
- Social Studies
- Art
- LOTE
- Physical Education
- Mathematics
- Science
- Sport
- History
- Other: _____

4. Please rate the following parts of the Materials and Structures Program:

Strongly Disliked (1) ← Neutral (4) → Strongly Liked (7)

	1	2	3	4	5	6	7
Hands-on Activities							
Thinking about observations							
Assistance with experiments							
Initial/final presentation							
Overall Program							

5. What, if anything, did you particularly like about CSIRO's program? Why?

6. What, if anything, did you particularly dislike about CSIRO's program? Why?

7. Rate your overall interest in the following science-related materials. Please use a 7 point scale, where 1 means "not at all interested" and 7 means "extremely interested". If you've never heard of it, tick 0.

(1) Not at all interested ← → (7) Extremely Interested

Science Media	0	1	2	3	4	5	6	7
Television (Discovery Channel, National Geographic, Mythbusters, Scope, etc)								
Print (Newspaper, Cosmos, The Helix, etc)								
Online (CSIRO.au, ABC Science, etc)								
Live (CSIRO Programs, zoos, aquariums, museums, etc)								

8. Aluminium is more brittle than glass. (circle one)

True or False

9. Trusses are typically composed of what shape?

10. Stress and strain are used to calculate what quantity?

- Toughness
- Yield Strength
- Young's Modulus
- Elasticity

P	
1	

Date of Birth: _ / _ / _ _ _ _

Materials and Structures



1. Which best describes your interest in science?

- | | | |
|---|--|--|
| <p>General Interest (tick one)</p> <p><input type="radio"/> I am <u>interested</u> in science.</p> <p><input type="radio"/> I am <u>neutral</u> about science.</p> <p><input type="radio"/> I am <u>not interested</u> in science.</p> | <p>Seeking Information (tick one)</p> <p><input type="radio"/> I <u>do</u> seek information about science.</p> <p><input type="radio"/> I <u>do not</u> seek information about science.</p> | <p>Understanding (tick one)</p> <p><input type="radio"/> I <u>do</u> understand/find the information I seek.</p> <p><input type="radio"/> I <u>do not</u> understand/find the information I seek.</p> |
|---|--|--|

2. Thinking about your knowledge and interest in the subjects listed below, please rate each one on a 7 point scale where "1" means you have a **low interest or knowledge**, and "7" means you have a **high interest or knowledge**.

1 (the lowest) <— 4(moderate) —> 7 (the highest)

	1	2	3	4	5	6	7
Your knowledge of science							
Your knowledge of Physics							
Your interest in science and technology							
Your interest in new technologies							
Your interest in how the items you use in everyday life function/work							

3. What type of science do you like? (Please tick all that apply).

- | | | | | |
|---------------------------------|---------------------------------|----------------------------------|-----------------------------------|------------------------------------|
| <input type="radio"/> Physics | <input type="radio"/> Biology | <input type="radio"/> Geology | <input type="radio"/> Environment | <input type="radio"/> Computers |
| <input type="radio"/> Chemistry | <input type="radio"/> Astronomy | <input type="radio"/> Psychology | <input type="radio"/> Forensics | <input type="radio"/> Other: _____ |

4. What school subjects do you like best? (Please tick all that apply).

- | | | | | |
|--------------------------------------|----------------------------|--|-------------------------------|------------------------------------|
| <input type="radio"/> English | <input type="radio"/> Art | <input type="radio"/> Physical Education | <input type="radio"/> Science | <input type="radio"/> History |
| <input type="radio"/> Social Studies | <input type="radio"/> LOTE | <input type="radio"/> Mathematics | <input type="radio"/> Sport | <input type="radio"/> Other: _____ |

5. If you can, please name one experiment you did with CSIRO last week.

6. What stands out most in your mind about CSIRO's Materials and Structures program from last week?

7. List a few words/phrases that you would associate with physics:

8. Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)	1	2	3	4	5	6	7
It is better to be told scientific facts than to find them out from experiments.							
Science can help make our lives better.							
A job as a scientist would be interesting.							
I do not enjoy learning about science outside of school.							

9. I have studied the following topics in class (please tick all that apply):

- | | | |
|----------------------------------|---------------------------------|---------------------------------|
| <input type="radio"/> Stress | <input type="radio"/> Strain | <input type="radio"/> Creep |
| <input type="radio"/> Elasticity | <input type="radio"/> Toughness | <input type="radio"/> Toughness |

10. What quantities are used to calculate Young's Modulus (please tick all that apply):

- | | | | | |
|------------------------------|--------------------------------------|----------------------------------|------------------------------|-----------------------------------|
| <input type="radio"/> Strain | <input type="radio"/> Yield Strength | <input type="radio"/> Elasticity | <input type="radio"/> Stress | <input type="radio"/> Temperature |
|------------------------------|--------------------------------------|----------------------------------|------------------------------|-----------------------------------|

11. Please circle the more brittle material: Glass or Aluminum

12. What is the elemental shape within a truss?

Name: _____

Date of Birth: _/ _/ _

Materials and Structures



1. Science is important.
Strongly Agree | Agree | Impartial | Disagree | Strongly Disagree

Why?

2. Thinking about your knowledge and interest in the subjects listed below, please rate each one on a 7 point scale where "1" means you have a low interest or knowledge, and "7" means you have a high interest or knowledge.

1 (the lowest) <— 4(moderate) —> 7 (the highest)

	1	2	3	4	5	6	7
Your knowledge of science							
Your knowledge of physics							
Your interest in science and technology							
Your interest in new technologies							
Your interest in how the items you use in everyday life function/work							

3. Consider the following statements and the degree to which you agree with them, with "1" being strongly disagree and "7" being strongly agree.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)

	1	2	3	4	5	6	7
It is better to be told scientific facts than to find them out from experiments.							
Science can help make our lives better.							
A job as a scientist would be interesting.							
I do not enjoy learning about science outside of school.							

4. What has been your favourite topic in science?

5. What do you remember from the CSIRO Materials and Structures program?

6. List 3 to 4 words/phrases that you associate with physics.

<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>

7. I have studied the following topics in class (please tick all that apply):

- Stress
- Strain
- Creep
- Elasticity
- Toughness
- Toughness

8. What quantities are used to calculate Young's Modulus (please tick all that apply):

- Strain
- Yield Strength
- Elasticity
- Stress
- Temperature

9. Please circle the more brittle material: Glass or Aluminum

10. What is the elemental shape within a truss?

APPENDIX C Observation Rubrics We Developed

Program Observation Group 1	Going down # of Students engaged									
Minutes into program	0	10	20	30	40	50	60	70	80	90
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Opening Presentation	Going down # of Students Engaged									
Minutes into program	0	5	10	15	20	25	30	35	40	Comments
Eye Contact										
Concentration										
Boredom										
Eagerness to Participate (Over Whole Time)										
Confusion/Frustration										
Physical Distractions										
Asking Questions										

Closing Presentation	Going down # of Students Engaged									
Minutes into program	0	5	10	15	20	25	30	35	40	Comments
Eye Contact										
Concentration										
Boredom										
Eagerness to Participate (Over Whole Time)										
Confusion/Frustration										
Physical Distractions										
Asking Questions										

APPENDIX D Teacher Interview Responses

Interview Questions

Teacher: Theresa Daunt

Date: 24/3/2010

School: St. Aloysious

Program: Nanotechnology

Interviewer: Vadim Chernyak

Pre Test

- Are you a science teacher?
 - Yes
 - How do you expect this program to fit with what you are currently covering in class?
Last topic that we covered in class is similar (things on a small scale)
 - Describe your students and their behavior when teaching science related subjects. Why do think this is?
Students have a general interest but have difficulty understanding where it fits in
 - What topics in your science curriculum have you noticed are most engaging to the students? Why?
The topics that students see a connection to with real life, and ones they can identify with themselves, (forensics anatomy)
 - Is there a technology curriculum? What about that do students get enthused about?
Yes, application of technology
 - At university, what are your areas of specialty within your teaching?
Bio/Chemistry/General Science
 - Do you plan to assess the students on this material covered (through reports, projects, tests, observations during the program, etc)? Do you plan to assess or discuss on the day of the session?
No

Interview Questions
Teacher: Theresa Daunt
Date: 24/3/2010
School: St. Aloysious
Program: Nanotechnology
Interviewer: Vadim Chernyak
Post Test 1

- Did you enjoy the program? How well did the program compliment the current science curriculum/or specific learning unit related to this program?

Yes, the program complimented quite well, the visual aspect was good

- Were the activities appropriate for the age group? Were the activities appropriate for your students specifically?

Yes

- Would you say this program captured the interest of the students?

Yes, judging by reactions

- Did the concept capture them?

Yes

- Did the hands on 'doing' engage them?

Yes

- Did the program keep and maintain their interest?

Yes, there was a good variety of activities

- What were the most engaging portions of the program?

Ferro fluids, diseases, hydrophobic

- What could be improved?

(Pressured to answer) Not sure, digital displays were more difficult

- What changes did you see during the program? How did behavior change from regular classroom settings?

More enthusiasm

- Is the program likely to have a lasting positive impact on the students?

Variable, the upcoming holiday is bad timing and they are likely to forget a lot because of it

- Do you think the students approach to science will improve as a result of the program? Will this program be advantageous to helping you teach them about science?

Unsure, Yes

- If question seems pertinent during specific interview: Do you expect the programs will affect students' future to be involved with science? VCE? University? Career?

The students will think beyond the typical sciences.

Interview Questions

Teacher: Miaka

Date:14/4/2010

School: Mount View Primary

Program: Cool Chemical Sciences

Interviewer: Vadim Chernyak

Pre Test

- Are you a science teacher?
 - No
 - How do you expect this program to fit with what you are currently covering in class?
We are looking at scientific advances
 - Describe your students and their behavior when teaching science related subjects. Why do think this is?
Really enjoy the science/hands on work
- What is your teaching background?
General teacher
- Are you familiar with these kids in the classroom? How do they normally behave?
Normally pretty good, with the occasional cheeky boys
- At university, what are your areas of specialty within your teaching?
Everything (Primary School)
- Do you plan to assess the students on this material covered (through reports, projects, tests, observations during the program, etc)? Do you plan to assess or discuss on the day of the session?
Yes, scientific report within the CSIRO Program

Interview Questions

Teacher: Miaka

Date:14/4/2010

School: Mount View Primary

Program: Cool Chemical Sciences

Interviewer: Vadim Chernyak

Post Test 1

- Did you enjoy the program? How well did the program compliment the current science curriculum/or specific learning unit related to this program?

Yes, I am not 100% sure yet how it will integrate into our curriculum

- Were the activities appropriate for the age group? Were the activities appropriate for your students specifically?

Yes, yes

- Would you say this program captured the interest of the students?

Yes

- Did the concept capture them?

Yes

- Did the hands on 'doing' engage them?

Yes

- Did the program keep and maintain their interest?

Yes

- What were the most engaging portions of the program?

Experiments

- What could be improved?

Less instructions

- What changes did you see during the program? How did behavior change from regular classroom settings?

They work well in groups

- Is the program likely to have a lasting positive impact on the students?

Yes, they will remember it

- Will this program be advantageous to helping you teach them about science?

Yes

Interview Questions

Teacher: Asha Jacob

Date: 24/3/2010

School: St. Aloysious

Program: Nanotechnology

Interviewer: Self Administered

Pre Test

- Are you a science teacher?
 - Yes
 - How do you expect this program to fit with what you are currently covering in class?
Unit: Nanotechnology
 - Describe your students and their behavior when teaching science related subjects. Why do think this is?
Generally very passive + cooperative
They appear to enjoy science
 - What topics in your science curriculum have you noticed are most engaging to the students? Why?
General evolution → Interest as it relates man to him
 - Is there a technology curriculum? What about that do students get enthused about?
Computer, powerpoint. Practical however now all students get enthused
 - No
- At university, what are your areas of specialty within your teaching?
Genetics
- Do you plan to assess the students on this material covered (through reports, projects, tests, observations during the program, etc)? Do you plan to assess or discuss on the day of the session?
No

Interview Questions
Teacher: Asha Jacob
Date: 24/3/2010
School: St. Aloysius
Program: Nanotechnology
Interviewer: Self Administered
Post Test 1

- Did you enjoy the program? How well did the program compliment the current science curriculum/or specific learning unit related to this program?

Highly relevant + complimented what we have done in class

- Were the activities appropriate for the age group? Were the activities appropriate for your students specifically?

Appropriate for age group + student. However they were slightly nervous about using information and new equipment

- Would you say this program captured the interest of the students?

Absolutely!

- Did the concept capture them?

Yes and it made the concept of nanosize very real

- Did the hands on 'doing' engage them?

Yes

- Did the program keep and maintain their interest?

Yes

- What were the most engaging portions of the program?

- What could be improved?

More time to explain

- What changes did you see during the program? How did behavior change from regular classroom settings?

- Is the program likely to have a lasting positive impact on the students?

Absolutely! Students tend to remember experiments like this one

- Do you think the students approach to science will improve as a result of the program? Will this program be advantageous to helping you teach them about science?

Yes, Yes

- If question seems pertinent during specific interview: Do you expect the programs will affect students' future to be involved with science? VCE? University? Career?

Yes this generates interest in science by making science real/ hands on.

- Did you have a post-program discussion with the students? Was it spontaneous or in depth? How did it go? (go more in depth if the discussion sounded good)

Enter Answer

Interview Questions

Teacher: Diane Krosby

Date: 17/3/2010

School: Mt. Eliza

Program: Materials and Structures

Interviewer: Dan DeCiero

Pre Test

- Are you a science teacher?
 - Yes
 - How do you expect this program to fit with what you are currently covering in class?
Next week we will have projects on materials and structures
The program uses equipment we don't have and we are mainly here to use the equipment
It is good to learn the basic concepts here
 - Describe your students and their behavior when teaching science related subjects. Why do think this is?
Generally good, most students going to engineering
 - What topics in your science curriculum have you noticed are most engaging to the students? Why?
Hands on topics
 - Is there a technology curriculum? What about that do students get enthused about?
No
 - At university, what are your areas of specialty within your teaching?
Labtech
- Do you plan to assess the students on this material covered (through reports, projects, tests, observations during the program, etc)? Do you plan to assess or discuss on the day of the session?
Yes, later in the classroom

Interview Questions

Teacher: Diane Krosby

Date: 17/3/2010

School: Mt. Eliza

Program: Materials and Structures

Interviewer: Dan DeCiero

Post Test 1

- Did you enjoy the program? How well did the program compliment the current science curriculum/or specific learning unit related to this program?

Yes, very relevant to VCE Course

- Were the activities appropriate for the age group? Were the activities appropriate for your students specifically?

Yes

- Would you say this program captured the interest of the students?

Yes

- Did the concept capture them?

Yes

- Did the hands on 'doing' engage them?

Yes, they really love this part

- Did the program keep and maintain their interest?

Yes

- What were the most engaging portions of the program?

Tensiometer,

- What could be improved?

More samples at each station, print the truss behaviour graphs

- What changes did you see during the program? How did behavior change from regular classroom settings?

Students are more motivated but year 12 Physics students are generally fairly motivated

- Is the program likely to have a lasting positive impact on the students?

Yes

- Do you think the students approach to science will improve as a result of the program? Will this program be advantageous to helping you teach them about science?

Engineering Experience

- If question seems pertinent during specific interview: Do you expect the programs will affect students' future to be involved with science? VCE? University? Career?

Hopefully encourage more engineers. This is already the plan

School Location: Eammas College
Date of Interview: 19/3/10

Teacher Name: Vince Verelli
Interviewer: Vadim Chernyak

Pre Test

- Are you a science teacher?
 - Yes
 - How do you expect this program to fit with what you are currently covering in class?

This program compliments current forensics curriculum

- Describe your students and their behavior when teaching science related subjects. Why do think this is?

Students are fairly enthusiastic, especially about forensics

- What topics in your science curriculum have you noticed are most engaging to the students? Why?

The Practical Topics

- Is there a technology curriculum? What about that do students get enthused about?

Yes, model building and electronics

- At university, what are your areas of specialty within your teaching?

Geographer, Geology

School Location: Eammas College
Date of Interview: 19/3/10

Teacher Name: Paolo Albetella
Interviewer: Vadim Chernyak

Post Test 1

- Did you enjoy the program? How well did the program compliment the current science curriculum/or specific learning unit related to this program?

Yes, I enjoyed the program and it relates

- Were the activities appropriate for the age group? Were the activities appropriate for your students specifically?

Yes

- Would you say this program captured the interest of the students?

Yes

- Did the concept capture them?

Yes

- Did the hands on 'doing' engage them?

Yes

- Did the program keep and maintain their interest?

Yes

- What were the most engaging portions of the program?

Blood (not sure) Guns

- What could be improved?

Nothing

- What changes did you see during the program? How did behavior change from regular classroom settings?

The students are interested and behave better

- Is the program likely to have a lasting positive impact on the students?

The students might talk about it for a little while and remember it

- Do you think the students approach to science will improve as a result of the program? Will this program be advantageous to helping you teach them about science?

(Pressured response), Maybe

- If question seems pertinent during specific interview: Do you expect the programs will affect students' future to be involved with science? VCE? University? Career?

If they didn't know anything about it before then maybe.

P2 – Interview Questions

Teacher: Stephen Wolpol

School: Eammas College

Program: Forensics

Interviewer: Vadim Chernyak

- Did you have a post-program discussion with the students? Was it spontaneous or in depth?
How did it go? (go more in depth if the discussion sounded good)
No, not yet
- Were there any follow-up assignments? If so, describe them.
Students were asked to write a report
- Have you noticed any changes in the students towards science and technology since the CSIRO program? What evidence tells you this?
Not specifically to technically but the 1st session class was very engaged after the workshop.
- Do you expect that the program will affect the students' future involvement with science (i.e. VCE, University, career)?
Not towards VCE though there may be a possible outcome towards science. Parents are always talking to me and telling me how the students talk about the CSIRO program at home.
- Is there anything that CSIRO could change about its programs to improve them? For you? For students?
No
- Was the program worth doing (cost, effort)? Would you book another CSIRO program?
Yes it was worth doing. Yes I would book another program. We don't schedule an excursion in science so this is great and the cost is reasonable.
- Why did you book this program
The program coincides with topics that we do and compliments curriculum well so its nice to have a follow up activity.

Interview Questions

Teacher: Jodie Kirchner

Date:14/4/2010

School: Mount View Primary

Program: Cool Chemical Sciences

Interviewer: Dan DeCiero

Pre Test

- Are you a science teacher?
 - Yes
 - How do you expect this program to fit with what you are currently covering in class?
This is a new unit and we are trying to get them thinking about science, learning how things work
 - Describe your students and their behavior when teaching science related subjects. Why do think this is?
When teaching them science the students are extremely interested, the hands on stuff engages them
 - What topics in your science curriculum have you noticed are most engaging to the students? Why?
Last year chemical science, not so much this yea.
 - Is there a technology curriculum? What about that do students get enthused about?
Yes, state curriculum
- At university, what are your areas of specialty within your teaching?
General teacher
- Do you plan to assess the students on this material covered (through reports, projects, tests, observations during the program, etc)? Do you plan to assess or discuss on the day of the session?
Just what is in CSIRO but other stuff in unit will be assessed

We are using the CSIRO unit as part of a unit

Interview Questions
Teacher: Jodie Kirchner
Date:14/4/2010
School: Mount View Primary
Program: Cool Chemical Sciences
Interviewer: Dan DeCiero
Post Test 1

- Did you enjoy the program? How well did the program compliment the current science curriculum/or specific learning unit related to this program?

This will kick off the unit

- Were the activities appropriate for the age group? Were the activities appropriate for your students specifically?

Yes, all were engaged

- Would you say this program captured the interest of the students?

All activities were good

- Did the concept capture them?

Yes

- Did the hands on 'doing' engage them?

Yes

- Did the program keep and maintain their interest?

Yes, there was a good variety of activities

- What were the most engaging portions of the program?

The hands-on

- What could be improved?

Nothing

- What changes did you see during the program? How did behavior change from regular classroom settings?

None

- Is the program likely to have a lasting positive impact on the students?

Yes

- Do you think the students approach to science will improve as a result of the program? Will this program be advantageous to helping you teach them about science?

Hard to know

Interview Questions

Teacher: Lisa Del Din

Date: 24/3/2010

School: St. Aloysious

Program: Nanotechnology

Interviewer: Self Administered

Pre Test

- Are you a science teacher?
 - Yes
 - How do you expect this program to fit with what you are currently covering in class?
It will give the students an opportunity to do more advanced experimments than we were able to provide
 - Describe your students and their behavior when teaching science related subjects. Why do think this is?
At year 10 some are very interested through to some who are not very engaged. As science teachers we must make our science curriculum relevant to the students when science is not made relevant to the students
 - What topics in your science curriculum have you noticed are most engaging to the students? Why?
Biology (body systems, disease, genetics) – it's about them
Chemistry – because it can be very hands on
Electricity – hands on
 - Is there a technology curriculum? What about that do students get enthused about?
We have food technology, information technology, design-fibrecraft
- At university, what are your areas of specialty within your teaching?
Science – biology & chemistry
- Do you plan to assess the students on this material covered (through reports, projects, tests, observations during the program, etc)? Do you plan to assess or discuss on the day of the session?
No. They just finished their nanotechnology unit.
- Why did you book this program?
It fit in exactly with what we were doing in Year 10 Science.

Interview Questions
Teacher: Lisa Del Din
Date: 24/3/2010
School: St. Aloysious
Program: Nanotechnology
Interviewer: Self Administered
Post Test 1

- Did you enjoy the program? How well did the program compliment the current science curriculum/or specific learning unit related to this program?

The program was very interesting – the experierments were simple (mostly), fun & demonstrated some of the useful properties of nano

- Were the activities appropriate for the age group? Were the activities appropriate for your students specifically?

Appropriate for Y10

- Would you say this program captured the interest of the students?

The students were interested + some worked slowly + would have liked more time

- Did the concept capture them?

Definitely

- Did the hands on 'doing' engage them?

Yes

- Did the program keep and maintain their interest?

Yes

- What were the most engaging portions of the program?

Introductory demo of the ferrofluid,

- What could be improved?

Some more demos to explain + discuss the nanomaterials + their applications

- What changes did you see during the program? How did behavior change from regular classroom settings?

The students acted similarly to in regular science when doing practical work

- Is the program likely to have a lasting positive impact on the students?

I'm not sure about lasting long term but hopefully enthused them about the future possibilities of science

- Do you think the students approach to science will improve as a result of the program? Will this program be advantageous to helping you teach them about science?

For some students they may be more engaged in the future – particularly those that think science is "boring"

- If question seems pertinent during specific interview: Do you expect the programs will affect students' future to be involved with science? VCE? University? Career?

For some it may have confirmed their interest in science + desire to continue studying it

School Location: Eammas College
Date of Interview: 19/3/10

Teacher Name: Anne Falvey
Interviewer: Vadim Chernyak

Pre Test

- Are you a science teacher?
 - Yes
 - How do you expect this program to fit with what you are currently covering in class?

This program reinforces concepts already learned in the forensics curriculum

- Describe your students and their behavior when teaching science related subjects. Why do think this is?

Some students are interested in science and some not so much

- What topics in your science curriculum have you noticed are most engaging to the students? Why?

Hands on work and work relating to every day subjects is most exciting

- Is there a technology curriculum? What about that do students get enthused about?

Yes, students are most interested in systems technology

- At university, what are your areas of specialty within your teaching?

Chemistry, Computer Science

- Do you plan to assess the students on this material covered (through reports, projects, tests, observations during the program, etc)? Do you plan to assess or discuss on the day of the session?

Yes, the students will be asked to write a report on the CSIRO program

School Location: Eammas College
Date of Interview: 19/3/10

Teacher Name: Anne Falvey
Interviewer: Vadim Chernyak

Post Test 1

- Did you enjoy the program? How well did the program compliment the current science curriculum/or specific learning unit related to this program?

Yes, I enjoyed the program and it complements the curriculum well.

- Were the activities appropriate for the age group? Were the activities appropriate for your students specifically?

Yes

- Would you say this program captured the interest of the students?

Mostly, yes

- Did the concept capture them?

Yes, the hands on did.

- Did the hands on 'doing' engage them?

Yes

- Did the program keep and maintain their interest?

Yes

- What were the most engaging portions of the program?

Gunshot, Identikid

- What could be improved?

Gel electrophoresis should be added

- What changes did you see during the program? How did behavior change from regular classroom settings?

The students appear to enjoy the program more

- Is the program likely to have a lasting positive impact on the students?

The students which are science oriented will remember the program

- Do you think the students approach to science will improve as a result of the program? Will this program be advantageous to helping you teach them about science?

For more science oriented students yes

- If question seems pertinent during specific interview: Do you expect the programs will affect students' future to be involved with science? VCE? University? Career?

Maybe

Interview Questions

Teacher: Raf Makkary

Date: 13/4/2010

School: Bentleigh Secondary School

Program: Materials and Structures

Interviewer: Vadim Chernyak/Pre-Interview, Dan DeCiero P1 Interview

Pre Test

- Are you a science teacher?
 - Yes
 - How do you expect this program to fit with what you are currently covering in class?
The program worked well last year and will fit in perfectly this year with this year's curriculum
 - Describe your students and their behavior when teaching science related subjects. Why do think this is?
Students are enjoying physics since they are already at the VCE level
 - What topics in your science curriculum have you noticed are most engaging to the students? Why?
Differs for every student
- At university, what are your areas of specialty within your teaching?
Physics, Mathematics, Engineering
- Do you plan to assess the students on this material covered (through reports, projects, tests, observations during the program, etc)? Do you plan to assess or discuss on the day of the session?
Yes, I will collect the worksheets

Interview Questions

Teacher: Raf Makkary

Date: 13/4/2010

School: Bentleigh Secondary School

Program: Materials and Structures

Interviewer: Vadim Chernyak/Pre-Interview, Dan DeCiero P1 Interview

Post Test 1

- Did you enjoy the program? How well did the program compliment the current science curriculum/or specific learning unit related to this program?

Yes, Yes, it is perfect

- Were the activities appropriate for the age group? Were the activities appropriate for your students specifically?

Perfect

- Would you say this program captured the interest of the students?

Yes

- Did the concept capture them?

Yes

- Did the hands on 'doing' engage them?

Yes

- Did the program keep and maintain their interest?

Yes

- What were the most engaging portions of the program?

Every Part

- What could be improved?

Time, takes longer than the time allotted

- What changes did you see during the program? How did behavior change from regular classroom settings?

Not this group, pretty much the same behavior

- Is the program likely to have a lasting positive impact on the students?

Yes, this will help the students design their own experiments which is one way which I will assess them.

- Do you think the students approach to science will improve as a result of the program? Will this program be advantageous to helping you teach them about science?

Yes, will help them to design their own experiments

- If question seems pertinent during specific interview: Do you expect the programs will affect students' future to be involved with science? VCE? University? Career?

No, it will help with their exams, not necessarily with their career and careers are mostly set at this age

Interview Questions

Teacher: Paul Rowland

Date: 18/3/2010

School: Bayside Christian College

Program: Materials and Structures

Interviewer: Vadim Chernyak

Pre Test

- Are you a science teacher?
 - Yes
 - How do you expect this program to fit with what you are currently covering in class?
We are learning materials and structures in class

 - Describe your students and their behavior when teaching science related subjects. Why do think this is?

This is my third year coming here and the highlight every year is coming here

 - What topics in your science curriculum have you noticed are most engaging to the students? Why?

Materials, 3D Motion, Lunar Park

 - Is there a technology curriculum? What about that do students get enthused about?

Yes, Crocodile Physics, Electronics Simulator
 - No

- At university, what are your areas of specialty within your teaching?
Photonics, Lasers, Robotics (Lego)

- Do you plan to assess the students on this material covered (through reports, projects, tests, observations during the program, etc)? Do you plan to assess or discuss on the day of the session?
No

Interview Questions

Teacher: Paul Rowland

Date: 18/3/2010

School: Bayside Christian College

Program: Materials and Structures

Interviewer: Vadim Chernyak

Post Test 1

- Did you enjoy the program? How well did the program compliment the current science curriculum/or specific learning unit related to this program?

The program is 100% relevant and I enjoyed it

- Were the activities appropriate for the age group? Were the activities appropriate for your students specifically?

Yes

- Would you say this program captured the interest of the students?

Yes

- Did the concept capture them?

Yes

- Did the hands on 'doing' engage them?

Yes

- Did the program keep and maintain their interest?

Yes

- What were the most engaging portions of the program?

Tensiometer, Impact Tests (PVC & Composite)

- What could be improved?

Print Up

- What changes did you see during the program? How did behavior change from regular classroom settings?

There is more tension in the everyday classroom

- Is the program likely to have a lasting positive impact on the students?

Yes, much

- Do you think the students approach to science will improve as a result of the program? Will this program be advantageous to helping you teach them about science?

Yes

- If question seems pertinent during specific interview: Do you expect the programs will affect students' future to be involved with science? VCE? University? Career?

Yes, the students now see how what they've learned related to the world

Interview Questions

Teacher: Paul Rowland

Date: 18/3/2010

School: Bayside Christian College

Program: Materials and Structures

Interviewer: Vadim Chernyak

- Did you have a post-program discussion with the students? Was it spontaneous or in depth? How did it go? (go more in depth if the discussion sounded good)
No, not yet
- Were there any follow-up assignments? If so, describe them.
Students were asked to complete the worksheets related with the program
- Have you taught any of the subject material (chemistry) in class since the CSIRO program? If so, did the students mention the CSIRO program during the unit?
Yes, yes, the tensiometer and the terminology
- Have you noticed any changes in the students towards science and technology since the CSIRO program? What evidence tells you this?
The students enjoy interaction and practical learning
- Do you expect that the program will affect the students' future involvement with science (i.e. VCE, University, career)?
Yes
- Has there been any unprompted questions or comments from the students? Were these observed during or outside of class time? (walking the halls, etc) What type of discussion was it? Are you surprised by the discussion?
No
- Have the students displayed any change in their attitude towards science overall? Towards a career in science?
Yes more excitement, interest and passion
- Is there anything that CSIRO could change about its programs to improve them? For you? For students?
Fix printer and receive graphs
- Was the program worth doing (cost, effort)? Would you book another CSIRO program?
Yes, absolutely, and I have booked one for the last three years and will again

APPENDIX E Sample TOSRA Questions Used

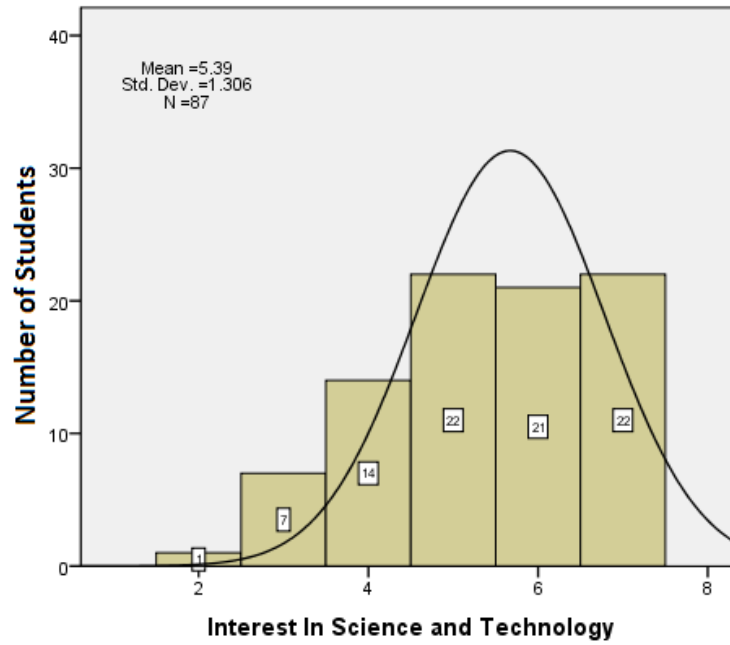
4. Consider the following statements and the degree to which you agree with them, with “1” being strongly disagree and “7” being strongly agree.

Strongly Disagree (1) ← Neutral (4) → Strongly Agree (7)

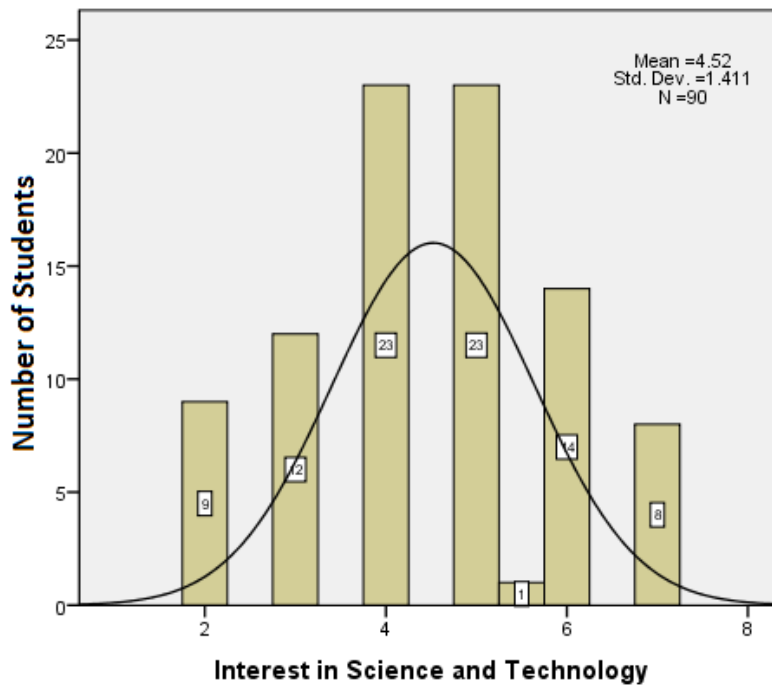
	1	2	3	4	5	6	7
It is better to be told scientific facts than to find them out from experiments.							
Science can help make our lives better.							
A job as a scientist would be interesting.							
I do not enjoy learning about science outside of school.							

APPENDIX F Interest in Science and Technology Distributions For Each Observed Program

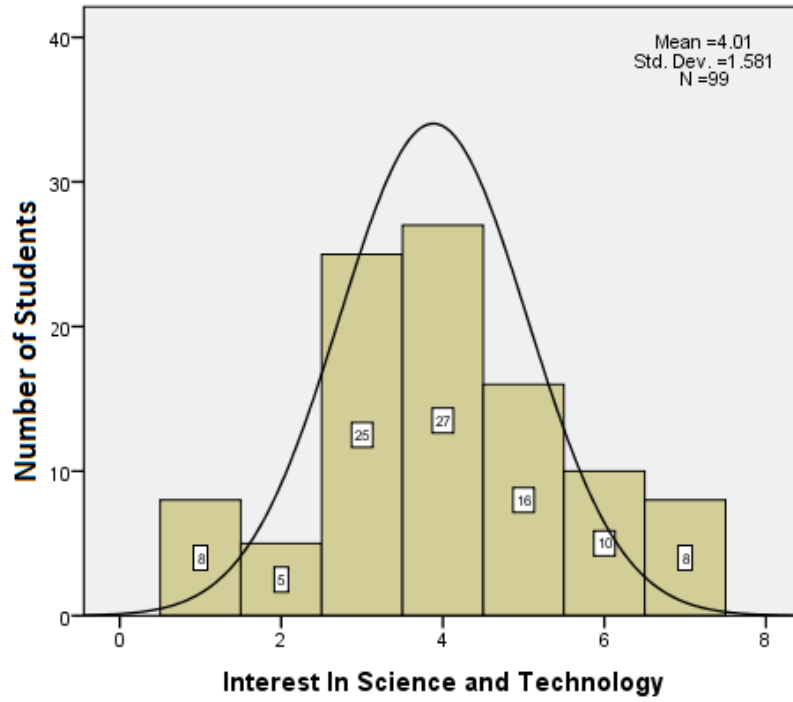
Cool Chemical Sciences



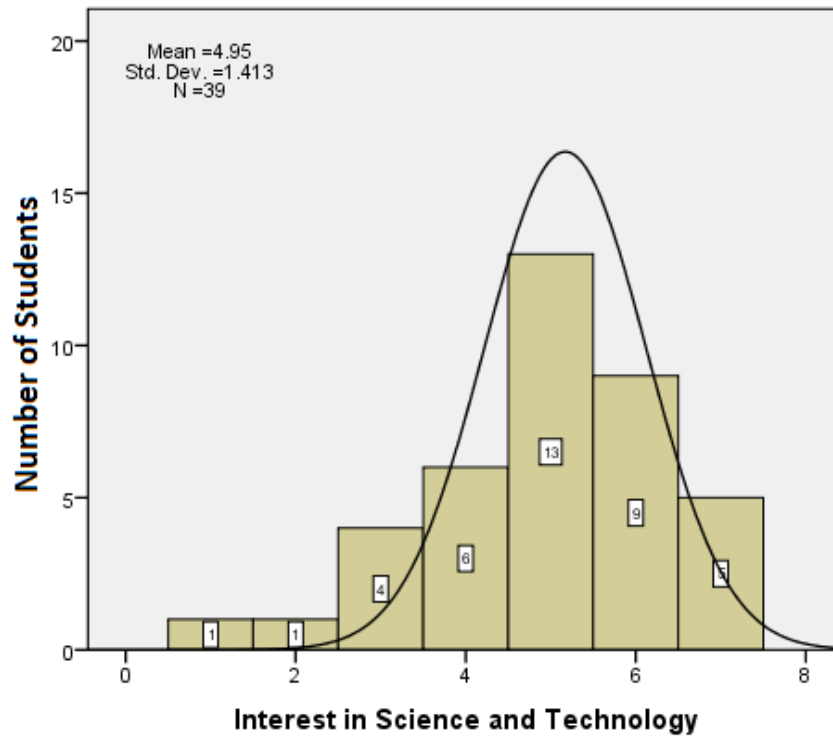
Nanotechnologies



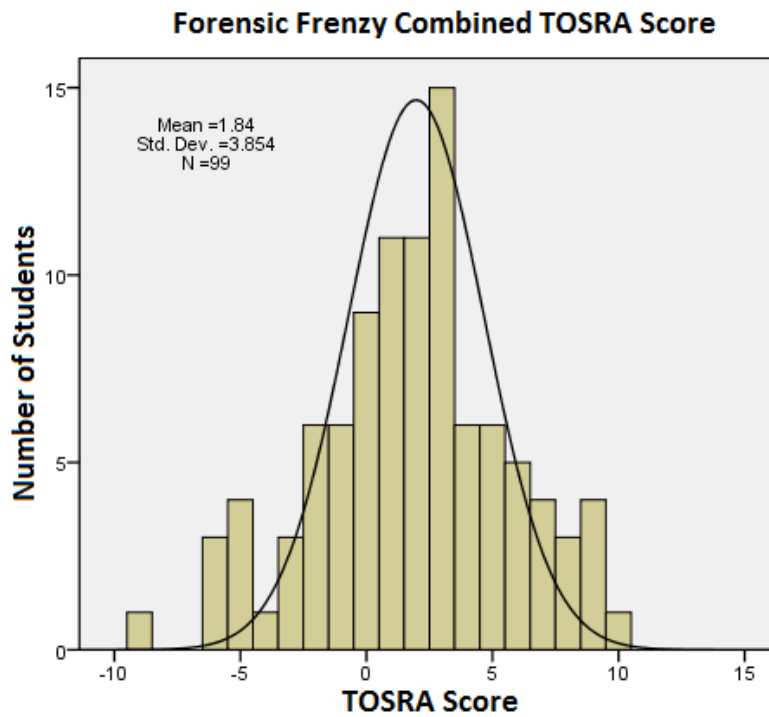
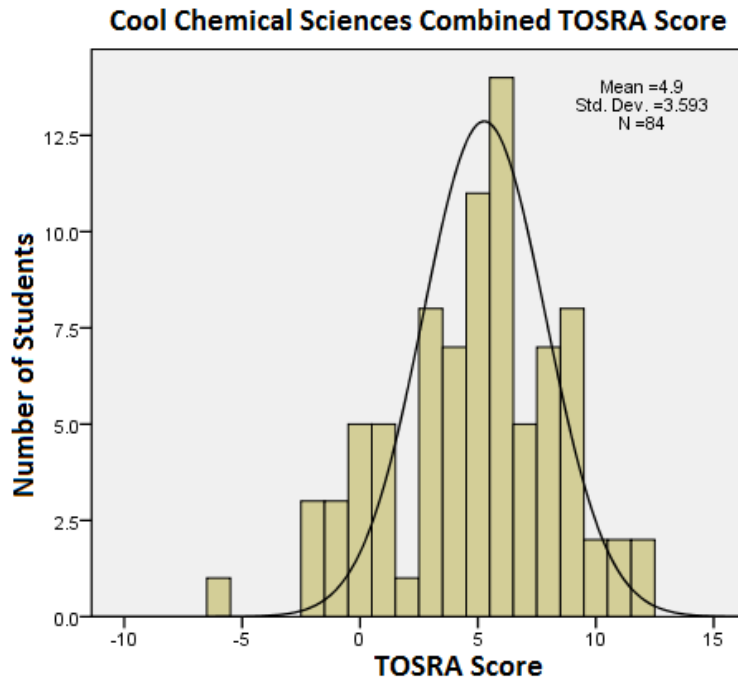
Forensic Frenzy



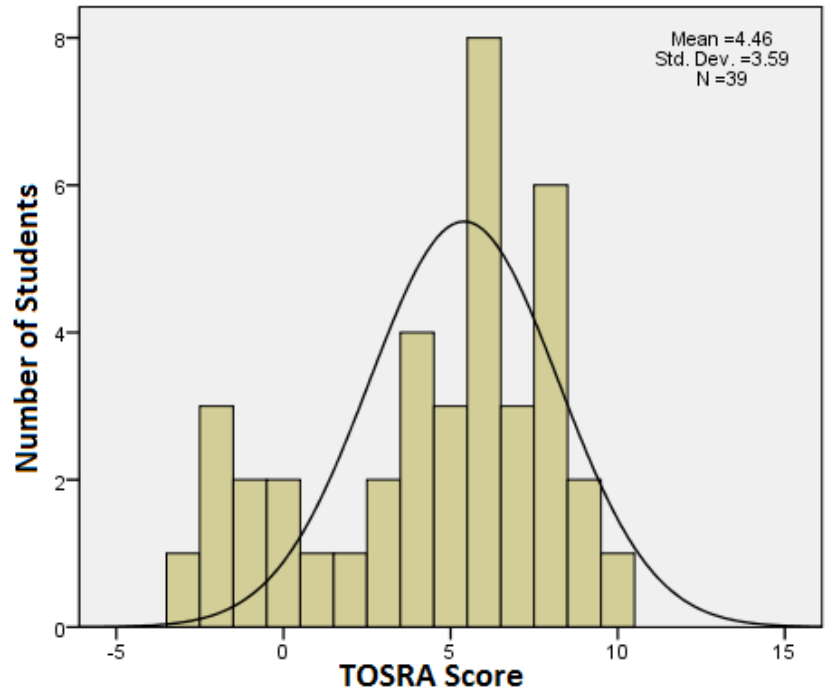
Materials and Structures



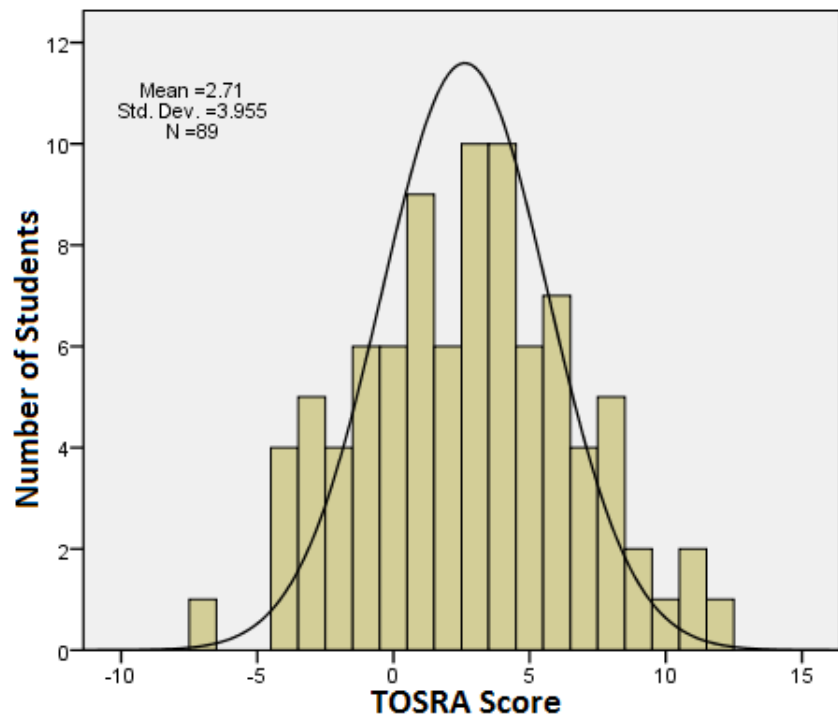
APPENDIX G Combined TOSRA Score Distributions for Each Program



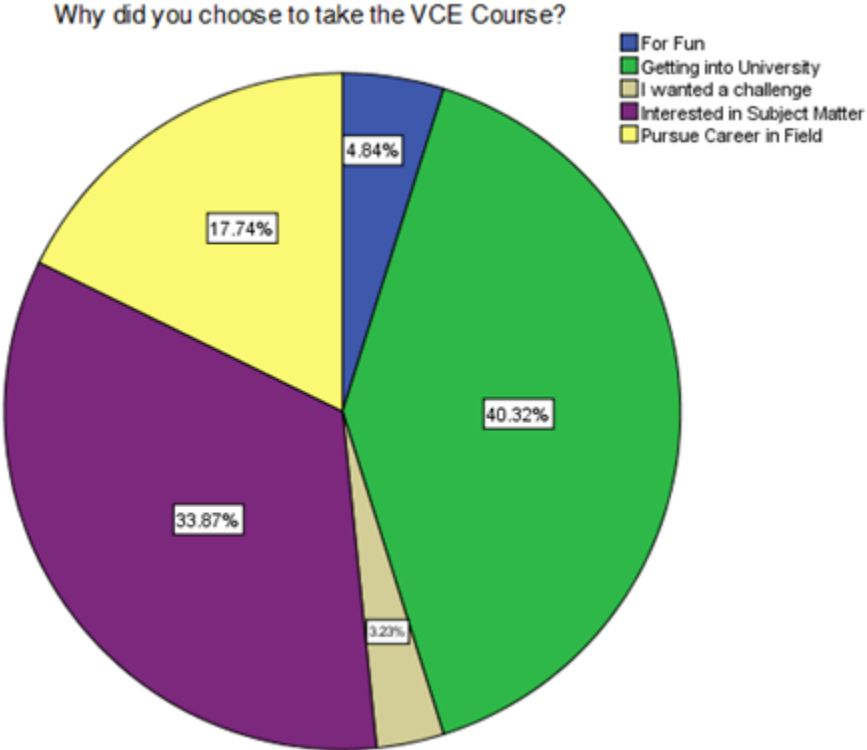
Materials and Structures Combined TOSRA Score



Nanotechnologies Combined TOSRA Score



APPENDIX H Reason Why VCE Students Enrolled in Course



APPENDIX I Preliminary Statistical Analysis on Observational Data

Observational Statistical Analysis

The following observations were conducted using an ANOVA test with a posthoc Tukey test. It should be noted that the following tests involved pseudoreplication and hence raise doubts about the validity of drawing conclusions based on these tests.

Cool Chemical Science

Analysis of each behavioral characteristic was completed in SPSS using three ANOVA tests coupled with Tukey tests. These tests were necessary to see if there was any significant change between different parts of the program. Results of the three ANOVA and Tukey tests can be found in Table 28. The table first shows the behavioral cue being analyzed. The ANOVA value outputted by SPSS was then analyzed to determine whether there was a significant difference between the portions of the program. If the difference was found to be significant we conducted a Tukey test. The Tukey test examined different portions of the program to see if they are significantly different between one another. Finally, the table summarizes whether or not the Tukey test was significant.

Behavioral Cue	ANOVA Value	ANOVA Significant	Portion of Program 1	Portion of Program 2	P-value	Tukey Significant
Concentration	.007	Yes	Opening Presentation	Activities	.043	Yes
			Activities	Closing Presentation	.007	Yes
Boredom	.003	Yes	Opening Presentation	Activities	.002	Yes
			Activities	Closing Presentation	.054	No
Confusion/Frustration	.003	Yes	Opening Presentation	Activities	.005	Yes
			Activities	Closing Presentation	.009	Yes

Results of ANOVA and Tukey Tests for *Cool Chemical Science* Observations

A summary of the explanation of these values and what the data suggests is shown in Table 29. As in the previous table the first column shows the behavioral cues being observed. The next

two columns then show which two portions of the program are being analyzed against one another.

The final column then suggests the explanation behind what the tests mean.

Behavioral Cue	Portion of Program 1	Portion of Program 2	Analysis suggests
Concentration	Opening Presentation	Activities	Concentration increases between portion of program 1 and 2
	Activities	Closing Presentation	Concentration decreases between portion of program 2 and 3
Boredom	Opening Presentation	Activities	Boredom decreases between portion of program 1 and 2
	Activities	Closing Presentation	No statistical difference
Confusion/Frustration	Opening Presentation	Activities	Confusion/Frustration increases between portion of program 1 and 2
	Activities	Closing Presentation	Confusion/Frustration decreases between portion of program 2 and 3

Analysis of Results for *Cool Chemical Science* Observations

These results suggest that concentration is generally higher while students are in the activity section of the program in relation to the opening and closing presentations. Additionally, the results also suggest that students find themselves less bored while in the activity section of the program as opposed to listening to an opening presentation. Finally, students do seem to find themselves more confused/frustrated during the activity session of the program than in the opening and closing presentations. These observations suggest that students find themselves more engaged in the activity section of the program. Similar tables with the same organizational style were also created for the other three programs.

Nanotechnologies

We then analyzed the *Nanotechnologies* program with identical tests as those used for the *Cool Chemical Science* observations. We created two tables following a similar format as those of Table 28 and Table 29. They can be seen in Table 30 and Table 31.

Behavioral Cue	ANOVA	ANOVA	Portion of	Portion of	P-	Tukey
----------------	-------	-------	------------	------------	----	-------

	Value	Significant	Program 1	Program 2	value	Significant
Concentration	.334	No	Tukey Test Not Conducted			
Boredom	.000	Yes	Opening Presentation	Activities	.000	Yes
			Activities	Closing Presentation	.107	No
Confusion/Frustration	.025	Yes	Opening Presentation	Activities	.022	Yes
			Activities	Closing Presentation	.288	No

Results of ANOVA and Tukey Tests for *Nanotechnologies* Observations

As can be seen this table shows that concentration was not ANOVA significant and it was not necessary to conduct a Tukey test.

Behavioral Cue	Portion of Program 1	Portion of Program 2	Analysis suggests
Concentration	N/A	N/A	No statistical difference between all three portions of the program
Boredom	Opening Presentation	Activities	Boredom decreases between portion of program 1 and 2
	Activities	Closing Presentation	No statistical significance
Confusion/Frustration	Opening Presentation	Activities	Confusion/Frustration increases between portion of program 1 and 2
	Activities	Closing Presentation	No Statistical Significance

Analysis of Results for *Nanotechnologies* Observations

These data suggest that concentration has no significant difference between moving between the different sections of the program. These data also suggest that boredom decreases as students transition from the opening presentation to the activities section of the program. Finally, the data also suggests that confusion/frustration increases as the students move to the activities section of the program. This test again suggests that students find themselves more engaged during the activity session of the program. However, a more in depth study of engagement would be necessary to verify this result.

Forensic Frenzy

We performed the same statistical analysis as was used for the *Cool Chemical Science* Program and the *Nanotechnologies* program. Results and analysis of the ANOVA test can be found in Table 32 and Table 33.

Behavioral Cue	ANOVA Value	ANOVA Significant	Portion of Program 1	Portion of Program 2	P-value	Tukey Significant
Concentration	.031	Yes	Opening Presentation	Activities	.053	No
			Activities	Closing Presentation	.053	No
Boredom	.000	Yes	Opening Presentation	Activities	.000	Yes
			Activities	Closing Presentation	.267	No
Confusion/Frustration	.022	Yes	Opening Presentation	Activities	.080	No
			Activities	Closing Presentation	.024	Yes

Results of ANOVA and Tukey Tests for *Forensic Frenzy* Observations

It should be noted that while the ANOVA value is significant, both Tukey levels are not. This is what is commonly referred to as a false positive and is the justification for requiring a Tukey test.

Behavioral Cue	Portion of Program 1	Portion of Program 2	Analysis suggests
Concentration	N/A	N/A	No statistical difference between all three portions of the program
Boredom	Opening Presentation	Activities	Boredom decreases between portion of program 1 and 2
	Activities	Closing Presentation	No statistical significance
Confusion/Frustration	Opening Presentation	Activities	No statistical significance
	Activities	Closing Presentation	Confusion/Frustration decreases between portion of program 2 and 3

Analysis of Results for *Forensic Frenzy* Observations

This analysis suggests dissimilar results to the previous two tests. In this test, the data suggests that concentration is not significantly increasing between any sections of the program. Additionally, we also found that boredom decreases as soon as students are engaged in the activity

section of the program. Finally, we found that confusion/frustration decreases when students are asked to stop the activity session of their program and begin the final wrap up portion of the program. These observations again suggest that students are most interested in the activity section of the program.

Materials and Structures

Similar to the other programs, we also quantitatively analyzed the data to test if there was any significant difference between the different parts of the programs. We once again investigated concentration, boredom, and confusion/frustration as the three behavioral cues of interest. Table 34 and Table 35 summarize the results of the three ANOVA and their corresponding Tukey tests.

Behavioral Cue	ANOVA Value	ANOVA Significant	Portion of Program 1	Portion of Program 2	P-value	Tukey Significant
Concentration	.320	No	Tukey Test Not Conducted			
Boredom	.565	No	Tukey Test Not Conducted			
Confusion/Frustration	.011	Yes	Opening Presentation	Activities	.012	Yes
			Activities	Closing Presentation	.136	No

Results of ANOVA and Tukey Tests for *Materials and Structures* Observations

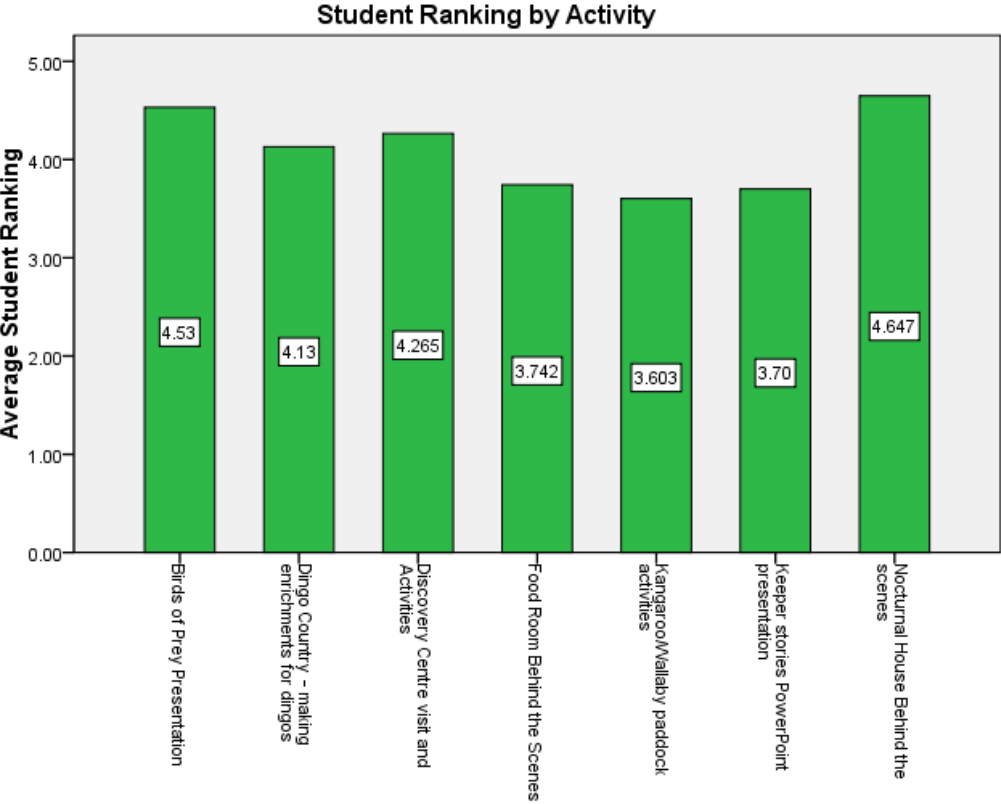
This test shows that neither concentration nor boredom had a significant ANOVA value. Therefore, it was not necessary to conduct a corresponding Tukey test on these behavioral cues.

Behavioral Cue	Portion of Program 1	Portion of Program 2	Analysis suggests
Concentration	N/A	N/A	No statistical difference between all three portions of the program
Boredom	N/A	N/A	No statistical difference between all three portions of the program
Confusion/Frustration	Opening Presentation	Activities	Confusion/Frustration increases between portion of program 1 and 2
	Activities	Closing Presentation	No statistical significance

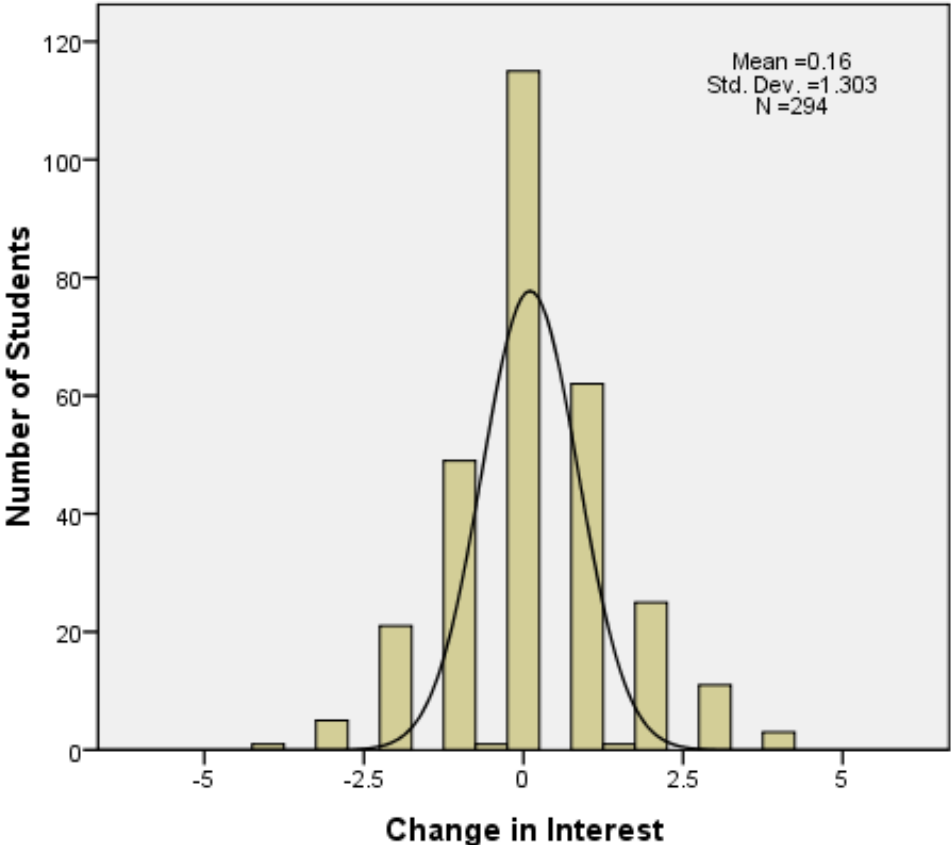
Analysis of Results for *Materials and Structures* Observations

These results suggest that students do not become any more concentrated or bored as a result of the program activities. However, students are more frustrated and confused as a result of the program activities. This can indicate to CSIRO that they need more explanation regarding how the activities are performed in their *Materials and Structures* program.

APPENDIX J Student Ranking of Healesville Program



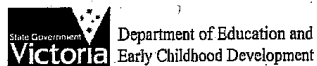
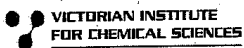
APPENDIX K Change in Student Interest between PR and P1



APPENDIX L Teacher Booklets



Cool Chemical Science Teacher Booklet



Australian Science, Australia's Future www.csiro.au

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1. GENERAL INTRODUCTION

With hands-on activities and demonstrations examining chemical and physical changes, chemical reactions and relating materials and chemicals to their common uses, students will have a great time exploring the world of chemistry.

2. CURRICULUM LINKS

2.1 The Victorian Essential Learning Standards

Science is the key domain for this program, with interpersonal development, communication and thinking promoted through problem solving, small group work, and group discussion related to science practice and innovations.

2.1.1 Discipline Based Learning

Science

Students investigate and analyse both common domestic and specialist materials and explore how science is used throughout their lives. The experiments aid students in understanding concepts related to matter, its properties and uses, and how different substances are created through chemical change.

Level 4

Students explore substances changing physically and chemically, use instruments and materials responsibly and analyse results and draw conclusions relevant to cause and relationship.

Level 5

The experiments require the practice of safe investigations, using chemicals responsibly and managing the safe disposal of these chemicals. Students explore particle models to explain structure and properties of matter, analyse results and draw conclusions.

2.1.2 Physical, Personal and Social Learning

Interpersonal Development

Students conduct experiments in small groups requiring collaboration to complete experiments and draw conclusions. Students will need to work together effectively in order to achieve shared outcomes.

2.1.3 Interdisciplinary Learning

Communication

Students are required to listen, view and respond to demonstrations and instructions as well as engage in group discussion. The experiments conducted during the session are linked to common and specialist applications of science in the broader community.

Thinking Processes

Students are encouraged to apply their creative thinking skills to solving problems and developing concepts for scientific innovations based on the outcomes of their experiments. Discussions guide students to form their own hypotheses and respond to models and explanations provided by the presenter.

2.2 CSF II Links

This program covers key areas of the following sections of CSF II:

2.2.1 Science Key Learning Area

Chemical Science

- Substances: structure, properties and uses
 - Level 4.1 – Relate properties of common substances to their suitability for particular use.
 - Level 5.1 – Use a simple particle model to explain the structure and properties of solids, liquids and gases.
 - Level 5.2 – Relate the safe use and disposal of common substances to their physical and chemical properties.
- Chemical Reactions
 - Level 4.3 – Distinguish between physical and chemical change.
 - Level 5.3 – Describe ways of producing a chemical change and influencing its rate.

3. CONCEPTS COVERED IN COOL CHEMICAL SCIENCE

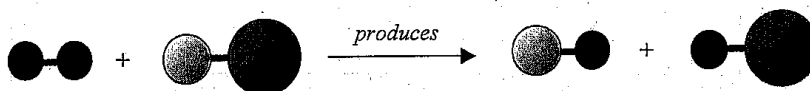
3.1 Materials: structure, properties and uses

In this program, the unusual properties of a range of materials are investigated. Where possible, their properties are related back to the structure and functionality of the constituent molecules. In many cases, the materials have been designed with a particular purpose in mind, whilst in others, the unique properties of a material have led them to use in a given application. Students

are encouraged to consider the relationship between a material's properties and its possible applications by suggesting alternative uses and possible modifications.

3.2 Chemical Reaction

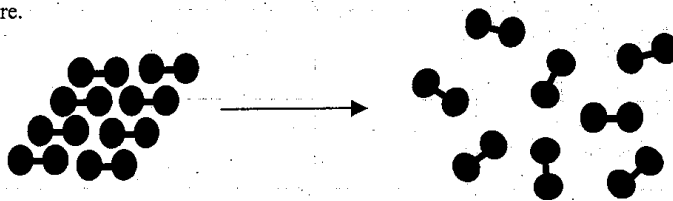
A chemical reaction is an event that occurs when chemical substances are transformed by the rearrangement of their atoms. It usually involves two or more chemical substances interacting with one another, producing new substance(s) which have properties different to the starting materials. See below for a schematic representation of one example.



Chemical reactions can be fast or slow, reversible or irreversible, and either consume or release energy. There are a number of physical changes that may be observed when chemical reactions occur including: Changes of colour, texture, size or shape; changes of temperature of materials; generation of gas (bubbles, fizzing); generation of light or sound; generation of odourous chemicals; or appearance of a precipitate (solid) from solution.

3.3 Physical Change

Physical change is different from a chemical reaction, but the two can be quite difficult to distinguish. In a physical change, the composition of the chemical substance does not change, but its physical properties do. Physical properties include size, shape, density, colour and texture.



The classic example of physical change is the change of state of water with changing temperature. The H_2O molecules remain intact whether the water exists as solid (ice), liquid or gas (steam).

4. CLASS ACTIVITIES

4.1 Table of Class Activities

Activity (Page No.)	Materials : structure, properties and uses	Chemical Reaction	Physical Change
Blue Bottle (pg. 6)		✓	
Cabbage Chemistry (pg. 7)		✓	
Curious Colours (pg. 8)	✓		✓
Gel Swell (pg. 9)	✓		✓
Heat Sensitive Materials (pg. 9-10)	✓		✓
Magic Jug Demonstration (pg. 11)		✓	
Mystery Muddle (pg. 12)		✓	✓
Silly Putty and Bouncing Balls (pg. 13)	✓		
Slime Time (pg. 14)	✓	✓	
UV Protection (pg. 14)	✓		

4.2 List Of Class Activities

4.2.1 Blue Bottle

This activity demonstrates the concept of *reversible* reactions. Many reactions are reversible, for example many of those involved in the body's metabolism of food, whereas others are much more difficult to reverse, such as burning a match.

In this experiment, students combine glucose, methylene blue and sodium hydroxide solution by shaking in a sealed jar. The solution is initially blue, but fades to colourless over approximately 3 minutes. At this time, the students shake the jar again, which makes the solution regain its blue colour, then it begins to fade slowly once again. The process can be repeated many times.

The chemistry involved is quite complicated, and involves the reduction and oxidation of a number of chemicals.

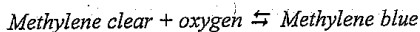
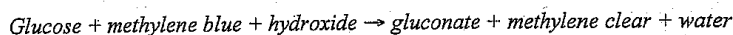
Simple explanation

Methylene blue is an indicator for the presence of oxygen in a solution. When there's lots of oxygen present in the solution, the indicator is deep blue, and when there's no oxygen present, the indicator is colourless.

At the start of the experiment, there is lots of oxygen present, so the solution is blue. However, the oxygen gets used up in a reaction with the glucose, so is slowly removed from the solution. This results in the loss of blue colour. When the jar is shaken, oxygen from the air at the top of the jar is dissolved into the solution, which reinstates the blue colour.

In more detail

Glucose is an aldehyde, which can be oxidised into gluconic acid, which is deprotonated in the presence of a base to form gluconate anions. The methylene blue acts as the oxidising agent, and in the process is reduced to methylene clear (also known as leucomethylene blue).



When the jar is shaken, oxygen dissolves into the solution, which re-oxidises the methylene clear back to methylene blue. The newly created methylene blue then oxidises more glucose, and is itself reduced, once more decolourising the solution. This cycle is repeated with each shake of the jar.

This redox reaction involving methylene blue is reversible, with each methylene blue molecule able to be cycled through its reduction and oxidation many times. The reaction only ceases when all the glucose is consumed.

More for students to explore

1. Oxygen levels in streams and rivers are important to the plants and animals that live in them. One way of testing for oxygen in water is to use methylene blue. Find out some other tests of water quality (eg turbidity tests measure how cloudy the water is).
2. Chemical reactions that change colour are common. Find some colour-changing reactions that you can perform safely with things that you can find around your house or school (eg making caramel, burning toast, Dettol in water).
3. Not all chemical reactions cause colour changes. Which other things might tell you that a reaction has taken place? For example, how do you know if a reaction has taken place between vinegar and sodium bicarbonate?

4.2.2 Cabbage Chemistry

An acid is a chemical compound which, when added to water, causes an increase in the amount of hydrogen ions in the solution. Bases (or alkalis) are the opposite of acids, and if you mix a base with an acid of equal strength you will form a salt and water. This reaction is called neutralisation.

The strength of an acid or base is measured by its pH, which relates to the concentration of hydrogen ions dissolved in the solution. Water (neutral) has a pH of 7, acids have a pH less than 7, and bases are between 7 and 14.

Acids and bases are everywhere, including in our bodies and in our food. Acids and bases can be useful to us, or dangerous to us. Strong acid in a car battery is useful, but it will damage your eyes and skin. Caustic soda is a strong base that will clear a blocked drain, but is also corrosive.

Many plants and animals are sensitive to small changes in the pH of their surroundings. Gardeners and farmers need to monitor the pH of their soils, and pH is also important for aquatic animals. Pure unpolluted rainwater has a pH of 5.5, which is slightly acidic. This is due to carbon dioxide in the air dissolving in raindrops.

What is happening?

Purple cabbage juice contains a pigment called anthocyanin, which is a natural acid-base indicator. Anthocyanins are found in many flowers and fruits. Indicators are chemicals that tell us whether a solution is a base, an acid, or neutral, by changing colour. The indicator derived from cabbage juice is purple when neutral, but turns pink in the presence of acids, and green in the presence of bases.

The colour change tells us that a chemical reaction has taken place between the indicator and the liquid being tested, and this reaction is reversible. For example, if you add acid to some cabbage juice to turn it pink, the juice can be turned purple again by adding a basic solution, and can be made to turn green if more base is added.

More for students to explore

1. Make up your own cabbage juice indicator! Just roughly chop a handful of red cabbage, and put it in a large jug. Add boiling water, and allow to soak for 30 minutes. Strain off the cabbage pieces, and use the remaining solution.
Predict whether these liquids would be acids, bases or neutral: soap, vinegar, bleach, cream of tartar, orange juice, tap water, honey, oil, salt water. Test your predictions at home or at school.
2. Try using other brightly coloured plants as indicators – rose petals or blackberries work well. Tea also makes a good indicator.
3. Your stomach contains an acid to help you digest your food. People with stomach aches sometimes take antacids like Mylanta. Do you think Mylanta is an acid, a base or neutral? Why do you think so?
4. It is often said that acids are very harmful to us. How is it we are able to drink some acids like lemon juice?

4.2.3 Curious Colours

In this activity, when detergent is added to milk which contains a few drops of food colouring, the colours swirl around and mix through the milk. There are two main processes which result in this explosion of colour.

Milk is primarily made of water, but also contains proteins, various vitamins and minerals, and fat which is suspended in tiny droplets. Water and fat don't generally mix well, but a small amount of fat may remain suspended in water as an emulsion.

Soaps and detergents are examples of *surfactants* (short for surface-active-agents). They are long molecules, with one end which is attracted to water (*hydrophilic*, or water-loving) and the other end attracted to fats and oils (*hydrophobic*, or water-hating). When you wash your dirty dishes, the detergent forms a link between the grime on your plates and the water, helping the grease to mix in with the water and be carried off down the plug hole.

In this experiment, the hydrophobic tails of the detergent molecules stick to the fat and protein in the milk, and cause them to mix around with the water. The food colouring doesn't take part, but is simply there to show the swirling and mixing motion of the mixture.

The second process at work is to do with the surface tension of the milk. Water has a very high surface tension, which makes the surface act like a skin. It is this skin which allows insects such as pond skaters to walk on water. The detergent disrupts the surface tension of the milk, which adds to the swirling and mixing process.

More for students to explore

1. How much does the fat in milk contribute to the curious colours experiment? Redo the experiment with skinny milk, Rev, Physical, etc. Is there a difference?
2. Do the experiment in 3D by using a glass dish. Is the mixing only on the surface, or do the colours dive deep into the milk?
3. Float a loop of thread in a bowl of water, and add a drop of detergent into the middle of the loop.
4. Sprinkle pepper onto the surface of a bowl of water and add a drop of detergent.

5. How many drops of water can you balance on a coin?
6. Try to balance a needle on the surface of a bowl of water. When it's floating, add a drop of detergent to the water. What happens? Why do you think this is? What does detergent do to water?

4.2.4 Gel Swell

The material used in this activity is sodium polyacrylate, which is an example of a super-absorbent hydrogel. Sodium polyacrylate is a *polymer*, which is a large molecule made up of many repeating smaller units, or *monomers*. The hydrophilic polymer chains form a porous network, like a sponge, which can expand to hold large amounts of water.

This material can absorb up to 800 times its own weight in water, and has found a large range of uses in industry and in the market place. Its water absorbing properties make it ideal for use in nappies and sanitary products. It is also widely used as an additive to soil potting mixtures to capture water and hold it in the soil, releasing it slowly to the plants. Similar hydrogels are used in science toys (Grow Alligators) and contact lenses.

The absorption of water is dependent on the salt concentration of the water, with very little absorption of salty water. This is why babies can wear nappies in the sea without being weighed down by absorbed seawater.

Hydrogels are increasingly being used in medicine. They are useful for dressing open wounds such as ulcers and burns, where a moist environment is required. Hydrogels made from biodegradable polymers are now being used inside the body to form a tissue scaffold, where the hydrogel forms a supportive matrix for human cells to grow through.

4.2.5 Heat Sensitive Materials – Thermochromic Paper

Many products use *thermochromic* pigments that change colour according to temperature. They cycle from a colour to colourless and back again. In the thermochromic paper, the coloured pigment is made up of microcapsules. The microcapsules are made from melanine formaldehyde (the same material as Formica), and contain a dye and a lipid (fat) such as methyl stearate.

The colour change occurs because waxes and fats are opaque when solid and transparent when liquid. When the fat is liquid at high temperatures, the dye is barely visible, but when the fat solidifies at low temperatures, the dye becomes vividly bright.

When the pigment is diluted in an ink or paint medium and spread in a thin layer during printing, it becomes essentially invisible. By altering the combination of lipids in the microcapsules, colour-changing pigments can be made to cycle at almost any chosen temperature within a range of only about 5°C.

Thermochromic pigments are found in a number of novelty applications such as 'Hypercolour' t-shirts, and colour changing toys. However, they are also useful temperature indicators for

safety purposes. Baby bath toys which can indicate if the water is too hot, or containers which can indicate unsafe food temperatures are currently on the market.

More for students to explore

1. Where else do you find thermochromic pigments? Are any used for purposes other than novelty decoration?
2. Thermochromic pigments are sometimes found in food packaging. Can you think of any examples? Design a type of food packaging which incorporates thermochromic pigments.

4.2.6 Heat Sensitive Materials – Memory Wire

Nitinol is an alloy of nickel and titanium (the 'ni' at the end of its name comes from the US Naval Ordnance Laboratory where it was first developed). It is an example of a shape memory alloy, or SMA.

Nitinol has two different solid forms, and it can swap between these forms by a simple temperature change. The transition temperature of the nitinol demonstrated is around 65 °C.

When the nitinol is under its transition temperature (e.g. at room temperature), it exists in a form which is easily bent and deformed. Heating the nitinol over its transition temperature causes a shift to a different form, in which the atoms are packed more closely. This means that the material contracts slightly on heating, and becomes harder. The phase change happens extremely rapidly, and with great force.

To set the 'memory' shape, the alloy must be heated above 500°C, and held in the desired position. This causes the atoms to arrange themselves into the high temperature phase. When cooled, it transforms into the low temperature phase, but even so, each atom 'remembers' its neighbours from the high temperature phase, and will return to the memory shape when warmed.

Nitinol is used in dental brace wire, glasses frames, as muscles in robots, and most importantly in medical stents. A transition temperature slightly less than body temperature will ensure that the stent remains in its memory shape, keeping arteries and veins open.

These wires also respond when they are heated by running an electric current through them. In this way they can be made to contract like muscles, and are useful in robotics.

More for students to explore

1. Imagine other uses for shape memory alloys like nitinol.

4.2.7 Magic Jug Demonstration

In this demonstration, a colourless solution is poured from a jug into the five cups, giving bright pink, blue, yellow, blue-black and colourless solutions. The cups are tipped back into each other, and finally into the jug, and each solution produced is colourless.

Simple explanation

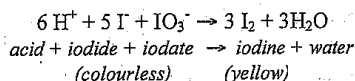
The jug contains a base along with iodide and iodate anions. There are a few processes occurring in this demonstration. Firstly, acid-base indicators show the basic nature of the jug solution (in cups 1 and 2, pink and blue respectively). Secondly, adding acid to the jug solution (in cups 3 and 4) produces iodine. This iodine gives the contents of cup 3 its yellow colour, and cup 4 (which also contains starch) its black colour. Cup 5 contains sodium sulfite which does not react, so no colour change is observed.

However, when the contents of cup 5 are combined with the contents of cup 4, the sodium sulfite removes the iodine, and therefore the black colour of the solution. Similarly, when this mixture is added to cup 3, the yellow colour disappears. By now, the contents of the cup are acidic (not basic any more). This means that when the mixture is poured back into cups 2 and 1, the acid-base indicators switch back to their acid state, which is colourless.

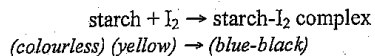
In more detail

Cups 1 and 2 contain acid-base indicators, which turn from colourless (neutral) to coloured as you add the basic solution. Cup 1 contains the indicator phenolphthalein, which turns pink in the presence of base. Cup 2 contains the indicator thymolphthalein, which turns blue in the presence of base.

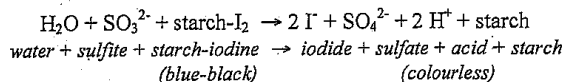
Cups 3 and 4 both contain an excess of sulfuric acid. This neutralises, then acidifies the basic solution. The acid then reacts with the iodide and iodate in solution to form iodine which is a yellow colour.



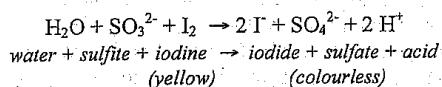
Cup 4 has starch added to it, which reacts with the iodine to produce the blue-black starch-iodine complex.



Cup 5 contains sodium sulfite. This does not react with the basic magic jug solution. However, when the contents of cup 5 are poured into cup 4, the sodium sulfite reacts with the starch-iodine complex, turning it from blue-black back into colourless iodide.



Similarly, when the contents of cup 4 are poured into cup 3, the sulfite again reduces the yellow iodine to colourless iodide.



When the contents of cup 3 is poured into cup 2, the resulting mixture is no longer basic, so the thymolphthalein indicator turns back to colourless. The same occurs when the contents of cup 2 is poured back into cup 1, turning the phenolphthalein indicator back to colourless.

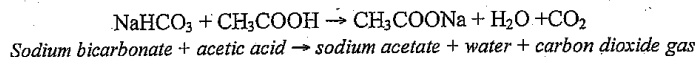
4.2.8 Mystery Muddle

In this experiment the students are asked to investigate three unknown white powders, using three tests – cabbage juice indicator, vinegar, and water. The powders are sugar, cream of tartar (potassium hydrogen tartrate), and bicarb soda (sodium bicarbonate). Students use the results of their tests, along with the table below to identify the powders.

Ingredient	Dissolves in water?	Colour with cabbage juice	Reaction with vinegar
Sugar	Yes	Purple	No gas
Cream of tartar	No	Pink	No gas
Bicarb soda	Yes	Green	Gas created

The cabbage juice tells us whether the powder is an acid, a base, or is neutral. See the “Cabbage Chemistry” description above for more information. Sugar solution is neutral, cream of tartar solution is acidic, and bicarb soda solution is basic.

The vinegar (acetic acid) tests for carbonates, which are shown by the production of bubbles of carbon dioxide gas. This is a useful test for minerals that contain carbonates, eg limestone. The bicarb soda is the only powder of the three tested which should react with vinegar.



The water tests for solubility – does it dissolve in water? Cream of tartar has very low solubility in water compared to sugar and bicarb soda.

More for students to explore

1. Investigate all the similar looking powders in your kitchen. What reactions do they have with the cabbage juice, the water and vinegar? You could draw up a table to show your

- results. Do any two different powders give the same results for all three tests? Invent an extra test to separate these two powders.
2. Develop some tests to sort different rocks and minerals (eg will it stick to a magnet, does it react with acid, what colour is it, texture, size of particles).
 3. Develop your own scientific method for an experiment. Outline the aims, the method, the results, your conclusions, and the reasons for your conclusions based on existing knowledge.
 4. Think of a famous scientist from history. What did they discover, and how did they discover it? Write a scientific method for one of their experiments.

4.2.9 Silly Putty and Bouncing Balls

Both of these activities investigate the properties of *polymers*. A polymer is a very long molecule, which is made up of many smaller molecules (called *monomers*) joined together. One way of thinking about a polymer molecule is like a train made up of many carriages. Man-made polymers are often referred to as 'plastics' and naturally-occurring polymers include materials such as starch, proteins, DNA, latex rubber and cellulose.

Silly Putty

Silly Putty is the registered trademark of a silicone polymer called polyboro-siloxane. It was discovered by accident during World War II by chemists at the General Electric Company in the USA. They were trying to make a synthetic rubber from silicon, which is extremely abundant in sand and rocks. Instead they discovered this strange fluid, which later became a best selling toy.

It is a fluid – if left on a table it will slowly flow into a flat puddle. Pulled slowly it stretches, but it snaps if it is pulled quickly. It bounces; it shatters if hit by a hammer; and it will pick up print from a newspaper.

Silly putty molecules are silicone polymers. That means they are long molecules made up of repeating units based on silicon. In silly putty the molecules lie side by side, and are attached to their neighbours by weak bonds. These bonds can break and reform very quickly.

When the putty is pulled slowly, the bonds between neighbouring molecules break and reform, allowing the molecules to slide past one another. When the putty is pulled quickly, or hit with a hammer the bonds don't have time to reform, and the putty breaks or shatters.

When Silly Putty is thrown against the floor, the polymer molecules are made to bend. They quickly bend back to their original position, and the putty bounces.

Decision Balls

The two balls are made from polymers, which show how a slight difference in chemical structure can lead to a large difference in properties.

The ball that bounces well at room temperature is made from polychloroprene (Neoprene®), which has large chlorine groups to restrict rotation on every fourth carbon in the long chain. With little bond rotation and chain slippage, the energy of the fall cannot be converted easily into heat. At room temperature, the ball deforms on impact and then immediately returns to a spherical shape causing the ball to bounce back to almost the same height as dropped.

The ball that does not bounce well is made from polynorborene (Norsorex®), which has a five-member ring as part of the chain structure. Although this group restricts the movement, it absorbs most of the energy of a fall. With more degrees of molecular freedom, this polymer does not quickly return to its original shape. Thus, at room temperature the energy of the fall is absorbed within the molecules in the form of heat, and the ball does not bounce.

4.2.10 Slime Time

PVA glue contains long polymer chains of polyvinyl alcohol. This is a little like having lots of rubber bands all stretched out separately. When the borax is added to the PVA solution, the borax links these strands together. You end up with slime that is like all of those rubber bands connected together to make a lump. The more borax you add, the more links you make, and the bouncier your slime will be. If less borax is added, the slime produced is runny and easily stretched.

The slime made here acts as a non-Newtonian fluid. A non-Newtonian fluid is a fluid in which the viscosity changes with the applied strain rate, or in other words, at the rate at which the force is applied to the material.

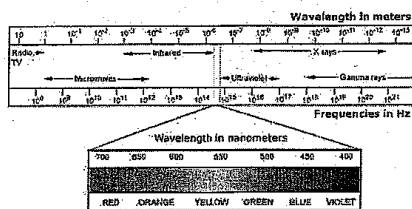
Shear thickening fluids of this sort are being researched for bullet resistant body armour, useful for their ability to absorb the energy of a high velocity projectile impact but remain soft and flexible while worn.

More for students to explore

A commonly used example of a non-Newtonian fluid, sometimes known as 'Oobleck', can be made very easily by adding cornflour to a cup of water. Add the starch in small portions and stir it in slowly. The cornflour does not dissolve in the fluid, but instead forms a suspension in which the small particles of cornflour are suspended in the water. When the suspension nears the critical concentration - becoming like cream in consistency - the unusual behaviour (sometimes called "shear thickening") of this non-Newtonian fluid becomes apparent. The application of force - for example by stabbing the surface with a finger, or rapidly inverting the container holding it - leads to the fluid behaving like a solid rather than a liquid. More gentle treatment, such as slowly inserting a spoon, will leave it in its liquid state. Trying to jerk the spoon back out again, however, will trigger the return of the temporary solid state. A person moving quickly and/or applying sufficient force with their feet can literally walk across such a liquid.

4.2.11 UV Protection

UV (or ultraviolet) light is a form of electromagnetic radiation, as is visible light, infrared light, radio waves, microwaves, X rays, gamma rays and cosmic rays (see diagram below). All electromagnetic radiation travels at the speed of light, which is 300,000km per second. That is fast enough to travel from Melbourne to London and back seven times a second.



UV light carries more energy than the visible colours and it has a higher frequency. This makes UV light dangerous for living things, including us. UV light damages the DNA in our cell nuclei, which can lead to cancers, especially of the skin. However, most of the UV rays from the sun are absorbed by the ozone layer.

Sunscreen (also known as sunblock) is a lotion, spray or other product that helps protect the skin from the sun's UV radiation, and which reduces sunburn and other skin damage, ultimately leading to a lower risk of skin cancer. The best sunscreens protect against both UVB (higher energy UV radiation with wavelength between 290 and 320 nanometres), which can cause sunburn, and UVA (lower energy UV light with wavelength between 320 and 400 nanometres), which can cause more long-term damage, such as premature skin aging. Most sunscreens work by containing either an organic chemical compound that absorbs ultraviolet light (such as oxybenzone) or an opaque material that reflects light (such as titanium dioxide, zinc oxide), or a combination of both. Typically, absorptive materials are referred to as chemical blocks, whereas opaque materials are mineral or physical blocks.

The principal ingredients in sunscreens are usually aromatic molecules conjugated with carbonyl groups. This general structure allows the molecule to absorb high-energy ultraviolet rays and release the energy as lower-energy rays, thereby preventing the skin-damaging ultraviolet rays from reaching the skin. So, upon exposure to UV light, the ingredients do not undergo significant chemical change, allowing these ingredients to retain the UV-absorbing potency without significant photo-degradation.

The SPF (sun protection factor) of a sunscreen is a laboratory measure of the effectiveness of sunscreen; the higher the SPF, the more protection a sunscreen offers against UV-B (the ultraviolet radiation that causes sunburn) and UV-A (associated more with longer-term skin damage). The SPF indicates the time a person can be exposed to sunlight before getting sunburn with a sunscreen applied relative to the time he or she can be exposed without sunscreen. For example, someone who would burn after 12 minutes in the sun would expect to burn after 2 hours (120 min) if protected by a sunscreen with SPF 10. In practice, the protection from a particular sunscreen depends on factors such as:

- The skin type of the user.
- The amount applied and frequency of re-application.
- Activities in which one engages (eg. Swimming, leading to a loss of sunscreen from the skin).
- Amount of sunscreen the skin has absorbed.

The SPF is an imperfect measure of skin damage because invisible damage and skin aging is also caused by UVA, which does not cause reddening or pain. According to a 2004 study, UVA also causes DNA damage to cells deep within the skin, increasing the risk of malignant melanomas. Conventional sunscreen does not block UVA as effectively as UVB, and an SPF rating of 30+ may translate to significantly lower levels of UVA protection.

APPENDIX A – USEFUL WEBSITES

Experiments

CSIRO DIY Science - Chemistry Experiments

<http://www.csiro.au/resources/ChemistryExperiments.html>

Royal Australian Chemical Institute - 'Cool Chemistry' experiments

<http://chemistry.org.au/>

Royal Society of Chemistry (UK) - Classic Chemistry Experiments

http://www.rsc.org/education/teachers/learnnet/classic_exp.htm

Suppliers

CSIRO Shop

<http://www.csiroshop.com>

Prof Bunsen

<http://www.profbunsen.com.au>

Educational Innovations (US)

<http://www.teachersource.com>

Contact Details

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Highett, 3156
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Email: education@csiro.au
Web: www.csiro.au/melbcsirosec

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Forensic Frenzy

Teacher Booklet (years 7-10)



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1. GENERAL INTRODUCTION

Forensics is a field of science dedicated to the methodical gathering and analysis of evidence to establish facts that can be presented in a legal proceeding. Though crime scenes and laboratories are perhaps most often associated with forensics, there is also computer or network forensics, forensic accounting, forensic engineering and forensic psychiatry, among other specialized fields that are today an integral part of forensics. The field of forensics is so vast that it requires specialists or criminalists at every point of investigation, from tyre track analysis, to odontology, to the lands and grooves that make every gun barrel unique. From microscopic evidence and transfer evidence such as fibres and hair, to blood splatter and forensic entomology, there are many fields of specialization within forensic science.

Those who collect forensic evidence must follow strict procedures to protect the evidence from getting contaminated or destroyed, and must preserve the chain of custody. Since science is unbiased and sound, forensics is considered a very critical part of any investigation. Though forensics often deals with circumstantial evidence, it is widely considered as the best and the most compelling evidence available. It has been suggested that the public's awareness of forensic science might be potentially compromising to law enforcement, producing educated criminals who might be more apt to try and effect a clean crime scene. Experts generally tend to believe that it is nearly impossible to avoid leaving behind trace evidence at a crime scene, even when extraordinary efforts are made to the contrary.

This program presents students with a simulated crime and evidence is presented for them to examine in a scientific way. Students are encouraged to formulate their own conclusions based upon the evidence that they have analysed.

2. CURRICULUM LINKS

2.1 The Victorian Essential Learning Standard

This program covers key areas of the following sections of Levels 5 and 6 of the VELS:

2.1.1 Discipline Based Learning

Science

Students will use science as a problem-solving tool and will develop reasoning and critical thinking skills in order to try and solve the crime that they are presented with. Students will collect data systematically, and analyse the collected data. They will link cause and effect to determine the possible sources of trace evidence left at the crime scene.

2.1.2 Physical, Personal and Social Learning

Interpersonal Development

Students work and learn in teams while performing the hands-on activities. They are encouraged to work at sharing tasks with others in their group while performing a range of physical and mental activities of varying lengths and complexity.

Civics and Citizenship

Through the course of discussions held within the program students learn about the role of the courts and police. They consider important principles such as the independence of the judiciary, equality before the law, and the presumption of innocence. Students understand that when Australians travel overseas, the laws of other countries apply to them.

2.1.3 Interdisciplinary Learning

Communication

Students are exposed to a range of aural, written and visual communication skills. They practice their listening skills in both formal and informal learning environments, learn to interpret information from instruction sheets and enjoy the opportunity of questioning speakers to seek clarification of key points.

Thinking Processes

Students participate in a variety of investigations and problem-solving activities that encourage them to experiment with a range of creative solutions. They begin to reflect on the approaches they use to assist them to form their solutions.

Activities in the program encourage students to develop questions and collect data from a range of sources. This data can then be evaluated to determine its validity.

2.2 CSF II Links

This program covers key areas of the following sections of CSF II:

2.2.1 Science Key Learning Area

This program covers each of the physical, chemical and biological science strands of the learning area.

3. CONCEPTS COVERED IN FORENSIC FRENZY

3.1 Types of Forensics

Forensic science is the umbrella term for a collection of scientific procedures that can be employed when it comes to providing evidence that a crime has been committed and also provides ways and means of proving how a crime has been committed. For example:

3.1.1 Computer Forensics

In today's ever changing criminal world the use of computers for fraud and the pursuit of other crimes has increased to dramatic proportions. So much so that specialist departments have been formed to help deal with the problem of computer crime. Computer crime is not only about fraud – online or otherwise – it also encompasses areas such as pornography, child sex abuse and the sale of black market goods online.

3.1.2 Forensic Accounting

A forensic accountant is charged with the task of poring over vast amounts of figures in order to find out where illegal financial practices have taken place and whether or not companies or individuals have been fraudulently treated by someone acting on their behalf.

3.1.3 Forensic Archaeology

Archaeology and anthropology are the study of historic human remains and the objects, buildings and other artefacts associated with them. Forensic archaeologists and anthropologists can apply the same techniques to crime scenes, to get evidence from human remains, as well as from drugs, guns or stolen goods found at crime scenes, whether recent or decades old. A forensic archaeologist's first involvement may be to help the police locate the site where a body and victim's personal items, or stolen goods are buried, through geological and geophysical surveying techniques, as well as using imaging and photography. The forensic archaeologist may also help with the excavation, using similar tools and expertise to those used at an archaeological dig.

3.1.4 Forensic Dentistry

Forensic Dentistry is the area of forensic medicine concerned with the examination of teeth, especially in the cases of victims who cannot be identified by conventional means or when an attacker bites a victim and leaves bite marks behind. A forensic dentist can provide accurate estimates as to the age of a victim, when they died, and can also take DNA samples from the teeth for use in the identification process. As teeth are one of the only things remaining when a body decomposes they are useful for extrapolating DNA samples along with bone marrow and hair.

3.1.5 Forensic Entomology

Entomology is the study of insects, and forensic entomologists use insects to provide more information about crimes. The live and dead insects found at the site of a crime can tell the forensic entomologist many things, including when and where crimes took place, whether the victim had been given drugs, and in murder cases, the time since death, and the length of time the body had been there.

3.1.6 Forensic Graphology

Forensic Graphology is the study of handwriting especially that found in ransom notes, poison pen letters or blackmail demands. As no two individual's handwriting is the same the comparison of handwriting can be used to match with evidence from a suspect. While you cannot tell a person's sex or race from their handwriting it can give interesting clues as to their mental and emotional state.

A Graphologist looks for insights into some of the following: mood, motivation, integrity, intelligence and emotional stability. This may not sound important but you can tell a lot about a person by the way they write - or more importantly - in the words they write. It has become commonplace now for us as individuals to write in the same manner as we speak, using abbreviations, slang and colloquialisms that vary from person to person and indeed place to place. These are important and a Graphologist can make good use of these things during the investigative process. Forensic Graphology can also help provide a usable profile in conjunction with a forensic psychologist that police can use in order to draw up a list of suspects.

3.1.7 Forensic Pathology

Pathology is the study of disease and its causes. Forensic pathology involves discovering the cause of death, especially in cases where it is sudden or the police suspect that it has not occurred by natural causes. A forensic pathologist is a medical doctor trained in pathology.

The first stage is to conduct a post-mortem (also known as an 'autopsy'). This involves first examining the body and looking at its external appearance to help identification and to begin to determine how the person died - for example looking for evidence of blows, looking at the size, shape and location of wounds such as stab wounds or bullet entry points, or looking for signs of asphyxia.

The pathologist will then begin surgical procedures and study the internal organs to see how external injuries connect to internal injuries, for example bruising of the brain following a head injury, or damage to the heart and blood vessels following a stabbing or shooting, and look for evidence of disease as a cause of death, for example heart attack, stroke, aneurysm or infection. The stomach contents may provide clues to the time, circumstances, or cause of death.

The autopsy may also include taking samples that may lead to conviction of a murderer or rapist including taking samples from under fingernails, or samples of semen from vaginal swabs.

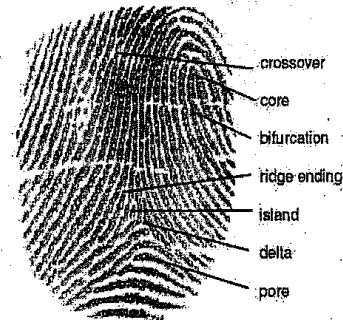
3.1.8 Forensic Psychology

Forensic psychology is the forensic study of the mind and the ways in which the mind works, especially in the instances of violent crime. During the course of an investigation a forensic psychologist is charged with the task of uncovering the reasons behind why an individual might carry out such an act.

3.2 Fingerprinting

Fingerprints are the patterns on the inside and the tips of fingers. The ridges of skin, also known as friction ridges, together with the valleys between them form unique patterns on the fingers. Fingerprint analysis is a biometric technique comparing prints from a crime scene with either the prints from a suspect or a database of fingerprints. Uniqueness of prints, and the fact that they do not change during a person's life, form the basis for fingerprint analysis. The uniqueness of the prints is determined by the minute changes in local environment during foetal development; therefore, identical twins undistinguishable by DNA analysis can be differentiated with fingerprint analysis. Although the fingerprint pattern remains the same, growth accounts for an enlargement of the patterns. Additionally, accidents or some diseases may alter fingerprint patterns

Marcello Malpighi first made notes about the ridges, loops, and spirals of fingerprints in 1686. In 1888 Sir Francis Galton established the first classification system for fingerprints and was the first to assert that no two prints are the same, or that the odds of two prints being identical were about 1 in 64 billion. Sir Edward Henry developed the Henry Classification System in 1901. This system today forms the basis for print recognition in most English speaking countries. This system categorized the ridge patterns into three groups: loops, whorls, and arches.



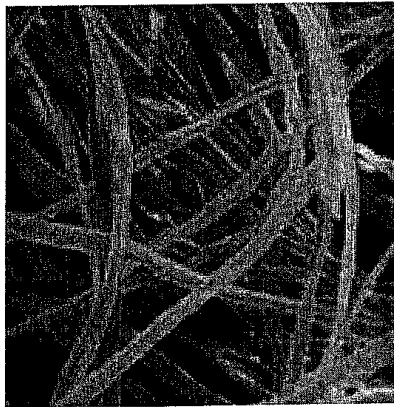
The presence of pores on the surface of the ridges of the fingers results in the accumulation of perspiration on the fingertips. This moisture remains on the surface of the object a person touches, leaving prints. Depending on the surface touched, prints can be visible to the naked eye (patent) or invisible (latent). Ridges present on the fingers are classified based on the patterns they form. The most important features are ridge endings and bifurcations (separation of a ridge into two). These features are called minutiae and form the basis for further classification and identification. Based on the forms created by the minutiae (loops, whorls, etc.) fingerprints are further sub-classified into many more distinct patterns.

3.3 Fibre Analysis

A fibre is the smallest unit of a textile material that has a length many times greater than its diameter. Fibres can occur naturally as plant and animal fibres or they can be synthetic (man-made). Fibres can be spun with other fibres to form a yarn that can be woven or knitted to form

a fabric. The type and length of fibre used, the type of spinning method, and the type of fabric construction all affect the transfer of fibres and the significance of fibre associations.

Analysing fibres is labour intensive, but often proves to be one of the most conclusive forms of forensic detective work. The main reason for this is that we're surrounded by fibres; on our clothes, carpets or fluff gathering in a getaway car. Placing a suspect at the scene of a crime is what it is all about. One of the ways that this can be done is by locating textile fibres similar to those from the victim's clothing or the crime scene on the clothing or person of the suspect or discovering fibre evidence at the crime scene that can somehow be traced back to the suspect.



Fibres are considered a form of trace evidence that can be transferred from the clothing of a suspect to the clothing of a victim during the commission of a crime. Textile fibres can also be transferred from rugs or blankets; between two individuals; between an individual and an object or between two objects.

Whenever a fibre found on the clothing of a victim matches the known fibres of a suspect's clothing, it can be a significant event. Matching dyed synthetic fibres or dyed natural fibres can be very meaningful, whereas the matching of common fibres such as white cotton or blue denim cotton would be less significant. In some situations, however, the presence of white cotton or blue

denim cotton may still have some meaning in resolving the truth of an issue. The discovery of cross transfers and multiple fibre transfers between the suspect's clothing and the victim's clothing dramatically increases the likelihood that these two individuals had physical contact.

When a fibre examiner matches a questioned fibre to a known item of clothing, there are only two possible explanations:

- The fibre actually originated from the item of clothing, or
- The fibre did not originate from the item of clothing.

It is argued that the large volume of fabric produced reduces the significance of any fibre association discovered in a criminal case. It can never be stated with certainty that a fibre originated from a particular garment because other garments were likely produced using the same fibre type and colour. The inability to positively associate a fibre with a particular garment to the exclusion of all other garments, however, does not mean that the fibre association is without value.

When one considers the volume of fabric produced in the world each year, the number of garments of a particular colour and fibre type is extremely small. The likelihood of two or more manufacturers duplicating all aspects of the fabric type and colour exactly is extremely remote. The large number of dye types and colours that exist in the world, coupled with the unlimited number of possible dye combinations, makes any fibre association by colour significant. One must also consider the lifespan of a particular fabric: only so much of a given fabric of a

particular colour and fibre type is produced, and it will eventually end up being destroyed or dumped in a landfill.

3.4 Chromatography

Chromatography is a method for analysing complex mixtures by separating them into the chemicals from which they are made. The basic principle of chromatography is that different compounds will stick to a solid surface or dissolve in a film of liquid to different degrees. Chromatography is used extensively in forensics, from analysing body fluids for the presence of illicit drugs, to fibre analysis, blood analysis from a crime scene, and at airports to detect residue from explosives.

Ink is a mixture of several dyes and therefore we can separate those colours from one another using chromatography. When ink is exposed to certain solvents the colours dissolve and can be separated out. When we expose a piece of paper with ink on it to a solvent, the ink spreads across the paper when the ink dissolves. This works because molecules in ink and other mixtures have different characteristics (such as size and solubility), and so travel at different speeds when pulled along a piece of paper by a solvent. Different ink pens use different types of ink and this is obvious when you expose the ink to a solvent. A banding pattern of the components of the ink mixture is called a chromatograph.

Many common inks are water soluble and spread apart into the component dyes using water as a solvent. Permanent inks are not water-soluble but are often alcohol-soluble and you can use Isopropyl alcohol as the solvent to create your chromatograph.

3.5 Blood and DNA analysis

Blood

We all have slightly less than 5 litres of blood pumping through our bodies. When wounded, bodies leak or spray blood, and the behaviour of blood in flight tends to be unaffected by such things as temperature, humidity, or atmospheric pressure. Blood found at a crime scene may be in the form of fresh liquid, coagulated, dried, or as a small drop or stain, and each form involves a different method of preservation and collection. The analysis of the properties and effects of serums (blood, semen, saliva, sweat, or faecal matter) is called serology.

Blood can tell us a lot of things. It contains DNA, which can be extracted for genetic fingerprinting. The blood type and other physical characteristics can be determined, perhaps the owner suffers from a disorder such as sickle-cell anaemia, which affects blood cell shape. While not in itself sufficient to solve a crime, blood typing can narrow the search and lead to verification of other data. Blood may be attacked by bacteria or insects, helping to reconstruct a time line of events.

Despite how well the crime scene may get cleaned up, even the finest trace of blood can often be detected and further tested. It is often the case that while the perpetrator may scrub down the

obvious places, they can still miss between floorboards, under pipes, and inside drains. Merely by pouring water on some tiles at a murder scene and pulling them up wherever the water flowed beneath them, one detective found the only existing trace of the crime--blood. His discovery so surprised the killer, who felt certain he'd done a thorough job of cleaning up, that he instantly confessed.

When a darkish substance is found at a crime scene, it must first be determined to be blood. There are several tests - presumptive tests used strictly for screening - that will differentiate between blood and other substances, but if other chemicals are present at the scene to which the test chemicals are sensitive, the tests may be vulnerable to corruption. For that reason, these tests are done with great care. A positive result from any of them is an indication to go ahead and use other tests to confirm.

The first test is simply the use of a powerful light moved across every surface of a crime scene. That yields possible traces for visual inspection.

If nothing is seen, but there is reason to suspect blood had been present, a chemical called luminol is sprayed across the scene because it reacts to the haemoglobin in blood by making it luminescent. It only takes about five seconds. The procedure requires that the room be considerably darkened in order to see the faint bluish glow, and the intensity of the glow increases proportionately to the amount of blood present. It works even with old blood or diluted stains, and can illuminate smear marks where blood has been wiped away. However, there is one problem with this test: luminol can destroy the properties of the blood that investigators need for further testing. Its use is limited to proving that blood is present even if not visible.

Other presumptive tests that depend on a colour change involve the following:

- Leucomalachite green (LMG) colour test: This chemical reagent has been around since the early part of the 20th century and undergoes a chemical interaction with blood, yielding a characteristic green colour.
- Tetramethylbenzidine (TMB) colour test: At a crime scene, a CSI technician swabs a suspected bloodstain with a moistened Q-tip and then applies it to a Hemastix strip containing TMB. A Hemastix strip is a dip stick used to test for the presence of blood. If the Hemastix strip turns blue-green, it might be blood.
- Kastle-Meyer colour test: Phenolphthalein is the active chemical reagent in this particular test. When blood, hydrogen peroxide, and phenolphthalein are mixed together, a dark pink colour results. This colour change is due to the haemoglobin (the oxygen-containing molecule within red blood cells) causing a chemical reaction between hydrogen peroxide and phenolphthalein.

Once the presence of blood has been determined, confirmatory tests are carried out. One such test is the Teichmann and Takayama test. This test depends on a chemical reaction between a reagent and haemoglobin. This reaction yields crystals, which then can be seen under a microscope. A considerable benefit of these tests is that they are more effective with aged stains.

DNA

DNA profiling (also called DNA testing, DNA typing, or genetic fingerprinting) is a technique employed by forensic scientists to assist in the identification of individuals on the basis of their respective DNA profiles.

Every single cell in our bodies contains DNA, the genetic material that programs how cells work. 99.9 percent of human DNA is the same in everyone, meaning that only 0.1 percent of our DNA is unique. Each human cell contains three billion DNA base pairs. Our unique DNA, 0.1 percent of 3 billion, amounts to 3 million base pairs. This is more than enough to provide profiles that accurately identify a person. The only exception is identical twins, who share 100 percent identical DNA.

DNA profiling was first described in 1985 by an English geneticist named Alec Jeffreys. Dr. Jeffreys found that certain regions of DNA contained DNA sequences that were repeated over and over again next to each other. He also discovered that the number of repeated sections present in a sample could differ from individual to individual. By developing a technique to examine the length variation of these DNA repeat sequences, Dr. Jeffreys created the ability to perform human identity tests.

These DNA repeat regions became known as VNTRs, which stands for variable number of tandem repeats. The technique used by Dr. Jeffreys to examine the VNTRs was called restriction fragment length polymorphism (RFLP) because it involved the use of a restriction enzyme to cut the regions of DNA surrounding the VNTRs. This RFLP method was first used to help in an English immigration case and shortly thereafter to solve a double homicide case. Since that time, human identity testing using DNA typing methods has been widespread, seeing tremendous growth in the use of DNA evidence in crime scene investigations as well as paternity testing.

To identify individuals, forensic scientists scan 13 DNA regions, or loci, that vary from person to person and use the data to create a DNA profile of that individual (sometimes called a DNA fingerprint). There is an extremely small chance that another person has the same DNA profile for a particular set of 13 regions. A match at all thirteen is rare enough that you a jury can be very confident ("beyond a reasonable doubt") that the right person is accused.

One way to obtain a match is to scan through a DNA database. There are now several DNA databases in existence around the world. Some are private, but most of the largest databases are government controlled. In the United Kingdom, for example, all suspects can be forced to provide a DNA sample. Likewise, all arrestees - regardless of the degree of the charge and the possibility that they may not be convicted - can be compelled to comply. This empowers police officers, rather than judges and juries, to provide the state with intimate evidence that could lead to investigative arrests. In the United States each state legislature independently decides whether DNA can be sampled from arrestees or convicts.

At present the Victoria police may request a sample from a person who is suspected of, charged with or summonsed for an indictable offence, i.e. a serious crime. In addition, police may seek a sample from offenders convicted of certain crimes, whether or not they are currently serving a

prison sentence. These include: sexual offences, murder and manslaughter, assault, armed robbery, house-breaking and burglary, hoax crimes and kidnapping.

If a suspect or convicted offender does not consent to provide a sample, the police may apply for a court order to require a sample to be taken and may then obtain a warrant for the arrest of the person to enforce the order. In the case of children aged 10–17 years, police must apply to the Children's Court for an order to require the child to provide a sample.

Currently in Victoria, if a person offers or volunteers to provide a sample, they can determine the use to which their sample may be put. Volunteers must be asked to specify whether they consent to their profile being used for only a limited purpose or whether they consent to their profile being retained on the database for unlimited use.

The United States maintains the largest DNA database, with the Combined DNA Index System, holding over 5 million records as of 2007. The United Kingdom maintains the National DNA Database (NDNAD), which is of similar size. The size of this database, and its rate of growth, is giving concern to civil liberties groups in the UK, where police have wide-ranging powers to take samples and retain them even in the event of acquittal. The primary concern is privacy. DNA profiles are different from fingerprints, which are useful only for identification. DNA can provide insights into many intimate aspects of people and their families including susceptibility to particular diseases, legitimacy of birth, and perhaps predispositions to certain behaviours and sexual orientation. This information increases the potential for genetic discrimination by government, insurers, employers, schools, banks, and others.

Some advantages of DNA databases include:

- Major crimes often involve people who also have committed other offences. Having DNA banked potentially could make it easier to identify suspects, just as fingerprint databases do.
- Innocent people currently are incarcerated for crimes they did not commit; if DNA samples had been taken at the time of arrest, these individuals could have been proven innocent and thereby avoided incarceration.
- Banking arrestees' DNA instead of banking only that of convicted criminals could result in financial savings in investigation, prosecution, and incarceration.

Some disadvantages include:

- Arrestees often are found innocent of crimes. The retention of innocent people's DNA raises significant ethical and social issues.
- If people's DNA is in police databases, they might be identified as matches or partial matches to DNA found at crime scenes. This occurs even with innocent people, for instance, if an individual had been at a crime scene earlier or had a similar DNA profile to the actual criminal.
- Sensitive genetic information, such as family relationships and disease susceptibility, can be obtained from DNA samples. Police, forensic science services, and researchers

using the database have access to people's DNA without their consent. This can be seen as an intrusion of personal privacy and a violation of civil liberties.

3.6 Soil Analysis

There are thousands of different soil samples around the world, but each has unique qualities that allow forensic analysis to link soil to a crime scene or soil to a suspect. Forensic scientists use soil as evidence in a criminal investigation.

Soil is considered trace evidence. It is made up of disintegrated surface material that can be organic, mineral or synthetic that is found on or near the Earth's surface. Soil can include rocks, minerals, vegetation, animal matter, glass, paint chips, asphalt, brick, and cinders, to name a few. The ratio of the mineral content compared to other matter in the soil can be very site specific. The ratios of mineral, organic and synthetic matter can vary even within a few feet. Sandy soils look, feel and behave quite differently from clay soils or peaty soils. By profiling an array of characteristics of each soil, it is sometimes possible to attribute those characteristics to a specific location. When properly taken soil samples can tell an investigator a lot about where a victim or suspect has been. Analysis of soil samples taken from vehicles can also tell an investigator about where a vehicle has been. Analysis of footwear, clothing and tyres can also place a suspect or victim in a particular location.

Soil samples may be evaluated in several ways:

- A direct comparison of the two samples may be conducted, with investigators looking for aspects such as colour similarities, pH levels and the variety and size of the particles found in the sample. For example, mineral particles will have traces of the rock from which they were derived, such as quartz and limestone, while grains of sand have distinctly different shapes if say, one comes from the ocean and the other from a desert.
- The mineral content can be tested. Some experienced analysts can moisten a sample and feel the soil. Based on feel alone they can tell the ratio of mineral and organic content. Microscopic examination of soil samples will subsequently reveal the type and nature of the mineral, biological and synthetic content of a sample. Electron microscopes can also be used to reveal the crystalline structures of minerals and synthetic material in a sample of soil.
- Another test that is commonly used is the density gradient tube. Two different liquids are added to a glass tube in various ratios. Each ratio represents a different density. The soil sample is poured into the tube. When the various particles reach a level in the liquid where their density is equal to the liquid the particles become suspended. This creates a unique profile of bands in the tube that can be matched to other samples.

3.7 Fluorescent Oils

Motor oil is a lubricant used in internal combustion engines. Most motor oils are made from a petroleum base stock derived from crude oil, with additives to improve certain properties. One of the most important properties of motor oil in maintaining a lubricating film between moving parts is its viscosity. The viscosity of a liquid can be thought of as its "thickness" or a quantity of resistance to flow. The Society of Automotive Engineers (SAE) has established a numerical code system for grading motor oils according to their viscosity.

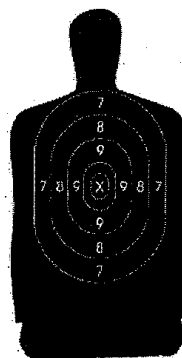
Fluorescence occurs when a molecule absorbs light energy of one specific wavelength and emits light energy of a longer wavelength. In this case, ultra violet (UV) light is absorbed and visible light (mostly blue) is emitted. Fluorescent compounds such as oil each have a unique colour signature. As most oils contain slightly different grades of oil based upon their viscosity, each type of oil will have a unique glow under the UV light that will enable them to be matched with evidence from a crime scene.

3.8 Ballistics

Forensic ballistics is the science of analysing firearm usage in crimes. The term ballistics refers to the science of the travel of a projectile in flight. The flight path of a bullet includes: travel down the barrel, path through the air and path through a target. Forensic ballistics involves analysis of bullets and bullet impacts to determine the type of bullet used.

Separately from the ballistics information, firearm and tool mark examinations also involve analysing firearm, ammunition, and tool mark evidence in order to establish whether a certain firearm or tool was used in the commission of a crime. Rifling is the process of making grooves in gun barrels that imparts a spin to the projectile for increased accuracy and range. Bullets fired from rifled weapons acquire a distinct signature of grooves, scratches, and indentations that are of value for matching a fired projectile to a firearm. And like fingerprints, no two firearms, even those of the same make and model, will produce the same marks on fired bullets and cartridge cases.

Examiners are often asked to offer conclusions about the origin of spent bullets or cartridge cases. This can sometimes provide a link, connecting evidence found at one scene with evidence found at another, which is very helpful to police and prosecutors in their investigations. A firearms examiner must examine the evidence for a conclusive match, but even a probable match can help police look for additional evidence in areas they would not otherwise have considered.



4. CLASS ACTIVITIES

4.1 Table of Class Activities by Concept

Activity (Page No.)	Types of Forensics	Fingerprinting	Fibre Analysis	Chromatography	Blood & DNA Analysis	Ballistics	Soil Analysis	Fluorescent Oils
Ballistics - who fired a gun (pg. 18)	✓	✓				✓		
Ballistics - type of firearm (pg. 18)					✓	✓		
Fabric on fence (pg. 17)	✓		✓					
Facial reconstruction (pg. 17)	✓							
Fibres on body (pg. 17)	✓		✓					
Fingerprints on factory bench (pg. 17)	✓	✓						
Fingerprints on ransom note (pg. 17)	✓	✓						
Ink from envelope (pg. 17)	✓			✓				
Oil stain (pg. 17)	✓							✓
Paid stamp on ransom note (pg. 17)	✓							
Smooth surfaces (pg. 167)	✓	✓						
Soil test from crime scene (pg. 17)	✓						✓	
Stained cloth (pg. 17)	✓				✓			
Tyre tracks (pg. 17)	✓							
Witness ID of suspect (pg. 17)	✓							

4.2 Class Activities in Detail

A crime has been committed and students must analyse various pieces of physical evidence left at the crime scene in order to determine the culprit from amongst four suspects presented to them. Students have been presented with the following information about the crime in the form of a police report and information about the various suspects:

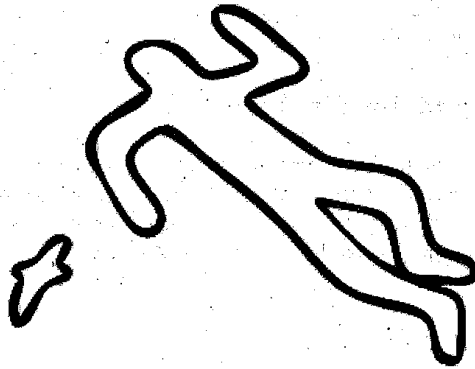
4.2.1 Police Report

The body of a young man has been found in the abandoned paint factory in Bloomsdale. The victim has died from a gunshot wound, and is yet to be positively identified from dental records. Crime scene detectives found the following physical evidence:

1. The shirt worn by the victim at the time of death.
2. Oil sample extracted from the victim's clothing.
3. Cloth fibres found on the victim's clothing.
4. A piece of torn fabric entangled in a barbed wire fence outside the factory.
5. Fingerprints on a bench top in the factory where the victim was found.
6. A footprint found in mud outside the factory.
7. A stained cloth found in an office at the Bloomsdale Research Laboratory.
8. Tyre tracks outside the crime scene.

The body is believed to be that of Nathan Bloom. He and his family are known to police for possession and sale of stolen goods, and for gambling fraud at The Lucky Country Club, a local casino. Their criminal activities have made them local identities in Bloomsdale.

Nathan was abducted for ransom while returning home from a local bar between 12:40 am and 1:00 am ten days ago. A type written note was posted to Mr. & Mrs. Bloom demanding \$50,000 in used currency. The ransom note was in an envelope with the address stencilled on the front with black ink.



4.2.2 Police Report ... continued

Four suspects have been interviewed. They all deny any knowledge of and involvement with the kidnapping and murder. The suspects are:

Name: Rodney Georgiou

Sex: Male

Age: 25 years

Occupation: Landscape gardener.

Comments: Currently unemployed. Single and lives alone in Bloomsdale. Actively involved in fitness programs. Known to police for break and enter, burglary and possession of stolen goods.



Name: Maria Crossman

Sex: Female

Age: 28 years

Occupation: Cleaner.

Comments: Married and lives with her partner in Bloomsdale. Suspected criminal associate of the Bloom family. Employed as a part time cleaner at the Bloomsdale Research Laboratory.



Name: Eric Smythe

Sex: Male

Age: 31 years

Occupation: Manager.

Comments: Married with two children. Employed at the Lucky Country Club and lives in an apartment at the club. Licensed owner of 2 guns kept at the club for security personnel. No police record.



Name: Tracy Zammitt

Sex: Female

Age: 23 years

Occupation: Laboratory technician.

Comments: Employed at the Bloomsdale Research Laboratory. Experiencing financial difficulties, due to gambling debts. Licensed gun owner and belongs to a sport shooting club.



4.2.3 Evidence Summary

Body identification

- Dental X-rays and DNA patterns on the blood sample indicate that the victim is Nathan Bloom.

FACES computer program

- Georgiou was identified by a witness as the person seen loitering around the Bloom's neighbourhood.

The ransom note

- The stamp impression found on the ransom note was traced to the office of Tracy Zammitt.
- The ink on the ransom note envelope matches ink found at Crossman's house.

Soil testing

- The soil test shows that both Georgiou and Smythe had walked near the crime scene.

Fingerprints

- Crossman's fingerprints were found on a bench top in the factory.
- Both Crossman's and Zammitt's fingerprints were found on the ransom note.

Fabrics and fibres

- Fibres on Nathan's body match those from Crossman's jumper.
- Fabric found on the fence at the factory matched Georgiou's cotton shirt.

Other physical evidence

- Oil stains on Nathan's body matched the oil used in both Crossman's and Smythe's cars.
- The "Hemastix" test confirmed the fabric in the bin in Zammitt's office was stained with blood. DNA analysis showed the blood was from Nathan Bloom.
- The tyre tracks showed that Crossman's car had been at the crime scene.

Ballistics

- Absence of discharge residue suggests gun was fired too far from the victim to be

suicide.

- The size of the bullet hole in the victim's shirt suggests that 0.38 ammunition was used.
- Greiss tests show that Smythe and Zammit have all fired guns recently.
- Guns owned by Smythe and Zammit have the fingerprints of the owner on them, and no-one else's.

4.2.4 Case Brought Before the Court by the Crown Prosecutor

Nathan Bloom and his family have been moderately successful in their criminal activities over the last ten years. They have in the process made enemies and earned the jealousy of like-minded people.

Maria Crossman was guilty of the kidnapping and murder of Nathan Bloom. She did it for her own personal financial gain, and shot Nathan dead in cold blood. It is uncertain whether she ever intended to hand Nathan over in return for the ransom.

Crossman abducted Nathan while he was walking home from a local bar. Nathan knew Crossman and accepted her offer of a lift home. He was held at gunpoint, against his will until his death.

Nathan was shot in the belly at a distance of more than 80 cm with a .38 Smith and Wesson handgun, and the bullet passed through the body. The shooting occurred at an unknown location, and no gun or bullet has been found. Crossman wore gloves during the shooting, so no discharge residue was found on her fingers.

After the shooting, the body was moved to the abandoned factory. A cloth was stained with blood, and this was planted in the office of Tracy Zammit as part of an attempt to make Tracy a prime suspect in the case. Crossman mistakenly left behind some of her own fingerprints in the factory, and cloth fibres from her clothing were found on the victim's clothing.

Crossman typed the ransom note on Zammit's typewriter using scrap paper found in her office. The scrap paper carried several clues, including an impression of a paid stamp, which was traced to Zammit's office, and fingerprints from both Zammit and Crossman.

Crossman sent the ransom note to the parents of the deceased in an envelope which she addressed using black ink and a stencil. The ink was analysed by police using chromatography, and was matched to a black ink pen found by police at Crossman's home. Crossman hoped to claim the ransom and leave the country before the body was discovered.

Georgiou was seen by a witness on the morning of the kidnapping as he was casing the Bloom's neighbourhood. He is a known felon, but it is believed he had no involvement in this case. He had been in the factory, tearing his T-shirt on the barbed wire fence and leaving footprints in the mud. This was unrelated to the crime.

APPENDIX A – USEFUL WEBSITES

Interesting websites that may relate to Forensic Frenzy, and to those interested in Forensic Science in general:

TEACHER RESOURCES

- Cybersleuth. An international school forensics program with a number of Victorian schools involved.
<http://www.kilvington.vic.edu.au/cyber/forensic/index.html>
- Yahoo's Forensic Science Index. Quite a good index for more forensic science sites
<http://www.yahoo.com/science/forensics>
- Zeno's Forensics Page. Older kids might be interested.
<http://forensic.to/forensic.html>
- Crime and Clues. In particular, try clicking on Fingerprint Evidence.
<http://crimeandclues.com/>

ACTIVITY SITES FOR KIDS

- MysteryNet kids section. Excellent see-and-solve site for kids.
<http://www.MysteryNet.com/thecase/>
- FACBS website. Download a free demo version of the photofit software used in the Forensic Frenzy
<http://www.iqbiometrix.com>

Contact Details

CSIRO Education, Victoria

P.O. Box 56

Highett, 3156

Ph: (03) 9252 6387 or (03) 9252 6410

Email: education@csiro.au

Web: www.csiro.au/melbcsirosec

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Nanotechnologies

Teacher Information



This program is provided in conjunction with DIISR. Some of the experiments have been developed using ideas and activities from AccessNano. The AccessNano program will also provide teachers with follow up activities and extension programs for students.

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1. PROGRAM OVERVIEW

This program aims to give secondary students an awareness and understanding of the contemporary issue of Nanotechnology. The students will not just gain a scientific understanding of the underlying principles, but also develop their scientific inquiry skills and their ability to form evidence-based opinions on the wider implications of this relatively new development in science.

The key outcomes for the students are:

- An awareness of Nanoscience and Nanotechnology, and a clear understanding of the nano scale.
- An understanding that nanomaterials have different properties to bulk materials, which will lead to their use in different applications.
- An appreciation that developments in Nanotechnologies will lead to innovations in topical areas including health and medicine, consumer products, energy and the environment.
- An awareness of the possible ethical, social, environmental and health issues surrounding Nanotechnologies, now and into the future.

The key outcomes for the teachers are:

- An awareness of the resources provided by *AccessNano*.
- An appreciation of the scope of nanotechnology across a range of scientific disciplines.

2. WHAT IS NANOTECHNOLOGY?

A nanometre is a billionth of a metre (10^{-9} m). As a size reference, intramolecular bond lengths are usually 0.1-0.2nm, the DNA double helix has a diameter of about 2nm, and the smallest bacteria are around 200nm in size.

Nano-sized objects may contain only tens to hundreds of atoms. Of these, a great many will exist on the surface of the object. Thus there is relatively little "bulk material", and the behaviour of that object is dominated by surface effects. The behaviour and properties of nanomaterials vary widely from those of a macro-sized quantity of the same material.

Nanotechnology is a word applied to many and varied areas of science, sometimes misleadingly. It is important to note the difference between nanoscience and nanotechnology. Nanoscience is the exploratory investigation of nano-sized objects, materials and processes. Nanotechnology is the application and use of these things. Nanotechnology is technology which relies on manipulation and control of matter on the atomic or molecular scale.

There are two main approaches to nanotechnology, referred to as 'top-down' and 'bottom-up'. In top-down approaches, existing materials and devices are successively miniaturised until they are only nanometres in size. Bottom-up design involves building materials and structures up out of atoms and molecules. This is often achieved by self-assembly of molecules, utilising intermolecular interactions such as hydrogen bonding.

The main issues faced in the development of nanotechnology are fairly obvious: nano-sized objects are hard to manipulate! They are difficult to see individually (requiring atomic force microscopy or

scanning electron microscopy), and even harder to control and move around. This is why bottom-up methods utilising molecular self-assembly are often favoured.

It is important to consider not just the hard science behind nanotechnology, but also its broader social context. For example, there is much concern about the impacts of nanomaterials and nanotechnologies, not only on human health, but also the environment. There is no mandatory labelling requirement for nanoparticle content in the many nano products currently on the market, which has upset a number of consumer rights groups. Much research is still being carried out regarding the possible toxicological effects of nanomaterials (by CSIRO amongst others). The concerns are that nanoparticles may be able to penetrate the body through skin contact or inhalation. Little is known about the transport of these materials through the body, their possible bio-accumulation or physiological impacts. That said, there is also no direct evidence of negative effects from any nano products.

Nanotechnologies have the potential to make huge positive impacts on a range of global issues including the energy crisis (and its links to climate change), population health, and environmental remediation. However, at the moment, many of these technologies are still very expensive. Questions therefore arise as to who benefits from the technologies – are they limited to the developed nations who can afford them when they may have a far greater positive impact on the lives of those in developing nations?

3. ACCESSNANO

AccessNano is an innovative nanotechnology educational resource designed to introduce accessible and innovative science and technology into Australian secondary school classrooms. The teaching content of AccessNano modules has been designed to align with secondary school science curricula across all states and territories of Australia. Most material is aimed at the Year 9-10 level, although some sections are aimed at supporting higher level curricula (Yr 11 Chemistry), are or useful at a lower level (Yrs 7-8).

AccessNano is an Australian government initiative funded through the Australian Office of Nanotechnology, under the Department of Innovation, Industry, Science and Research in working with the Department of Education, Employment and Workplace Relations. AccessNano has been produced by foresight and science communications consultancy Bridge8 Pty Ltd.

3.1 AccessNano Learning Modules

The AccessNano material is divided into teaching modules, any number of which can be utilised in schools, to whatever extent is practicable for the school concerned. AccessNano content can be introduced into the classroom in a variety of guises. These include as a standard (6-10 week) unit of work; as a semester-long elective unit; incorporation into as a specialist Yr 9 program; use in a school's outreach program; or as science week activities. Due to the multidisciplinary nature of nanotechnology, it can even be integrated into a whole school approach, which incorporates departments other than science, for example SOSE, Art, etc.

The learning modules in AccessNano are as follows:

- Junior Science (Years 7–8)
 - The Space Elevator
 - Shape Memory Alloy
- Middle Science (Years 9–10)
 - Scale & Measurement (core)
 - Properties (core)
 - Performance Materials
 - Health & Medicine
 - Glass
 - Social Issues - Magazine
 - Personal Care Products
- Senior Chemistry (Year 11)
 - Gold
- All Year Levels
 - Social Issues - Utility Fog

4. NANOTECHNOLOGY IN SCHOOLS

The Australian Curriculum, Assessment and Reporting Authority (ACARA) are responsible for the development of a national curriculum from Kindergarten to Year 12 in specified learning areas. The national science curriculum will be the basis of planning, teaching and assessment of school science. It will be useful for, and useable by experienced and less experienced teachers of K–12 science. The document 'Shape of the Australian Curriculum: Science' (May, 2009) will guide the writing of the Australian science curriculum K–12, and was used as a guide to the future shape of the Australian science curriculum for the purposes of this document.

The proposed unit will draw from all three interconnected strands within the Australian national science curriculum: science understanding, science inquiry skills, and science as a human endeavour.

The curriculum focus for years 7-10 is about explaining phenomena involving science and its applications. During these years, students study science concepts associated with each of the disciplines: biology, physics, chemistry and earth science. It is important to include contemporary contexts in which science can be learned as well as issues and recent research to enhance understanding of science in the world. It is current research and its human uses and implications that motivates and excites students.

4.1 Science Understanding

Science is as much a body of knowledge as a technique for investigating the world around us. The Science Understanding strand of the curriculum refers to a student's grasp of that knowledge which is considered appropriate for their age level. Students demonstrate such understanding when they select and integrate appropriate science knowledge in ways that explain and predict phenomena, and apply

that knowledge to new situations and events. Science knowledge refers to facts, concepts, principles, laws, theories and models that have been established by scientists over time.

Relevance to the National Teaching Unit

The areas of the Science Understanding strand of the curriculum that are relevant to the proposed unit are:

Physics and chemistry:

- nature of matter, including particle theory
- forms of energy, energy transfer and storage
- metals and non-metals
- elements, compounds and chemical reactions.

Biology

- cells and living things

In addition, one of the underpinning concepts of the new program is the following unifying idea from the curriculum:

Form and Function: For objects and organisms, form and function are complementary. Form describes the nature or make-up of an aspect of an object or organism, while function represents the use of that aspect. For example, the form of a particular bone in the human body is specifically suited to its use.

The new national program will promote the understanding of these areas of the curriculum through demonstrations and hands-on activities that highlight the concepts to be covered, as well as through the discussions to be held between students and the presenters.

4.2 Science Inquiry Skills

This section of the curriculum is about developing the skills necessary to use scientific principles to answer questions. The skills involve posing questions, planning, conducting and critiquing investigations, collecting, analysing and interpreting evidence and communicating findings. This strand is concerned with evaluating claims, investigating and making valid conclusions. It also recognises that scientific explanations change as new or different evidence becomes available.

In the Science Inquiry Skills strand of the curriculum students will:

- formulate scientific questions or hypotheses for testing
- design and conduct science investigations involving measurement and repeated trials.
- gather and organise data from a variety of sources
- analyse and test models and theories based on the evidence available
- explain and summarise patterns in data using science concepts.

Relevance to the National Teaching Unit

In particular, the focus will be on the following underlying ideas:

Evidence, models, explanations and theories: Just as evidence provides the basis of explanations, explanations are used and refined to form models and theories. Models and theories are more complex; abstract schemes or structures that provide a more detailed but tentative basis for understanding a range of evidence.

The new unit will help to develop these skills through hands-on activities in which students carry out fair tests and look at simplified models of complex systems. Group discussions between students and the presenter will also focus on the way in which empirical evidence leads to models, theories and solutions.

4.3 Science as a Human Endeavour

Science influences society through the posing and responding to social and ethical issues and science research is influenced by societal challenges or social priorities. This strand highlights the need for informed, evidence-based decision making about current and future applications of science. It acknowledges that, in making decisions about science and its practices, moral, ethical and social implications must be taken into account. It also acknowledges that science has advanced through, and is open to, the contributions of many different people from different cultures at different times in history and that science offers rewarding career paths.

The *Science as a Human Endeavour* strand seeks to enable students to use their scientific understanding to:

- be aware of contemporary issues such as water and its management, climate change, stem cell research, nanotechnology, gene technology
- apply scientific understandings to make responsible, ethical and informed decisions about issues
- be aware of the nature of science and research of Australian scientists
- appreciate that science provides rewarding careers
- appreciate the diversity of people who have contributed to, and shaped the development of, science.

Relevance to the National Teaching Unit

The new unit will enable students to examine in detail important contemporary issues relating to nanotechnology, with emphasis given to current Australian research being carried out by scientists within the CSIRO and other academic and industrial groups. The ethical implications of this cutting edge technology and its possible impacts on human health, social structure and the environment will also be highlighted.

5. CONCEPTS COVERED IN THE PROGRAM

Nanotechnology, like any technology, is application-driven. It is the aim of this program to engage students with the subject by showing how developments in Nanotechnologies will lead to innovations in topical areas including health and medicine, consumer products, energy and the environment.

The underlying concept of the nano-scale is crucial to understanding many of the novel properties of nanomaterials, and will be emphasised throughout the program. In general, a material has certain properties, which lead to its use in certain applications. The properties of nano-scale materials usually vary widely from the properties of bulk quantities of the same material. This leads to new and diverse applications for a given material.

Each activity in this program relates to one or more of the six broad topic areas described below. See section 7 for more details.

5.1 Scale and Measurement

The central point of nanotechnology is its scale. It is therefore extremely important that the students have a clear understanding of the concept of a nanometre, and what sort of particles and materials exist in this size regime. Demonstrating the physical size of a nanometre by putting it into context requires more than simply stating that 1 nm is equal to 10^{-9} m or a billionth of a metre. For example, a DNA double helix is approximately 2nm in diameter, the smallest viruses are about 20nm in size, and the wavelength of visible light ranges from about 380 – 750nm.

The other main consideration in this topic is how we measure (and manipulate) nano-sized objects. If an object is smaller than the wavelength of light, the light isn't reflected or scattered in the same way as from larger objects. So how do we 'see' them? Alternative techniques must be used. Some of these involve utilising portions of the electromagnetic spectrum with shorter wavelengths, such as x-rays. Alternatively, using atomic force microscopes or scanning tunnelling microscopes can provide a representation of the topography of a material or surface on the nano scale.

5.2 Materials

Materials that display certain properties at the macro scale often behave very differently at the nano scale. Changes can occur in optical properties, conductivity, magnetic properties, chemical reactivity and much more. Many of these effects are due to the fact that nano-sized particles have a far higher surface area to volume ratio than larger objects. Nanoparticles may contain only a few hundred atoms, most of which will be arranged on the surface of the particle. This means that our understanding of the 'bulk' structure and bonding of the constituent chemical elements only covers a small proportion of the atoms in the particle. The rest are arrayed on the surface of the particle, with a very different chemical environment. In addition, quantum effects can come to dominate the behaviour of nanoparticles due to their small numbers of constituent atoms.

5.3 Surface modification

'Bulk' materials can be modified with treatments or coatings that change the structure or chemical functionality of the material's surface.

Making a surface rough on the nano-scale can reduce wetting of surfaces. This can be achieved by the addition of self-assembling chemicals, which bond to one another on the surface to create a nanoscale pattern. This roughened pattern prevents liquids from attaching to the surface effectively, causing them to form beads rather than spreading out across the surface.

By changing the chemical functionality of a surface, it can be made to attract or repel particular types of chemicals. For example, the surface of silica (glass or sand), which is normally very hydrophilic due to its covering of hydroxyl groups can be easily modified to become hydrophobic. A simple chemical reaction can lead to a nano-scale layer of methyl groups, which will cause water to bead up and roll off the glass.

5.4 Energy

The engineering of materials at the nano scale has already led to significant improvements in the way we capture, store, transfer and use energy. This will only continue to progress in the future as we seek more efficient, environmentally benign and cost effective energy options.

Much of the early 'top-down' research in nanotechnology was aimed at the miniaturisation of electronic circuitry. These approaches have led to huge advances in the computing speed and capacity of ever-smaller devices. However, 'bottom-up' approaches are being increasingly favoured, leading to the use of nanostructures as computer components.

Until now, solar energy usage has been limited by the relatively high cost and low efficiency of silicon-based solar cells. Recent innovations including dye-sensitised and polymer solar cells rely on nano-scale engineering of various materials, and are showing great promise. By making solar cells cheap and easily accessible, huge changes can be made to our energy consumption patterns, with tangible benefits to the environment.

These benefits are further enhanced by the use of nanotechnologies in increasing the efficiency of consumer products such as lighting systems, thermal insulation, self-cleaning materials, energy storage devices such as batteries, and many more.

5.5 Environment

As mentioned above, nanotechnology will further enhance the availability and use of alternative energy sources such as solar energy and hydrogen fuel cells. This will lead to a decrease in our reliance on fossil fuels, with an associated lessening of greenhouse gas emissions. This is vital to a sustainable future.

The use of nano products in the agricultural sector can lead to more efficient, targeted and long lasting pesticide and fertiliser use, thus providing positive effects with less bio-burden due to wasted product. Nano engineered devices are also being developed which can act as environmental monitoring agents, detecting contaminants with far greater sensitivity than current methods.

The use of nano-engineered membranes for water purification shows great promise in a number of environmental applications. For example, nanoporous membranes can be used to remove bacteria and viruses from contaminated water supplies without recourse to chemical sterilisation. This is particularly advantageous after natural disasters such as floods and tsunamis, where follow-on disease is often a worse threat to people and the environment than the disaster itself. Nano-engineered membranes are also finding use in water desalination.

5.6 Health

Most biologically active molecules and processes occur on the nanoscale. Nanoparticles are of optimal size to be transported through the body to interact with specific molecules or tissues. Nanoparticles can be engineered to bind selectively to particular biomolecules, allowing them to be used as drug delivery and diagnostic agents. By selectively targeting certain cell types, treatment can be carried out with very little damage to healthy cells in the body.

Due to their ease of transport through the body, questions have arisen regarding the safety of all nanoparticles. In particular, many consumers are questioning their use in personal care products such as sunscreens and cosmetics, which is fuelled by a lack of mandatory labeling of nano-containing products. Much research is currently underway into the possible routes of transport of nanoparticles into the body by skin application and inhalation, routes of transport through the body, and possible bioaccumulation and toxicity.

While new technologies can bring great benefits, potential risks must also be considered. CSIRO aims to help Australia capture the benefits of nanotechnology in a safe and socially responsible way, in which appropriate risk management strategies are in place for research, manufacturing, consumer use, community and environmental impact. CSIRO works with Australian industry to position it to readily adopt the benefits of nanotechnology, while undertaking systematic investigation into the potential risks and unintended consequences that nanotechnologies could present. Work is also underway with Government and community groups to ensure that we understand concerns and issues that are raised regarding nanotechnology.

CSIRO's research program will identify, understand and minimise the risks to environmental and human health associated with the development of nanotechnology-based products by:

- analysing the life-cycles of nanoparticles to identify where humans and the environment may be at risk from exposure
- monitoring workplace exposure to nanoparticles
- determining the impact on human health upon workplace exposure, and from use of products containing nanomaterials
- determining the fate and transport of nanoparticles in the environment
- determining nanoparticle toxicity to ecosystems in soil and water
- fully characterising the properties of nanoparticles and determining the nanoparticle metrics associated with any toxic effect
- developing a set of human and environmental predictive models for the toxicological effects of nanomaterials.

ACTIVITIES SORTED BY CONCEPT

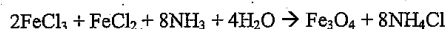
CONCEPT \ ACTIVITY	Scale and Measurement	Materials	Surface Modification	Energy	Environment	Health
Ferrofluid (page 11)		✓				
Nano Treated Fabric (page 13)			✓			
Disc Diffraction (page 14)	✓					
Sorting By Size (page 18)	✓					
Nanofiltration (page 19)	✓				✓	✓
Carbon Nanotubes (page 20)		✓		✓		
Zinc Oxide (page 22)				✓	✓	
Gold Nanoparticle Diagnostics (page 24)						✓
Glass Coatings (page 25)			✓	✓		

6. DETAILS OF ACTIVITIES

6.1 Ferrofluid

Ferrofluids have the fluid properties of a liquid and the magnetic properties of a solid. They contain tiny particles (~10nm diameter) of a magnetic solid suspended in a liquid medium. They were originally discovered in the 1960s at the NASA Research Centre, where scientists were investigating different possible methods of controlling liquids in space.

The most common type of ferrofluid contains nanoparticles of magnetite, Fe_3O_4 . The ferrofluid is prepared by combining an Fe(II) salt and an Fe(III) salt in basic solution. The resultant mixed valence oxide, Fe_3O_4 , precipitates from solution:



The particles of magnetite must remain small in order to stay suspended in the liquid medium, so both magnetic and van der Waals (dispersion) interactions must be overcome to prevent the particles agglomerating. One way of keeping the particles well separated is by adding a surfactant to the liquid medium. The surfactants generally act in one of two ways (see Figure 1).

One type of surfactant contains a long-chain hydrocarbon with a polar head that is attracted to the surface of the magnetite particle, forming a coating on the particle's surface. The long non-polar chains of the tails act as a repellent cushion and prevent the close approach of other magnetite particles.

Alternatively, ionic surfactants such as tetramethylammonium hydroxide can be used. In this case, the hydroxide ions are attracted to the surface of each magnetite particle, forming a negatively charged layer at the magnetite surface. The tetramethylammonium cations are attracted to the negatively charged layer, forming a positive layer. When magnetite particles approach each other, the electrostatic repulsions between their positively charged layers keep them from getting too close.

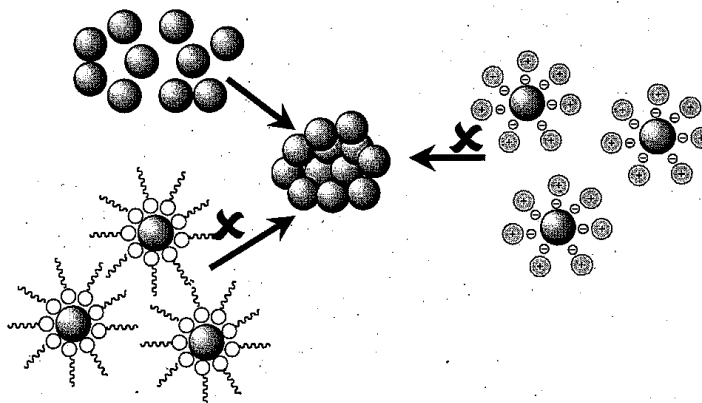


Figure 1. Two types of surfactants to prevent agglomeration of magnetite nanoparticles. On the left, a long chain surfactant creates a physical separation of particles, whereas on the right, an ionic surfactant produces an electrostatic repulsion between particles.

Answers to Questions

1. Describe what happens to the surface of the liquid when the magnet is brought close to the bottom of the ferrofluid container.

The oil-based ferrofluid used in this activity is so attracted to magnetic fields that it stands up along magnetic field lines, forming an array of spikes. As the magnet is brought closer to the container, first one spike appears, then several spikes appear until the spikes appear to closely pack, with any given spike having six nearest neighbours arranged in a regular hexagon.

The pattern of spikes appears because the ferrofluid arranges itself along the magnetic field lines of the magnet (as do iron filings). The number of visible spikes reflects the strength of the magnetic field and the surface tension of the medium.

2. Can you use the magnet to move the ferrofluid around?

Yes, the liquid follows the magnet.

3. Can you think of any possible applications for this nanotechnology?

In the biomedical field, ferrofluids are being investigated as contrast agents for magnetic resonance imaging (MRI) and in the hope that they could carry medications to specific locations in the body through the use of applied magnetic fields.

Ferrofluids are used in rotating shaft seals – they behave as a liquid O-ring where a rotating shaft enters either a low- or high-pressure chamber. The ferrofluid is held in place by permanent magnets and forms a tight seal, eliminating most of the friction produced in a traditional mechanical seal. These ferrofluid seals are found in vacuum chambers used in the semiconductor industry and rotating anode X-ray generators. Ferrofluid seals are used in high-speed computer disk drives to eliminate harmful dust particles or other impurities that can cause the data-reading heads to crash into the disks.

Ferrofluids are also used to improve the performance of some loudspeakers, by dampening unwanted resonances and providing a mechanism to dissipate heat from excess energy supplied to the electric coil.

Another interesting use is in the tuneable car suspension. Electromagnets surrounding ferrofluid-filled shock absorbers can control the viscosity of the fluid, and therefore the 'hardness' of the ride. This system, known as MagneRide can be found on some vehicle models from GM, Audi, BMW and Ferrari.

Q4 Compare the behaviour of the ferrofluid to the behaviour of the larger iron filings.

The larger particles are still attracted to the magnet, and do move with the magnet. However, because of their larger size, the fine structure of the magnetic field lines is lost, and it appears less fluid.

AccessNano Links

The 'Properties' module of AccessNano contains some information about ferrofluids in the module's PowerPoint presentation. It also has an activity (Activity 4) where students can prepare their own (aqueous) ferrofluid.

<http://www.accessnano.org/teaching-modules/properties>

Links

Ferrofluid stockists include:

Educational Innovations: <http://www.teachersource.com/ElectricityAndMagnetism/Ferrofluid.aspx>

Prof Bunsen: www.profunsen.com.au

For more information on commercial applications, visit Ferrotec:

<http://www.ferrotec.com/technology/ferrofluid/>

6.2 Nano Treated Fabric

There are many 'nano' textiles on the market that display stain-repelling properties. The shirt demonstrated and fabric used in the hands-on experiments is from the King Gee Nanotex range. They are good examples of biomimicry, the use of biological systems as the inspiration for design. In this case, the properties of the fabric are based on the 'Lotus Effect'.

Lotus plants are used as a symbol of purity in some eastern cultures, since the leaves are always clean, despite the muddy ponds they grow in. At a microscopic level, the leaves are covered in tiny bumps of a waxy material. These bumps are in turn covered in nanoscale 'whiskers'. These act to prevent droplets from wetting the surface. As the water rolls off the leaf, it carries with it particles of dirt, pollen and even bacteria.

The fabric utilises the same principle as the lotus leaf. Each fibre is treated with nano-whiskers, which repel water and stains. Self-cleaning windows, roofs, textiles and surface coatings based on nanoscale surface patterning are commercially available.

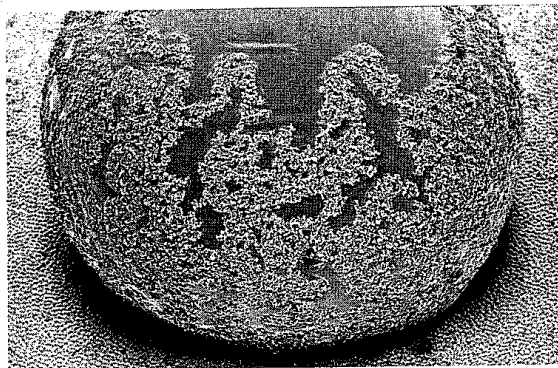


Figure 2. A water drop (covered in dirt) on a lotus leaf. Picture courtesy of BASF.

Answers to Questions

Q1. What do the drops of liquid do when dropped on to each fabric?

Initially, the liquid beads up on the surface of both pieces of fabric. However, after a few seconds time it soaks into the untreated cotton/polyester blend, leaving a stain. When the fabric is folded over, this helps to push the liquid deeper into the cotton sample, but not into the nano-treated fabric. When a tissue is placed over both samples, the liquid from the surface of the nano-treated fabric is absorbed into the tissue, leaving the fabric spotless.

Q2. Why do you think it behaves like this?

Cotton contains over 90% cellulose, which is a linear polysaccharide, made of many glucose monomers. Cellulose, like starch, has many hydroxide groups on its surface, which makes it hydrophilic. This is why the water can soak into the fabric. In contrast, the surface patterning of the nano-treated fabric makes it far harder to wet, keeping the liquid on the surface where it can be easily removed.

AccessNano Links

The 'Performance Materials-Textiles' module outlines 'Experiment 3: Observation of Fabrics' for students to investigate and think about applications of hydrophobic fabrics.

<http://www.accessnano.org/teaching-modules/performance-materials/textiles>

Links

www.nano-tex.com for information on this textile.

6.3 Disc Diffraction

Optical Discs

Optical discs (CD, DVD and Blu-Ray) have a single continuous spiral track etched into them. Within this track are pits that store the information for the disc. The width of the track (track pitch) and the size of the pits varies between media. Obviously, the smaller the pits and the smaller the track pitch, the more data can be stored in a given space.

	Track 'Pitch'	Pit width	Min. Pit length	Storage capacity
CD	1600nm	500nm	830nm	783MB
DVD	740nm	320nm	400nm	4.7GB
Blu-Ray	320nm	130nm	150nm	27GB

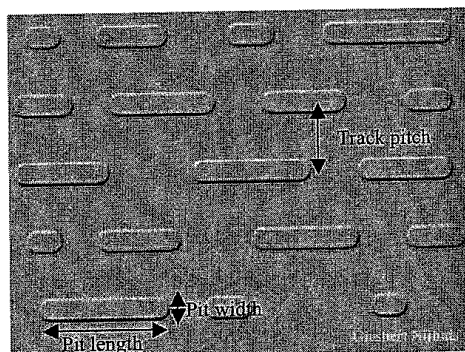


Figure 3. Diagram of an optical disc showing the pits and tracks

The spiral track on the disc acts as a reflection diffraction grating, and the track pitch can be measured by diffraction using a laser light source.

Diffraction

Diffraction refers to various phenomena, which occur when a wave encounters an obstacle. It is described as the apparent bending of waves around small obstacles and the spreading out of waves

past small openings. Diffraction occurs with all waves, including sound waves, water waves, and electromagnetic waves such as visible light, x-rays and radio waves.

While diffraction occurs whenever waves encounter such obstacles, its effects are generally most pronounced for waves where the wavelength is in the order of the size of the diffracting objects. If the obstructing object provides multiple, closely spaced openings, a complex pattern of varying intensity can result. This is due to the superposition, or interference, of different parts of a wave that travelled to the observer by different paths.

Diffraction Gratings

In optics, a diffraction grating is an array of fine, parallel, equally spaced grooves ('rulings') on a reflecting or transparent substrate. When a beam is incident on a grating with an angle θ_i (measured from the normal to the grating), it is diffracted into several beams.

$$n\lambda = d \sin \theta$$

Where λ is the wavelength, d is the distance between scattering centres, θ is the angle of diffraction and n is an integer known as the order of the diffracted beam.

The beam that corresponds to direct transmission (or specular reflection in the case of a reflection grating) is called the zero order, and is noted as $n=0$. The other orders correspond to diffracted angles that deviate from the one predicted by geometrical optics, and are represented by non-zero integers n .

Note that n can be positive or negative, resulting in diffracted orders on both sides of the zero order beam.

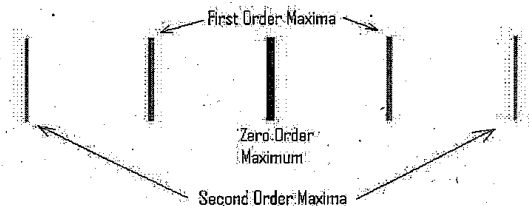


Figure 4. A typical pattern

created by laser light reflected from a CD.

The groove dimensions and spacings in a diffraction grating are on the order of the wavelength in question. In the visible wavelength range of the spectrum, in which the use of diffraction gratings is most common, there are many hundreds (or even thousands) of grooves per millimetre.

How a CD works

Ordinary pressed CD and DVD media are every-day examples of diffraction gratings and can be used to demonstrate the effect by shining an ordinary laser pointer onto the surface. This is a side effect of their manufacture, as one surface of a CD has many small pits in the plastic, arranged in a spiral pattern; that surface has a thin layer of metal applied to make the pits more visible.

Inside a CD is a flat light-reflecting layer called "land". On the land are many "pits" written in a spiral-shaped track. From the reading lasers point of view, the track spiral goes outwards when the disk rotates counter-clockwise. The spiral has a pitch of 1600nm. From the reading lasers point of view the pits appear as bumps because the master disc with pits is duplicated negatively, turning the pits into bumps. Pits have the same light-reflecting surface as the land, but the pits reflect the read-laser's light

in a diffuse way that leads to destructive interference and thus look relatively dark compared to the land areas.

Pit depth = 110 nm - 150 nm. The typically used laser for CD players has a wavelength in air of 780 nm. The wavelength inside the polycarbonate is a factor of $n=1.55$ smaller (where n is the refractive index of polycarbonate), or about 500 nm. The pit is fabricated so that it is a quarter of a wavelength high. The idea here is that light striking the land travels $1/4 + 1/4 = 1/2$ of a wavelength further than light striking the top of the pit. The light reflected from the land is then delayed by $1/2$ a wavelength, and so is exactly out of phase with the light reflected from the pit. These two waves will interfere destructively, so effectively no light is reflected.

Data is stored on an optical disc in binary format. That is, a series of 1's and 0's. However, it is not as simply that land represents a "1" data bit, and a pit a "0" data bit. A data bit is a "1" or "0" from the original data, but on a CD there are no data-bits, only channel-bits. A channel bit is the smallest time unit used on a CD: $1/4,321,800$ sec.

A "1" channel bit is a transition from land to pit, or from pit to land, while a "0" channel bit is a time when there is no change.

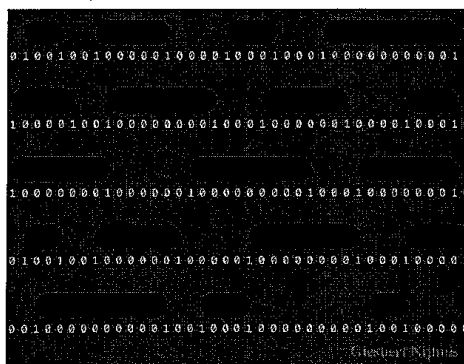


Figure 5. 1's and 0's correspond to transitions from pit to land

The Experiment

In this activity the students shine the light from a green laser pointer ($\lambda = 532\text{nm}$) onto the surface of a CD. By measuring the position of the resultant diffraction maxima (bright spots on a screen) they can calculate the track pitch of the disc.

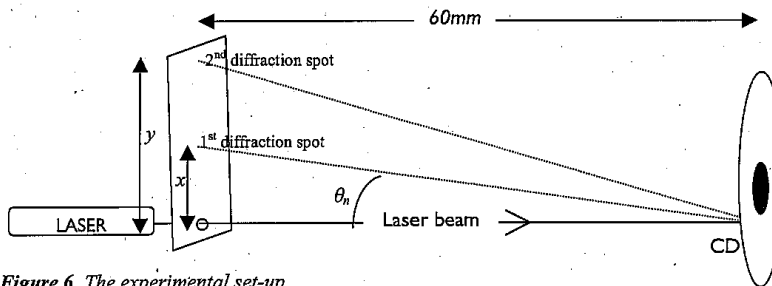


Figure 6. The experimental set-up

Answers to Questions

1. Can you see the grooves using the magnifying glass?

Students will not be able to see the grooves on the CD, even when using the magnifying glass. Another method, such as diffraction, will need to be used to observe the grooves.

Value of x (+ 4.6mm) = 21.6 mm

Value of y (+ 4.6mm) = 56.6 mm

* 4.6mm added to the measurements accounts for the distance between the edge of the hole in the screen and the laser beam.

2. Use the formulae to calculate the width of the CD groove (d) for both diffraction spots.

$$\text{SPOT 1} \\ d = \frac{1 \times 532 \sqrt{(60^2 + x^2)}}{x}$$

$$d = \frac{1 \times 532 \sqrt{(60^2 + 21.6^2)}}{21.6}$$

$$d = 1570.6 \text{ nm}$$

$$\text{SPOT 2} \\ d = \frac{2 \times 532 \sqrt{(60^2 + y^2)}}{y}$$

$$d = \frac{1 \times 532 \sqrt{(60^2 + 55.9^2)}}{55.9}$$

$$d = 1560.9 \text{ nm}$$

Student responses will vary slightly, depending on their measurements.
The expected value for this calculation is $1.6 \mu\text{m}$.

3. What is the average value of d ?

Answers will vary but should be close to 1600 nm

4. What could have contributed to you not getting the expected answer for the value of d ?

Sources of error in this experiment include:

- marking the diffraction spot with the whiteboard marker
- assumption of the laser wavelength. It's likely that the laser wavelength will vary over a small range of wavelengths
- assumption of the distance between the laser light and the edge of the laser hole
- measuring the distance between the diffraction spot and the laser hole

5. Can you think of another small thing that could be measured using this diffraction technique?

CDs, DVDs and Blue-Ray discs can all be measured using the same technique, however a more powerful laser with a shorter wavelength (for example violet or ultra violet) would be required for blue-ray. Crystal structures can also be determined using diffraction, however in this case x-rays are used, as the wavelength is similar to the gaps between atoms.

AccessNano Links

The 'Scale and Measurement' module of AccessNano allows students to learn about scientific notation and the metric system, putting the size of things at the nanoscale into perspective. They will learn about the methods used to visualise things at the nanoscale, including microscopy and light diffraction.

<http://www.accessnano.org/teaching-modules/scale-measurement>

6.4 Sorting By Size

In this experiment students look at a series of images and compare their sizes. The concept of scale is very important to understanding nanotechnologies. When objects become too small for us to view with the naked eye, different techniques must be employed. A light microscope uses a lens to magnify samples up to 100 times. Visible light is used to view the samples. Often the sample will be stained to improve its visibility. The use of visible light limits the resolution of the image, so more powerful microscopes employ light of smaller wavelengths such as x-rays or even electron beams to improve resolution. A Scanning Electron Microscope (SEM) takes images of the surface of samples by scanning it with a beam of electrons. X-ray crystallography uses diffraction of an x-ray beam to determine electron density in a crystal of the sample. By observing electron density in the crystal, positions of atoms can be determined. A Synchrotron accelerates charged particles to almost the speed of light. When these particles are deflected through magnetic fields they create extremely bright light, which can be used to view samples.

Approximate scale	Object	Equipment that could help you view/detect the object
10^{-11} m	Hydrogen atoms	Atomic Force Microscopy
10^{-10} m	Water molecules	Atomic Force Microscopy
10^{-9} m	Width of DNA molecule	X-ray crystallography, Synchrotron
10^{-8} m	Haemagglutinin	X-ray crystallography
10^{-7} m	Influenza virus	Scanning Electron Microscope (SEM)
10^{-6} m	Sheep foot rot bacteria	Light microscope, SEM
10^{-5} m	Red blood cell	Light microscope, SEM
10^{-4} m	Width of a human hair	Naked eye
10^{-3} m	Flea	Naked eye
10^{-2} m	Five cent coin	Naked eye
10^{-1} m	Baseball	Naked eye
10^0 m	Child	Naked eye
10^1 m	Large truck	Naked eye

Answers to Questions

1. Which of these do you consider to be nano-sized objects?

Nanomaterials are usually regarded as measuring between 1-100 nanometres. DNA has a width of 2nm, Haemagglutinin is 13.5nm and the Influenza virus is highly pleiomorphic and ranges in size from 80nm to 120nm. These items are regarded as nano-sized.

2. Which of these are visible to the naked eye?
Width of human hair, Flea, Five cent coin, Baseball, Child, Large truck

AccessNano Links

See <http://www.accessnano.org/teaching-modules/scale-measurement> 'Activity 2: Sorting by Size' for this experiment.

Links

The following website allows you to play with a sliding scale and see different sized objects compared to one another.

<http://www.newgrounds.com/portal/view/525347>

6.5 Nanofiltration

Nanofiltration is the use of membranes to filter or desalinate water. Membranes must be geometrically characterised to ensure their pore size, distribution and connectivity. Small deviations in pore size and surface conditions can have significant impact of separation and filtration. Surface and geometry are very important to membrane effectiveness. Biomimetics (the study of biomimicry) is allowing for the creation of new, novel structures and materials. For example, the silicate cell walls of diatoms, a single celled type of eukaryotic algae is being examined for pore architecture

The LIFESAVER bottle is an all-in-one unit that filters water for safe drinking. It incorporates a membrane with a pore size of 15nm. The smallest known viruses are about 25nm in size, so this bottle will filter out viruses and bacteria from water as well as larger particles.

Researchers from CSIRO in collaboration with a range of Australian universities are working on the use of nanotechnologies to improve membranes for removal of contaminants from water and desalination.

1. Observe and describe the contents of each sieve and the base.

Sieve pore size	Observations
2.5mm	Rocks, ball bearings
700µm	Glass beads, Sand, dirt
108µm	Sand, dirt, some clay
Base	Murky water, with suspended clay

2. Observe and compare the water coming from the LIFESAVER bottle teat with that sitting in the base of the sieves.

The water that has just been sifted is murky due to the suspended clay, which has a size of just 1-10µm. Any bacteria or viruses would also be still in the water as they are small enough to slide through even the smallest sieve pores.

The filtration system in the LIFESAVER bottle contains pores of only 15nm in size. The water coming from the bottle's teat looks very clear as none of the clay could get through. Also, bacterial and viral contaminants will have been filtered from the water.

3. Would you drink the water coming out of the LIFESAVER bottle? (Do NOT drink)

The water coming from the LIFESAVER bottle would be safe to drink. However, the teat is no longer clean, due to students touching it. The LIFESAVER bottle will not filter salts from urine or seawater.

4. Can you think of an application for the LIFESAVER bottle?

The bottle is particularly useful in areas that have experienced a natural disaster and have a lack of clean drinking water. In areas of natural disaster, many people die in the disease-ridden aftermath of the disaster, not the event itself. After a disaster water sources can become contaminated and disease can easily spread. Contaminated drinking water can perpetuate spread of diseases in disaster zones. Water purification becomes vital to halt the spread of disease. LIFESAVER bottles can be donated to natural disaster zones.

Links

<http://www.lifesaversystems.com/index.html>

This links to concepts of bio-mimicry (copying biological membranes) as well as big themes of water shortage, desalination and environmental cleanup <http://www.csiro.au/partnerships/ps30e.html>.

6.6 Carbon Nanotubes

Traditionally, carbon was known to occur as two allotropes: graphite and diamond. In 1985, Kroto, Smalley and Curl discovered a new, spherical arrangement of 60 carbon atoms, which they named buckminsterfullerene. For this work, they were awarded the 1996 Nobel Prize in Chemistry. Since then, a whole family of carbon allotropes has been discovered, which have spherical, ellipsoid or cylindrical structures. These are known collectively as fullerenes.

Diamond is electrically insulating due to the fact that its electrons are confined to single covalent bonds (it has no mobile charge carriers). Graphite and C_{60} , on the other hand are electrical conductors due to their conjugated structures. (see Figure 7 below)

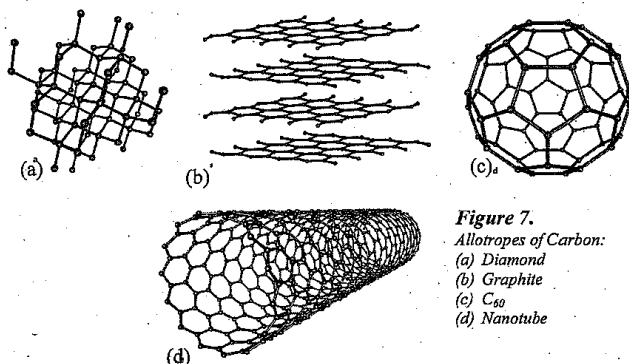


Figure 7.
Allotropes of Carbon:
(a) Diamond
(b) Graphite
(c) C_{60}
(d) Nanotube

Carbon nanotubes (CNTs) are cylindrical fullerenes. Their structure can be visualised as a single sheet of graphite (called 'graphene'), rolled up into a cylinder. The aromatic nature of the sheet is maintained, making the nanotubes electrically conducting, they 10 times more electrically conductive than graphite. The diameter of a carbon nanotube is a 10,000th of that of a human hair. CNTs have shown great promise in a variety of nanotechnology applications, since they are exceptionally strong, and have interesting electronic and optical properties. Carbon nanotubes are 5 times stiffer and 30 times stronger than steel, while only being one fifth of the density of steel.

Individual carbon nanotubes are like minute pieces of string, and many trillions of these strings must be assembled to make useful macroscopic articles. Researchers at CSIRO Textile and Fibre Technology have developed a technique for spinning nanotubes into yarns, which can then be used to create a range of functional materials and fabrics.

Nanotubes are drawn into a web, which is then twisted to create a yarn (much the same process as spinning wool). The yarn can be knitted or woven into various structures. Applications include tissue scaffolding, incandescent light sources, and artificial muscles.

The Experiment

Students measure and compare resistance of three carbon allotropes. Resistance measures the opposition to electrical current of a material with a particular surface area and volume. To compare samples, the unit of resistivity should be used. $\rho = RA/L$

Where: ρ = Resistivity

R = resistance

A = cross sectional Area

L = length

Resistivity is a measure of a materials opposition to electrical current, regardless of the shape and size.

In this experiment, materials used have a similar mass and comparable density. All samples have similar lengths. Students will measure and compare resistance of each material (instead of resistivity). This will provide a qualitative comparison of the three allotropes in question to determine whether they are good or poor electrical conductors.

Answers to Questions

1. Record the resistance of each carbon form

Carbon Allotrope	Molecule (tube) diameter	Properties	Resistance
Carbon Nanotubes	8nm	Strong, Stiff	Approximately 10k Ω
Carbon Soot	Nanoparticulate Powder (not tubes)	Thermal conductor	Very high resistance
Carbon Fibres	7.8 μ m	Strong, Brittle	Approximately 8k Ω

2. Which of the 3 carbon allotropes conduct electricity?

Graphite and carbon nanotubes both conduct electricity. Graphite displays extensive delocalisation of its π -electrons in the plane of its sheets. In comparison, buckyballs do not conduct electricity, as their π -electrons cannot delocalise over the whole surface.

If we imagine a nanotube to be made of a sheet of graphite that has been rolled into a tube, the 'chiral vector' describes the amount of twist or offset which has been incorporated into the tube. The conductivity of nanotubes varies from semiconducting through to fully conducting depending on their chiral vector.

Carbon Soot is an insulator. It is a fine powder of discrete particles, they are not connected and therefore electrons cannot flow through the soot.

Carbon Fibre does conduct electricity. It is composed of sheets of carbon atoms arranged in a hexagonal pattern (like graphite). These sheets are then crumpled together to form the smooth carbon fibre of 7.8 μ m diameter.

3. What possible applications can you imagine for CNTs?

Carbon nanotubes have a huge array of potential applications.

Examples of CNT applications include:

- Using CNTs as a steel replacement, from reinforcing concrete to building suspension bridges. Bucky paper, a sheet made of CNTs, is 250 times stronger than steel and 10 times lighter
- Exploiting CNT conductive properties to make light bulb filaments and heat sinks
- Scaffolding for nerve regeneration
- space elevator
- filtration membranes

- artificial muscles
- sporting equipment (carbon fibre is being used already)
- superconductors, below 20K

4. *Why do you think carbon nanotubes are difficult to work with and turn into processed materials?*

The main difficulty in working with nanotubes is their size - they are difficult to manipulate and process because they are so tiny. As you can see from the samples, a forest of nanotubes on the slide looks like soot. Another complicating factor is the 'stickiness' of the nanotubes to one another. At the nanoscale, van der Waals interactions are the dominant force, so particles can be difficult to separate.

AccessNano Links

In AccessNano there is a 'Space Elevator' module that discusses CNTs. In the 'Performance Materials unit, there's a mini-module on CNTs.

Links

<http://www.csiro.au/science/Carbon-Nanotube-Yarn.html>

6.7 Zinc Oxide

Zinc oxide and titanium oxide have been used in paints for centuries. More recently, they have found use in personal sunscreens, as they are good UV blockers. However, as these sunscreens are not transparent, many people chose not to use them. Scientists at CSIRO Materials Science and Engineering have developed a process for producing nano-particulate zinc oxide and titanium oxide (with a diameter less than 100 nanometers). Sunscreens containing zinc oxide nanoparticles are now commercially available.

Nano-particulate zinc oxide and titanium oxide are good UV protectors predominantly because their absorbance increases with decreasing particle size. Larger particles provide UV protection by scattering UV rays. The smaller nanoparticles provide UV protection by UV absorbance, which is more effective than scattering. Also gaps between nanoparticles are smaller providing a better barrier than the larger particles (with larger gaps). Zinc Oxide with larger particles, and larger gaps allow some UV rays, or scattered UV rays, to pass through if the material is not thick enough.

Nano-particulate zinc oxide is used in a variety of commercially available sunscreens and other personal care products such as make-up. Nano-ZnO and -TiO₂ containing building materials such as plastics and paints demonstrate superior UV performance compared to products containing larger zinc or titanium oxide particles. Research is also underway to develop nano-particulate zinc or titanium coating for use in furnishings and upholstery, and potentially clothing. The trend between particle size and UV protection is not linear. It has been found that as particle size decreases from 200+ nm, the efficiency of UV protection decreases. However, once the particles are below a certain size (around 50nm), the efficiency suddenly increases again. As yet, the exact reason for this behaviour is unclear.

The Experiment

Students will look at slides, which have been prepared with different sized ZnO particles. Students will note the differences in transparency in the slides and measure the UV absorbance using a UV light box and UV detectors attached to a data logger.

Average Zinc Oxide Particle Size	Transparency	Relative UVA Light Intensity Range
No slide	-	100
1000 – 5000nm	Opaque	
500nm	Translucent	
30nm	Transparent	
No zinc oxide, resin only	Transparent	

Answers to questions

1. Which slide, or slides provide the best UV protection?

Slides that have a coating of ZnO all provide relatively good UV protection compared to the uncoated slide.

2. What are some of the advantages of the nano-particulate zinc oxide compared to zinc oxides with larger particles?

Advantages of nano-particulate zinc oxide include:

- similar UV protection to larger particles;
- the nano-particles are clear rather than opaque or white; and
- less material is needed (a thinner layer) to provide the same level of UV protection, enhancing material's efficiency.

3. Can you think of possible applications for nano-particulate zinc oxide?

Nano-particulate zinc oxide and titanium oxide is used for sunscreens and other personal care products such as make-up. Building materials utilising nano-particulate zinc oxide such as plastics and paints demonstrate superior UV performance compared to products containing larger zinc or titanium oxide particles.

Traditionally, medicines and alcoholic beverages have been stored in dark green, amber or blue glass bottles, to slow the UV degradation of the contents. Glass bottles are currently coated with a thin layer of plastic to prevent chipping. Incorporating nano-particulate zinc or titanium oxide within this plastic coating provides UV protection for the contents of the bottle, regardless of the colour of the glass. This is a CSIRO invention. Research is also underway to develop a nano-particulate zinc or titanium coating for use in furnishings and upholstery, and potentially clothing.

One of the main challenges in producing nano-particulate zinc and titanium oxide products is avoiding coagulation of particles to ensure an even and efficient layer. Cost effectiveness is also problematic at this stage with applications other than personal sunscreens. Health impacts of nano-particulate zinc and titanium oxide continue to be researched. Zinc has so far been selected for use in sunscreens, as it has a long history of use for skin application without detrimental effects. Zinc is also a natural component of cells, and does not demonstrate the photo-activity that titanium oxide exhibits.

As nano products become more readily available, research to better understand the potential effects on health and the environment are progressing. Concerns exist about the possibility of nanoparticles being absorbed into the body by inhalation or skin contact, and the potential impacts of bioaccumulation. CSIRO's Niche Manufacturing Research Flagship has established a Nanosafety Theme, which aims to research these areas, and lead to appropriate risk management strategies for people and the environment.

AccessNano Links

AccessNano has a module on 'Personal Care products' that mentions zinc oxide in sunscreens.
<http://www.accessnano.org/teaching-modules/personal-care-products>

Links

<http://www.csiro.au/multimedia/Nanoparticle-sunscreens.html>
<http://www.csiro.au/multimedia/Sunscreen-For-Bottles-Video.html>

6.8 Gold Nanoparticle Diagnostics

Gold nanoparticles (GNPs) have been widely studied. They are fairly chemically inert, and can be reproducibly created with specific shapes and sizes. Their optical properties vary with their size and shape, with colloidal solutions of gold ranging in colour from red to blue-green. They are also easily modified, with various functional groups added to their surfaces.

GNPs are particularly useful in medical applications as they can be modified by adding biologically active molecules, including antibodies. This means that when they are introduced to a biological system, they can bind selectively to certain tissues, protein targets or viral surfaces. This can make them useful as drug delivery systems. A drug compound may be wrapped in a nanosized shell of gold, which delivers it to a specific tissue target. They can also be used as a 'Nano-scalpel' – the nanoparticles bind to a cancer cell, which ends up coated in gold. When infra-red radiation is applied, the gold nanoparticles heat up, killing only the target cells, and very little surrounding tissue.

GNPs can also be used outside the body as a diagnostic tool. One example of this is modification of a GNP so that its surface contains antibodies for a protein found in bacteria, for example meningococcal. A sample of a patient's bodily fluid is added to the solution of modified GNPs. When the GNPs bind to the protein, they agglomerate, which changes their optical properties. A simple visual test shows the solution changes from red to blue as the GNPs come together (guided by the meningococcal protein). This test can be up to a million times more sensitive than traditional tests for the same protein.

The Experiment

In this experiment students use GNPs to analyse patient samples for the presence of meningococcal bacteria. This experiment is a simulation. Students are not working with harmful or contagious samples.

Answers to questions

1. *What colour is the gold nanoparticle solution?*

Red/pink

2.

<i>Sample</i>	<i>Colour of solution after adding sample</i>	<i>Meningococcal?</i>
<i>Positive control</i>	Blue	Yes
<i>Negative control</i>	Red / pink	No
<i>Patient A</i>	Red / pink	No
<i>Patient B</i>	Blue	Yes

3. *What has happened to the gold nanoparticles in the solution?*

The gold nanoparticles have agglomerated in samples 1 and 4. The colour of GNP solutions is dependent on particle size. In the test solution, the GNPs are present at a specific concentration and have a certain size, so the solution appears red. The GNPs have been functionalised with specific antibodies. When the antibody attaches to meningococcal surface proteins it brings the GNPs in to close proximity. The GNPs agglomerate and the Surface Plasmon Resonance affects of the gold causes an immediate colour change from red to blue.

Access Nano Links

AccessNano has a unit in the 'Health and Medicine' module about nanogold. It includes an animation about the diagnostic test outlined above, and an interactive PowerPoint presentation called 'Nick's Test' which is a virtual version of the test outlined above.

<http://www.accessnano.org/teaching-modules/health-medicine/nanogold>

Links

CSIRO research is also being carried out into how diamond nanoparticles can add value to chemotherapeutic delivery systems and assist medical imaging using light imaging in cells. See

<http://www.csiro.au/people/Amanda.Barnard.html>

6.9 Nano Coatings

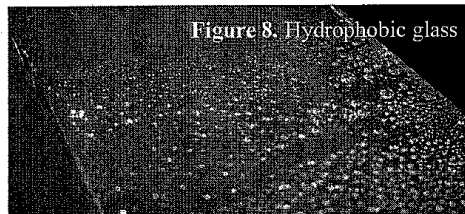
Glass is made primarily from silica (SiO_2), with other ingredients such as sodium carbonate and calcium oxide added to aid in its processing. If we were to look very closely at the surface of glass, any oxygen atoms on its surface would be capped by hydrogen atoms. This makes it a very hydrophilic (water-loving) surface.

If glass is very clean, water will not bead up on it, but instead will form a fine sheet across the surface. However, as soon as any organic (hydrophobic) contaminants appear on the surface, the water is repelled from these, causing beads or droplets to form. As these beads roll across the surface, they leave dirty tracks behind them.

To make self-cleaning glass you have two options: you can make the surface very hydrophilic or very hydrophobic. Nano-patterning of a glass surface can modify its properties to become either hydrophilic or hydrophobic.

Water will sheet up and not cause visible beading on hydrophilic glass. This type of surface coating usually contains nanoparticulate TiO_2 to help break down organic matter on the glass. It has a photocatalytic effect, using UV light to create free radicals and break down organic contaminants to allow them to be easily washed away.

When water hits the surface of hydrophobic glass, it beads up into drops with very small contact angles, causing it to roll off immediately, carrying dirt with it. This is similar to the Lotus Leaf effect discussed in the fabric treatments activity.



Answers to Questions

Part 1 - Nano-coated Glass

1. *When looking at clean, dry glass can you see a difference between sides A and B?*
It is very difficult to tell the difference between sides A and B.

2. *What happens to the water when it is sprayed onto the glass?*
The water forms puddles on side A and beads up on side B.

3. *What happens to the clay suspension when it is applied to the glass?*
The clay covers the surface of side A, making it really dirty and very difficult to see through. The clay does not spread out on side B but rather beads up, allowing you to still see through the glass.

4. *Can you explain the difference between the two sides now?*
Side A is normal glass. The surface of side B has been treated, making it hydrophobic and preventing water or the clay mixture from spreading out on its surface.

Part 2 – Nano-coated Sand

Normal sand is made of silica, so is hydrophilic. Hydrophobic sand has a coating on each grain of sand, which covers it in hydrophobic CH_3 groups. The grains behave very differently when placed in water. Hydrophobic sand is commercially known as 'magic sand,' 'Mars sand' or 'Space sand)

1. *What do you observe when the sand comes in contact with water?*
Instead of sinking, as regular sand would, this sand floats. The coated sand floats until there is enough weight on the water surface to drag all of the sand under water in one big clump.

2. *What happens when the sand reaches the surface of the water? How does it feel?*
When you bring the sand back up to the water's surface it appears and feels dry.

3. *Is the sand hydrophobic or hydrophilic?*
Hydrophobic. It is not mixing with the water.

4. *Can you think of an application for this type of coated sand?*
Hydrophobic sand was originally developed to help clean up oil spills. The idea was that the oil would stick to the sand and then sink to the bottom, where it could be scooped up. However, the cost of hydrophobic sand production means that it is not used for this. Utility companies in the Arctic bury junction boxes in hydrophobic sand. Frozen ground is very difficult to dig through. As the sand does not get wet it remains loose and dry, enabling easy access to service the boxes. Using hydrophobic sand in dry desert areas could also decrease the amount of water required for plant irrigation.

AccessNano Links

AccessNano has a teaching module called 'Glass' which looks at glass coatings. This also includes an activity on magic sand. See www.accessnano.org/teaching-modules/glass

Links

Glass samples were provided by Nanovations - <http://www.nanovations.com.au/Glass1.htm>

7. ACKNOWLEDGEMENTS

Zinc Oxide slides were prepared by Phil Casey and Richard Harris,
CSIRO Materials Science and Engineering

Nano-Coated Glass samples provided by Nanovations

Carbon Nanotube, Carbon Fibre and Carbon Soot samples provided by Dr Stephen Hawkins,
CSIRO Materials Science and Engineering

Pyrogel samples provided by Aerogels Australia

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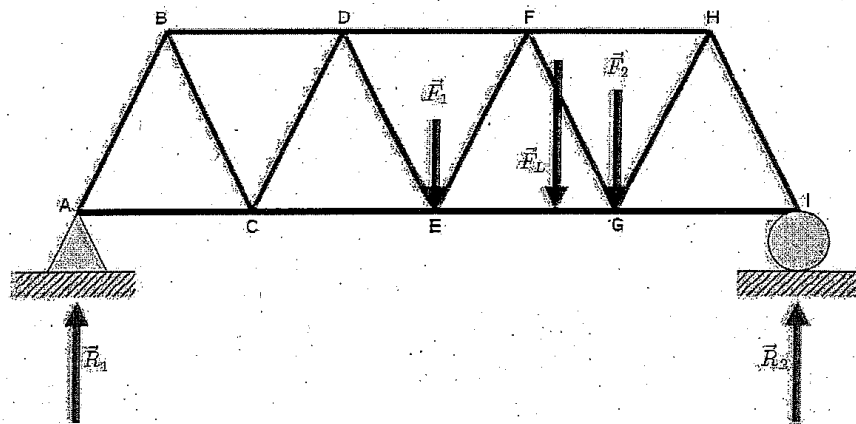
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VCE Physics

Materials & Structures

Teacher Booklet – 2010



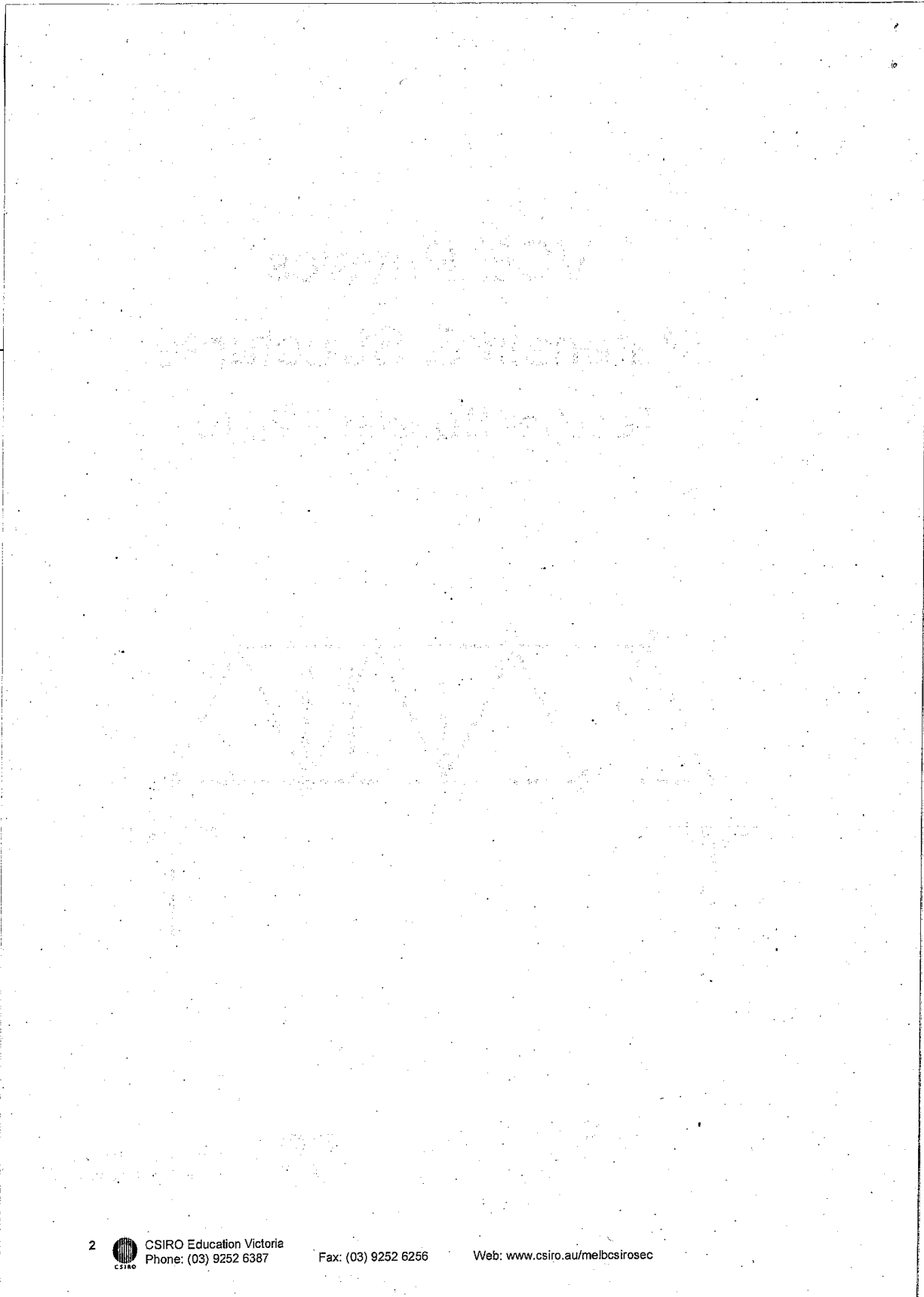
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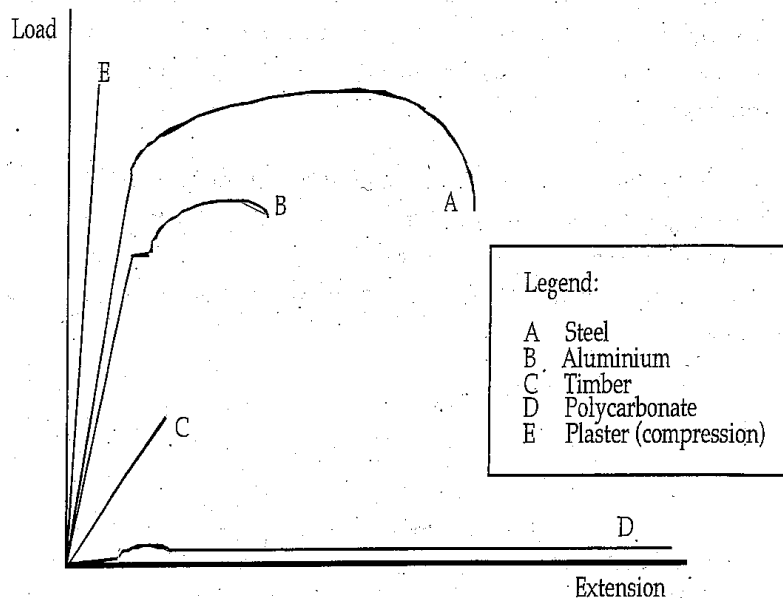


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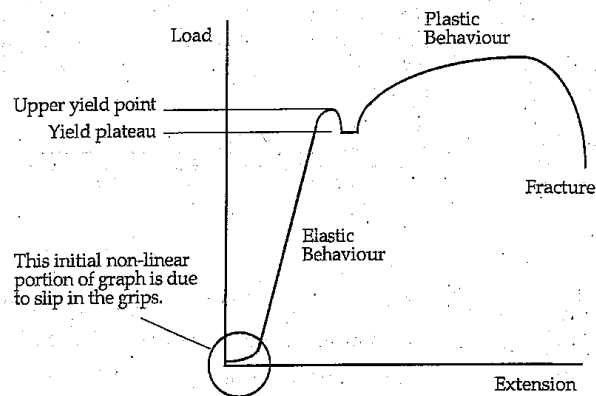
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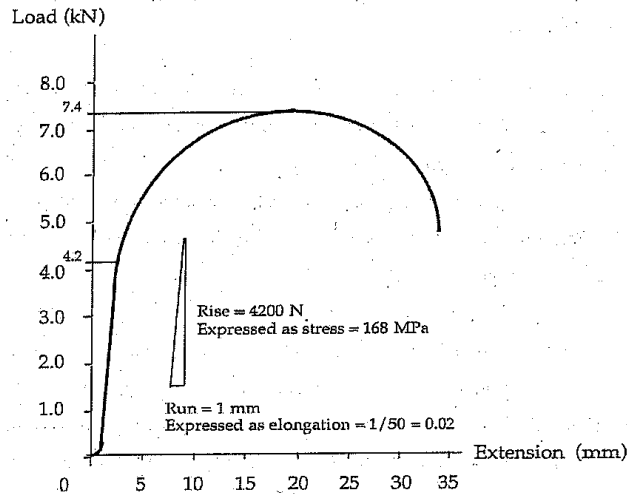
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**Normalised steel
- typical curve**



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 &= \text{Extension} / \text{Gauge length} \\
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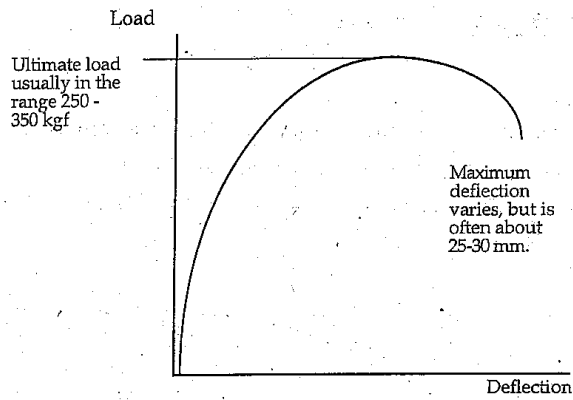


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Data for this experiment is now collected electronically by 2 sensors and downloaded to the Data Studio program. This program is available in a reduced form known as Data Studio Lite and is free of charge to teachers. It can be downloaded from <http://store.pasco.com/forms/DStownload.cfm>

Students have the options of saving their data as a Data Studio workbook (able to be opened in Data Studio Lite) or as a plain text file (for importing to MS Excel or any other graphing software) which can then be emailed to their home or school accounts, or put onto a USB drive.

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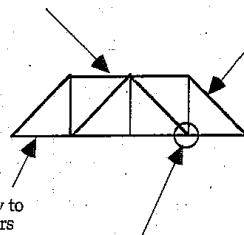


Typical load deflection curve for
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Combined flexure and compression. The bending will be laterally ie. a sideways bow.

Possible modes of failure for the trusses

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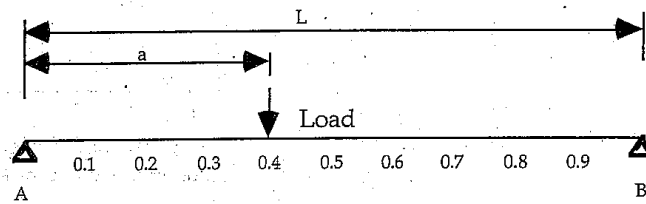
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Failure of a joint ie. the adhesive. This is analogous to the failure of a welded or bolted connection.

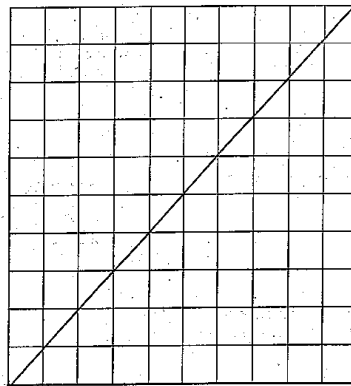


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For this activity the students determine how the load on a simply supported beam is distributed to its supports. The configuration of the equipment, a typical graph and the mathematical relationship is shown below. The relationship is easily determined by using moments about support B.



$$R_B = R_A$$



$$\text{ie. } R_B = a/L \times R_A$$

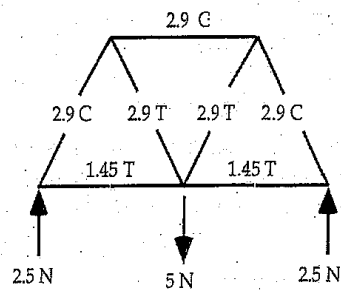
$$a/L = 1$$

2.8 Forces in a Truss:

In this activity the equipment enables students to measure the forces in the members of the truss shown below. These measured values are then used to determine whether there is equilibrium at the joints. The activity relies on students understanding that the load is shared equally between the supports and that because the truss is symmetrical the forces in similar members will be the same. This should be evident by inspection. The theoretical forces in members are determined using the *method of equilibrium of joints*. This method applies at

- any joint where at least one force is known and not more than two unknown forces are present. Therefore the analysis begins at the supports.

Summary of member forces:



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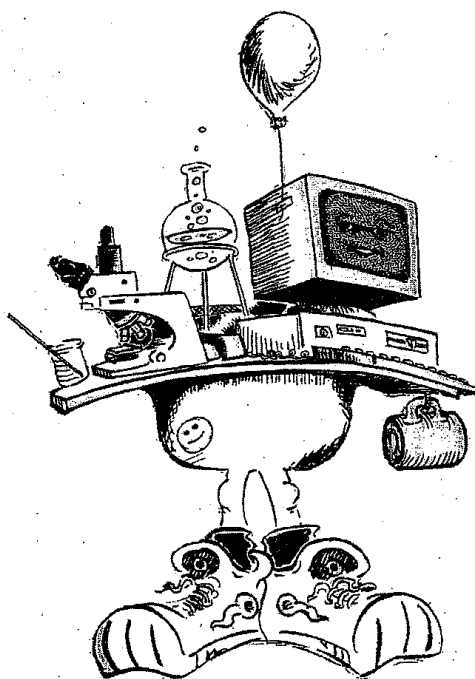
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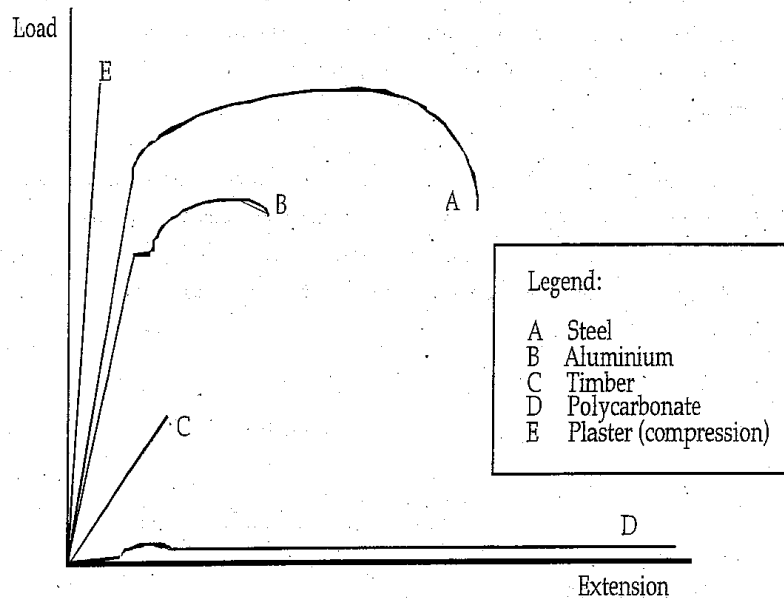
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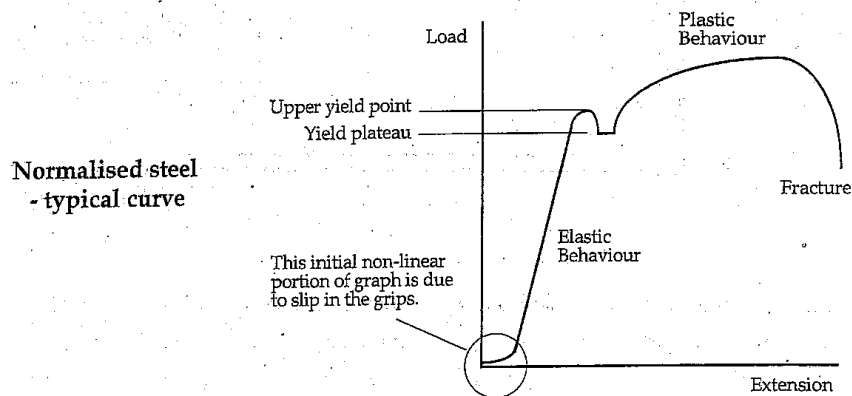
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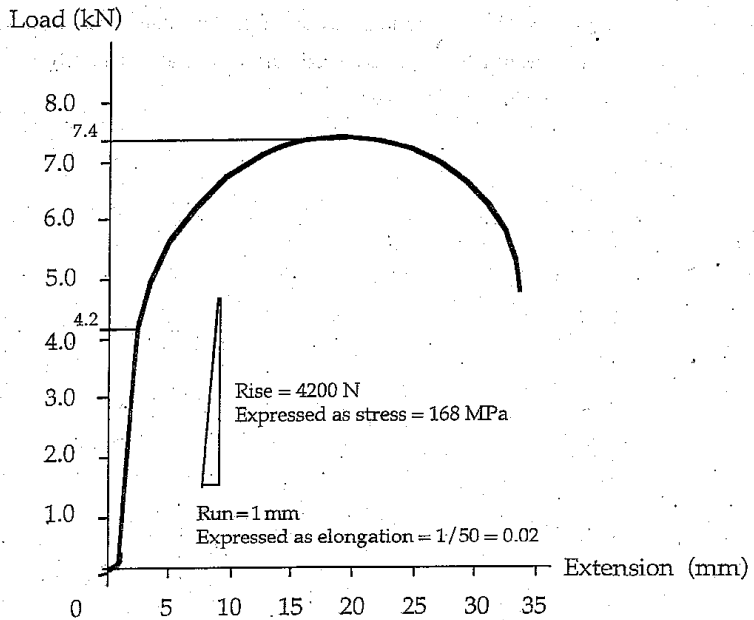
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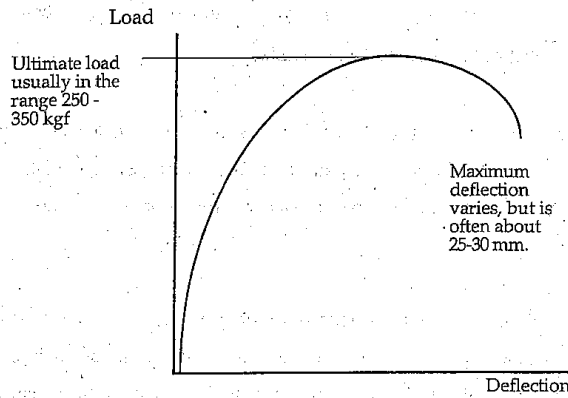
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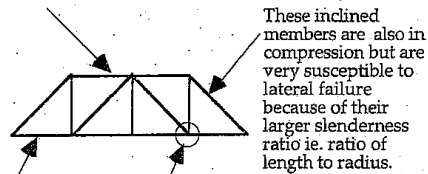


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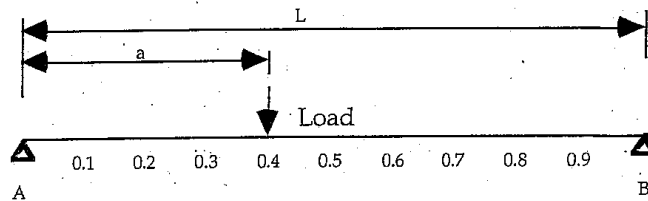


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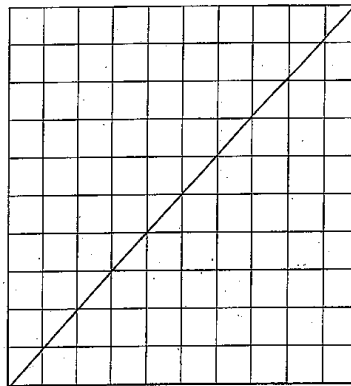
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2.7 Reaction Forces:

For this activity the students determine how the load on a simply supported beam is distributed to its supports. The configuration of the equipment, a typical graph and the mathematical relationship is shown below. The relationship is easily determined by using moments about support B.



$$R_B = R_A$$

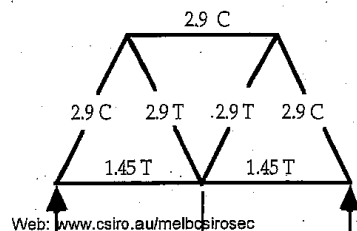


$$\text{ie. } R_B = a/L \times R_A$$

$$a/L = 1$$

2.8 Forces in a Truss:

Summary of member forces:



CSIRO Education Victoria
Phone: (03) 9252 6367

Fax: (03) 9252 6256

Web: www.csiro.au/melbcsirosec

In this activity the equipment enables students to measure the forces in the members of the truss shown below. These measured values are then used to determine whether there is equilibrium at the joints. The activity relies on students understanding that the load is shared equally between the supports and that because the truss is symmetrical the forces in similar members will be the same. This should be evident by inspection. The theoretical forces in members are determined using the *method of equilibrium of joints*. This method applies at any joint where at least one force is known and not more than two unknown forces are present. Therefore the analysis begins at the supports.



Contact Details

CSIRO Education, Victoria
P.O. Box 56
Highett, 3156
Ph: (03) 9252 6386 or (03) 9252 6410
Email: education@csiro.au
Web: www.csiro.au/melbcsirosec

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APPENDIX M Observation Sheets

Date: 4/14/2010
Program: Cool Chem
School: Mt. View Primary
Number of classes: 2

Opening Presentation	4										Going down # of Students Engaged				Comments
	0	5	10	15	20	25	30	35	40						
Minutes into program	4	4	4	4	4	3	4	4	4	3					
Eye Contact	4	3	4	4	4	4	3	3							
Concentration		1				1									
Boredom	2	3	3	4	3	3	4								
Eagerness to Participate (Over Whole Time)															
Confusion/Frustration	1						1	1							
Physical Distractions															
Asking Questions															

Closing Presentation	8										Going down # of Students Engaged				Comments
	0	5	10	15	20	25	30	35	40						
Minutes into program	8	8	4	8											
Eye Contact	8	4	4	8											
Concentration															
Boredom	6	8	5	4											
Eagerness to Participate (Over Whole Time)															
Confusion/Frustration															
Physical Distractions															
Asking Questions															

Carol Chen
 mt. View PT/Mary
 4/14/2010
 Alex
 2nd grade

Opening Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	0	6	6	6	6	6	6	6	6	6	
Eye Contact	0	6	6	6	6	6	6	6	6	6	
Concentration	0	6	6	5	5	4	4	4	4	4	
Boredom	0	0	0	1	1	2	2	2	2	2	
Eagerness to Participate (Over Whole Time)	0	0	0	0	0	0	0	0	0	0	
Confusion/Frustration	0	0	0	0	0	0	0	0	0	0	
Physical Distractions	0	0	0	0	0	0	0	0	0	0	
Asking Questions	0	0	0	0	0	0	0	0	0	0	

Closing Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	0	6	6	6	6	6	6	6	6	6	
Eye Contact	0	6	6	6	6	6	6	6	6	6	
Concentration	0	4	3	3	3	3	3	3	3	3	
Boredom	0	1	2	2	2	2	2	2	2	2	
Eagerness to Participate (Over Whole Time)	0	0	0	0	0	0	0	0	0	0	
Confusion/Frustration	0	0	0	0	0	0	0	0	0	0	
Physical Distractions	0	0	0	0	0	0	0	0	0	0	
Asking Questions	0	0	0	0	0	0	0	0	0	0	

Opening Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	6	5	6	6	7	6	7				
Eye Contact	6	5	6	6	7	5	6				
Concentration	1	1	0	1	1	1	0				
Boredom	3	0	2	4	0	2					
Eagerness to Participate (Over Whole Time)	0	0	0	0	0	0	0				
Confusion/Frustration	3	1	2	0	2	0					
Physical Distractions	0	0	0	0	0	0					
Asking Questions											

Closing Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	7	6	7								
Eye Contact	6	6	7								
Concentration	0	0	0								
Boredom	4	3	0								
Eagerness to Participate (Over Whole Time)	0	0	0								
Confusion/Frustration	2	2	0								
Physical Distractions	1	0	0								
Asking Questions											

2

Geo. Chem
Mt. View Primary
11.15
14/4/2010
Y6
Vodini

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation											
Minutes into program	9	9	9	9	9	9	9	9	9	9	
Eye Contact	9	9	9	9	9	9	9	9	9	9	
Concentration	9	9	9	9	9	9	9	9	9	9	
Boredom	0	0	0	0	0	0	0	0	0	0	
Eagerness to Participate (Over Whole Time)	0	2	3	6	0	0	0	0	0	0	
Confusion/Frustration	0	0	0	0	0	0	0	0	0	0	
Physical Distractions	0	0	1	0	0	0	0	0	0	0	
Asking Questions	0	0	0	0	0	0	0	0	0	0	

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation											
Minutes into program	7	8	9								
Eye Contact	7	8	9								
Concentration	7	8	9								
Boredom	1	1	1								
Eagerness to Participate (Over Whole Time)	1	2	4								
Confusion/Frustration	0	0	0								
Physical Distractions	0	1	1								
Asking Questions	0	0	0								

2nd Session

Program Name: Cool Olem
 School: ME View Primary
 Time: 11:30G
 Date: 4/4/10
 Age Group: Year 6
 Observer: AKX

SFS SFS

Observation Group #	0	5	10	15	20	25	30	35	40	45
Minutes into program										
Activity students working on	milik	get down	get down	memoria	NaOH	Siva				
Discussion (P or O or N)	P P P	P P P	P P P	N P P	P P P	O G O				
Concentration	A X X	X X X	X X X	X X X	X X X	X X X				
Enjoyment/Excitement		X								
Boredom										
Confusion/Frustration	X		X X X							
Physical Distractions		X		X		X X X				
Read Instructions at Start										
Teamwork (P or N)	P P P	P P P	P P P	P P P	P P P					

Observation Group #	Going down # of Students engaged									
Minutes into program	50	55	60	65	70	75	80	85	90	95
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Program Name: Cool Chem
 School: Mt. View Primary
 Time: 11:30
 Date: 4-14-10
 Age Group: Yess 6
 Observer: Wesley Dittrol

Observation Group # 3 boys Wesley Dittrol

	0	5	10	15	20	25	30	35	40	45
Minutes into program										
Activity students working on	<u>Bored</u>		<u>Active</u>	<u>Blue top</u>	<u>Hot Water</u>					
Discussion (P or O or N)	<u>P P P</u>	<u>P P P</u>	<u>P P P</u>	<u>O O</u>	<u>P P P</u>	<u>P P P</u>				
Concentration	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>				
Enjoyment/Excitement	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>				
Boredom	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>				
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>				
Teamwork (P or N)	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>				

Observation Group # 6 boys Wesley Dittrol

	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on	<u>NaOH</u>		<u>Powder</u>		<u>Sally's</u>	<u>UV light</u>				
Discussion (P or O or N)	<u>P P P</u>	<u>P P P</u>	<u>P P P</u>	<u>P P P</u>	<u>P P P</u>	<u>P P P</u>				
Concentration	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>				
Enjoyment/Excitement	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>				
Boredom	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>				
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>				
Teamwork (P or N)	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>	<u>/</u>				

2010
S. J. ...

Program Name: Cool Chem
 School: McVeen Primary
 Time: 11:30
 Date: 4-14-10
 Age Group: Year 6
 Observer: Alex

B1 BCS B1 BCS

Observation Group #	0	5	10	15	20	25	30	35	40	45
Minutes into program										
Activity students working on	party	milk	Non-milk	UV	UV	non-milk				
Discussion (P or O or N)	PP	NPP	PP	PP	PP	NPP				
Concentration	X	X	X	X	X	X				
Enjoyment/Excitement	X	X								
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	PP	PP	PP	PP	PP	PP				
Teamwork (P or N)	PP	PP	PP	PP	PP	PP				

AU

Observation Group #	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on	cake	minutes	minutes	minutes	minutes	minutes				
Discussion (P or O or N)	PP	PP	PP	PP	PP	PP				
Concentration	X	X	X	X	X	X				
Enjoyment/Excitement	X	X								
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start		X		X						
Teamwork (P or N)	PP	PP	PP	PP	PP	PP				

2

A - Ind
 13 - Wes Jr
 1C - ~~West~~ ~~Pres~~ Dan Jr

Program Name: Cool Chem
 School: Mt. View Primary
 Time: 11:45
 Date: 1/4/10
 Age Group: 4C
 Observer: Madlin

Observation Group #	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Minutes into program	0	5	10	15	20	25	30	35	40	45
Activity students working on	Get Swill	Hot Soap	Slime	Colbase Chem	Colbase Chem	Colbase Chem	Colbase Chem			
Discussion (P or O or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P			
Concentration	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓			
Enjoyment/Excitement	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓			
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P			

Observation Group #	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program	50	55	60	65	70	75	80	85	90	95
Activity students working on	Curious Collins	Milk Detergent	Milk Detergent	Aluminum Sulfate	Colbase Chem	Colbase Chem	Colbase Chem			
Discussion (P or O or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P			
Concentration	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓			
Enjoyment/Excitement	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓			
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓			
Teamwork (P or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P			

2A - Non Eng Sci
 2B - Pe/low Eng
 2C - Air Soc S

Cool Chem

Program Name: NF VIEW
 School: 11.16
 Time: 4/14/2010
 Date: 6
 Age Group: Alex
 Observer: Black

Observation Group #	Going down # of Students engaged									
	5	10	15	20	25	30	35	40	45	
Minutes into program	5:15	6:00	6:45	7:30	8:15	9:00	9:45	10:30	11:15	
Activity students working on	ST/ME	BEADS	MARSH	Gal Small	MIN CANTS					
Discussion (P or O or N)	PPP	PPP	PPP	PPP	PPP					
Concentration	XX	XX	XX	XX	XX					
Enjoyment/Excitement	XX	XX	XX	XX	XX					
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	PPP	PPP	PPP	PPP	PPP					

Observation Group #	Going down # of Students engaged									
	55	60	65	70	75	80	85	90	95	
Minutes into program	55:00	56:00	57:00	58:00	59:00	60:00	61:00	62:00	63:00	
Activity students working on	balls	CAIORS	blue bottle	ST/ME	ST/ME					
Discussion (P or O or N)	PPP	PPP	PPP	PPP	PPP					
Concentration	XX	XX	XX	XX	XX					
Enjoyment/Excitement	XX	XX	XX	XX	XX					
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	PPP	PPP	PPP	PPP	PPP					

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation											
Minutes into program	8	5	8	9	10	8	6				
Eye Contact	7	6	8	8	4	7					
Concentration	1	2	0	1	1	1					
Boredom	12	12	12	12	12	12					
Eagerness to Participate (Over Whole Time)	0	0	1	0	2	0	0				
Confusion/Frustration	0	0	1	0	1	0	0				
Physical Distractions	2	4	3	1	0	3	0				
Asking Questions	0	0	0	0	0	0	0				

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation											
Minutes into program	8	7									
Eye Contact	7										
Concentration	0										
Boredom	11										
Eagerness to Participate (Over Whole Time)	0										
Confusion/Frustration	0										
Physical Distractions	3										
Asking Questions											

Cool Chem

4/14/2010

Mt. View Primary

Class 1

Alced

Greg gives a very good discussion of what chemistry is.

6 hot

opening ~~opening~~
basic
too long

	Going down # of Students Engaged								Comments	
	0	5	10	15	20	25	30	35		40
Opening Presentation										
Minutes into program	5	4	3	2	1	0	0	0	0	
Eye Contact	3	1	0	0	0	0	0	0	0	
Concentration	2	3	1	0	0	0	0	0	0	
Boredom	0	0	0	0	0	0	0	0	0	
Eagerness to Participate (Over Whole Time)	0	0	0	0	0	0	0	0	0	
Confusion/Frustration	0	0	0	0	0	0	0	0	0	
Physical Distractions	0	0	0	0	0	0	0	0	0	
Asking Questions	0	0	0	0	0	0	0	0	0	

	Going down # of Students Engaged								Comments	
	0	5	10	15	20	25	30	35		40
Closing Presentation										
Minutes into program	6									
Eye Contact	4									
Concentration	0									
Boredom	0									
Eagerness to Participate (Over Whole Time)	0									
Confusion/Frustration	0									
Physical Distractions	0									
Asking Questions	0									

Cool Chen
 4-14-10
 9:15am
 Wes Dittus

Mt. View Primary
 Year 6

Opening Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	8	8	8	8	8	8	6	8			
Eye Contact	8	8	8	8	8	8	4	8			
Concentration	8	8	8	8	8	8	4	8			
Boredom							1				
Eagerness to Participate (Over Whole Time)	3	8	8	8	7	8	4	4			
Confusion/Frustration											
Physical Distractions				8							
Asking Questions								1			

Closing Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	8	8	8	8							
Eye Contact	8	8	8	8							
Concentration											
Boredom	1	1	1								
Eagerness to Participate (Over Whole Time)	4	5	3								
Confusion/Frustration											
Physical Distractions	1	2									
Asking Questions											

PROGRAM TITLE: WJL
 School: ME View Primary
 Time: 9:15 am
 Date: 4-14-10
 Age Group: Year 6
 Observer: ↓

Minutes into program	Going down # of Students engaged														
	0	5	10	15	20	25	30	35	40	45					
Activity students working on	<u>Map</u>	<u>Map</u>	<u>Map</u>	<u>Map</u>	<u>Map</u>	<u>Map</u>	<u>Map</u>	<u>Map</u>	<u>Map</u>	<u>Map</u>	<u>Map</u>	<u>Map</u>	<u>Map</u>	<u>Map</u>	<u>Map</u>
Discussion (P or O or N)	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>
Concentration	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
Enjoyment/Excitement	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
Boredom															
Confusion/Frustration		<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
Physical Distractions															
Read Instructions at Start	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
Teamwork (P or N)	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>	<u>P</u>

Minutes into program	Going down # of Students engaged														
	50	55	60	65	70	75	80	85	90	95					
Activity students working on															
Discussion (P or O or N)															
Concentration															
Enjoyment/Excitement															
Boredom															
Confusion/Frustration															
Physical Distractions															
Read Instructions at Start															
Teamwork (P or N)															

Program Name: Cool Crew
 School: Mt. View Primary
 Time: 9:15
 Date: 4/14/2010
 Age Group: 6 yr
 Observer: Alex

Observation Group #	Going down # of Students engaged									
	5	10	15	20	25	30	35	40	45	
Minutes into program										
Activity students working on	balls	Colors	Colors	Colors	Colors	Colors	Colors	Colors	Colors	
Discussion (P or O or N)	PP	PP	PP	PP	PP	PP	PP	PP	PP	
Concentration	XX	XX	XX	XX	XX	XX	XX	XX	XX	
Enjoyment/Excitement	XX									
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	PP	PP	PP	PP	PP	PP	PP	PP	PP	

Observation Group #	Going down # of Students engaged									
	55	60	65	70	75	80	85	90	95	
Minutes into program										
Activity students working on	Game	Meal	Colors	Colors	Colors	Colors	Colors	Colors	Colors	
Discussion (P or O or N)	PP	PP	PP	PP	PP	PP	PP	PP	PP	
Concentration	XX	XX	XX	XX	XX	XX	XX	XX	XX	
Enjoyment/Excitement	XX									
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	PP	PP	PP	PP	PP	PP	PP	PP	PP	

①

Cool Chem

Program Name: Mt. View Primary
 School: _____
 Time: 9:15
 Date: 12/14/2010
 Age Group: Y6
 Observer: Vastin

Hot Sun Mat

Observation Group # 1	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Minutes into program	0	5	10	15	20	25	30	35	40	45
Activity students working on	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)
Concentration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enjoyment/Excitement	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Teamwork (P or N)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Observation Group # 2	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program	50	55	60	65	70	75	80	85	90	95
Activity students working on	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)	Discussion (P or O or N)
Concentration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enjoyment/Excitement	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Teamwork (P or N)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Program Name: Cool Chem Science
 School: Mc New Primary
 Time: 9:15 am
 Date: 4-14-10
 Age Group: Year 6
 Observer: Alex

Cabbage AB

Observation Group #	SA	WA	SA	WA	SA	WA	SA	WA	SA	WA	SA	WA	SA	WA	SA	WA	SA	WA	
Minutes into program	0		5		10		15		20		25		30		35		40		45
Activity students working on	<u>Smiling</u>		<u>FS Milk</u>		<u>giving</u>		<u>from milk</u>		<u>Cabbage AB</u>										
Discussion (P or O or N)	<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>
Concentration	<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>
Enjoyment/Excitement	<u>XX</u>		<u>XX</u>		<u>XX</u>		<u>XX</u>		<u>XX</u>		<u>XX</u>		<u>XX</u>		<u>XX</u>		<u>XX</u>		<u>XX</u>
Boredom																			
Confusion/Frustration																			
Physical Distractions																			
Read Instructions at Start	<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>
Teamwork (P or N)	<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>

Group 1

Observation Group #	F	S	N	F	S	N	F	S	N	F	S	N	F	S	N	F	S	N	
Minutes into program	50		55		60		65		70		75		80		85		90		95
Activity students working on	<u>milk</u>		<u>Cabbage AB</u>		<u>Cabbage AB</u>		<u>Cabbage AB</u>		<u>Cabbage AB</u>		<u>Cabbage AB</u>		<u>Cabbage AB</u>		<u>Cabbage AB</u>		<u>Cabbage AB</u>		<u>Cabbage AB</u>
Discussion (P or O or N)	<u>PPN</u>		<u>PPN</u>		<u>PPN</u>		<u>PPN</u>		<u>PPN</u>		<u>PPN</u>		<u>PPN</u>		<u>PPN</u>		<u>PPN</u>		<u>PPN</u>
Concentration	<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>
Enjoyment/Excitement	<u>XXX</u>		<u>XX</u>		<u>XX</u>		<u>XX</u>		<u>XX</u>		<u>XX</u>		<u>XX</u>		<u>XX</u>		<u>XX</u>		<u>XX</u>
Boredom																			
Confusion/Frustration																			
Physical Distractions																			
Read Instructions at Start	<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>		<u>XXX</u>
Teamwork (P or N)	<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>		<u>PPP</u>

Group 2

Program Name: Cool Chemical Science
 School: ME View Primary
 Time: 9:55 am
 Date: 4-14-10
 Age Group: Year 6
 Observer: Wes Dittick

Observation Group #	Minutes into program	Going down # of Students engaged																					
		0	5	10	15	20	25	30	35	40	45												
2	Activity students working on	None	UV light	UV light	UV light	UV light	UV light	UV light	UV light	UV light	UV light	UV light	UV light	UV light	UV light	UV light	UV light	UV light	UV light	UV light	UV light	UV light	
	Discussion (P or O or N)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	Concentration	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Enjoyment/Excitement	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Boredom	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Confusion/Frustration	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Physical Distractions	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Read Instructions at Start	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Teamwork (P or N)	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/

Observation Group #	Minutes into program	Going down # of Students engaged																					
		50	55	60	65	70	75	80	85	90	95												
2	Activity students working on	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
	Discussion (P or O or N)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	Concentration	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Enjoyment/Excitement	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Boredom	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Confusion/Frustration	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Physical Distractions	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Read Instructions at Start	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Teamwork (P or N)	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/

Date: 3/19/2010

Program: Forensic Frenzy

School: Eammas College

Number of classes: 2

Session: 1

FF
Emmons College
3/19/10 @ 8:45
yr. 9
Alex

Alex + ①

- Just finished a Forensics Unit

12 students
10 of those were

- Students bored during read-aloud portion

	Going down # of Students Engaged										Comments	
	0	5	10	15	20	25	30	35	40	40		
Opening Presentation												
Minutes into program	12	12	12	12	12	10	8					
Eye Contact	17	12	12	12	9	8						
Concentration	0	2	2	3	4	4						
Boredom	8	3	1	0	0	0						
Eagerness to Participate (Over Whole Time)	0	0	0	0	0	0						
Confusion/Frustration	0	0	0	0	0	0						
Physical Distractions	0	0	0	0	0	0						
Asking Questions	0	0	0	0	0	0						

girls were interesting

	Going down # of Students Engaged										Comments	
	0	5	10	15	20	25	30	35	40	40		
Closing Presentation												
Minutes into program	4	8	8	10								
Eye Contact	2	6	1									
Concentration	4	4	0									
Boredom	0	0	0									
Eagerness to Participate (Over Whole Time)	0	0	0									
Confusion/Frustration	0	0	0									
Physical Distractions	0	0	0									
Asking Questions	0	0	0									

→ Rebuilding face does not give actual evidence, it is just for fun
 → groups sit and eat during presentation
 →

FF
 A/ed
 D

Program Name: FF
 School: Farmus College
 Time: 8:45
 Date: 7/19
 Age Group: 9
 Observer: Alax

Observation Group #	Going down # of Students engaged									
	5	10	15	20	25	30	35	40	45	
Minutes into program	61	60	59	58	57	56	55	54	53	
Activity students working on	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	
Discussion (P or O or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	
Concentration	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	
Teamwork (P or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	

Observation Group #	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program	50	55	60	65	70	75	80	85	90	95
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Alex ①

Program Name: Reading Strategy
 School: EMMENS CANY
 Time: 8:45 am
 Date: 7/19/10
 Age Group: 9
 Observer: Alex

→ split off
 → having her own
 → having her own

Observation Group # 1	Going down # of Students engaged														
	50	55	60	65	70	75	80	85	90	95					
Minutes into program	W BOP	5	10	15	20	25	30	35	40	45					
Activity students working on	DNA	Sail	Sail	chcm	o'ill	Dental									
Discussion (P or O or N)	P P P	PMP	PMP	O M O	PMP	POP									
Concentration	X X X	X X X	X X X	X X X	X X X										
Enjoyment/Excitement															
Boredom															
Confusion/Frustration															
Physical Distractions															
Read Instructions at Start	X X X	X X X													
Teamwork (P or N)	P P P	PMP	PMP	P P P	P P P	P P P									

Observation Group #	Going down # of Students engaged														
	50	55	60	65	70	75	80	85	90	95					
Minutes into program															
Activity students working on															
Discussion (P or O or N)															
Concentration															
Enjoyment/Excitement															
Boredom															
Confusion/Frustration															
Physical Distractions															
Read Instructions at Start															
Teamwork (P or N)															

Alex
①

Program Name: FF
 School: Erasmus College
 Time: 8:15 am
 Date: 3/19/10
 Age Group: Year 8
 Observer: Alex

Observation Group # <u>3</u>	Going down # of Students engaged									
	5	10	15	20	25	30	35	40	45	
Minutes into program	6:10	6:15	6:20	6:25	6:30	6:35	6:40	6:45	6:50	
Activity students working on	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Discussion (P or O or N)	P	P	P	P	P	P	P	P	P	
Concentration	X	X	X	X	X	X	X	X	X	
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	X	X	X	X	X	X	X	X	X	
Teamwork (P or N)	A	A	A	A	A	A	A	A	A	

Observation Group #	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Program Name: EF
 School: Emory College
 Time: 2:45
 Date: 2/10/10
 Age Group: 18-19
 Observer: Alex

Alex ①

Observation Group #	Going down # of Students engaged									
	5	10	15	20	25	30	35	40	45	
Minutes into program	0	1	2	3	4	5	6	7	8	9
Activity students working on	0	1	2	3	4	5	6	7	8	9
Discussion (P or O or N)	0	1	2	3	4	5	6	7	8	9
Concentration	X	X	X	X	X	X	X	X	X	X
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	X									
Teamwork (P or N)	N	P	P	P	P	P	P	P	P	P

Observation Group #	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Emmons College
19/3/2010
Formosa Franzy

Year 9
rebuilding families
8/9/10 not provide with
evidence

Students told
Francis or Tim Livingston
on relationship
of family / Smix

Students bored
during reality
of crime
scene

middle Melbourne
is well off
may will be
professionals

Just finished
forensics unit

DAV
①
Don't forget
to get
them
of them

	Going down # of Students Engaged									
	0	5	10	15	20	25	30	35	40	Comments
Opening Presentation	0	5	10	15	20	25	30	35	40	
Minutes into program	14	13	14	14	13	12	12			
Eye Contact	12	12	14	12	11	6	7			
Concentration	0	1	2	3	2	3				
Boredom	0	0	0	0	0	0	0			
Eagerness to Participate (Over Whole Time)	0	0	0	0	0	0	0			
Confusion/Frustration	0	0	0	0	0	0	0			
Physical Distractions	0	1	0	0	2	3	2			
Asking Questions	0	0	0	0	0	0	0			

Some kids just shy

	Going down # of Students Engaged									
	0	5	10	15	20	25	30	35	40	Comments
Closing Presentation	0	5	10	15	20 <td>25</td> <td>30</td> <td>35</td> <td>40</td> <td></td>	25	30	35	40	
Minutes into program	10	8	9							
Eye Contact	6	9	7							
Concentration	4	1	1							
Boredom	0	0	0							
Eagerness to Participate (Over Whole Time)	0	0	0							
Confusion/Frustration	2	2	2							
Physical Distractions	0	0	0							
Asking Questions	0	0	0							

Presenter noted that some people aren't participating in class

①

3 days

DCM
D

Program Name: FF
 School: Emmy College
 Time: 8:45 AM
 Date: 3/19/10
 Age Group: Year 9
 Observer: DAN

8 M CAS

Observation Group #	0		5		10		15		20		25		30		35		40		45	
	B	M	C	O	B	M	C	O	B	M	C	O	B	M	C	O	B	M	C	O
Minutes into program																				
Activity students working on																				
Discussion (P or O or N)																				
Concentration																				
Enjoyment/Excitement																				
Boredom																				
Confusion/Frustration																				
Physical Distractions																				
Read Instructions at Start																				
Teamwork (P or N)																				

Observation Group #	50		55		60		65		70		75		80		85		90		95	
	B	M	C	O	B	M	C	O	B	M	C	O	B	M	C	O	B	M	C	O
Minutes into program																				
Activity students working on																				
Discussion (P or O or N)																				
Concentration																				
Enjoyment/Excitement																				
Boredom																				
Confusion/Frustration																				
Physical Distractions																				
Read Instructions at Start																				
Teamwork (P or N)																				

2

2 girls 1500

30
 7
 10

Program Name: FF
 School: EMMUS
 Time: 8:45
 Date: 3/1/80
 Age Group: Year 9
 Observer: DMS

FFP

Observation Group #	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Minutes into program	BWF	BWF	BWF	BWF	BWF	BWF	BWF	BWF	BWF	BWF
Activity students working on	PP	PP	PP	PP	PP	PP	PP	PP	PP	PP
Discussion (P or O or N)	X	X	X	X	X	X	X	X	X	X
Concentration	X	X	X	X	X	X	X	X	X	X
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	X	X	X	X	X	X	X	X	X	X
Teamwork (P or N)	N	P	P	P	P	P	P	P	P	P

Observation Group #	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

3

2 girls 1 boy

Handwritten initials and marks

Program Name: FF
 School: Lincoln College
 Time: 8:45 am
 Date: 3/19/10
 Age Group: Year 9
 Observer: DAN

Handwritten notes:
 May forward
 on track
~~no~~ no activity
 SP

Observation Group #	0	5	10	15	20	25	30	35	40	45
Minutes into program	0	5	10	15	20	25	30	35	40	45
Activity students working on	SBA	SBA	SBA	SBA	SBA					
Discussion (P or O or N)	PPP	PPP	PPP	PPP	PPP					
Concentration	XX	XX	XX	XX	XX					
Enjoyment/Excitement	X									
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	XX	XX	XX	XX	XX					
Teamwork (P or N)	PPP	PPP	PPP	PPP	PPP					

Observation Group #	50	55	60	65	70	75	80	85	90	95
Minutes into program	50	55	60	65	70	75	80	85	90	95
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

④

2 boys

1905
 (17)

Program Name: EF
 School: Emory College
 Time: 8:45 am
 Date: 3/19/10
 Age Group: Year 9
 Observer: SAW

10/2/10
SAW

SAW

Observation Group #	Going down # of Students engaged											
	0	5	10	15	20	25	30	35	40	45		
Minutes into program												
Activity students working on												
Discussion (P or O or N)												
Concentration												
Enjoyment/Excitement												
Boredom												
Confusion/Frustration												
Physical Distractions												
Read Instructions at Start												
Teamwork (P or N)												

Observation Group #	Going down # of Students engaged										
	50	55	60	65	70	75	80	85	90	95	
Minutes into program											
Activity students working on											
Discussion (P or O or N)											
Concentration											
Enjoyment/Excitement											
Boredom											
Confusion/Frustration											
Physical Distractions											
Read Instructions at Start											
Teamwork (P or N)											

Perennis
 Eamnis College
 9:00
 14/5
 79
 Vadim

Vadim

14 students

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation	11	12	6	10	11	7	13				
Minutes into program	3	3	8	10	11	5	10				
Eye Contact	8	7	7	3	3	9	4				
Concentration	0	3	2	3	1	1	0				
Boredom	0	2	3	0	2	0	0				
Eagerness to Participate (Over Whole Time)	2	2	2	1	1	1	4				
Confusion/Frustration	0	0	0	0	0	0	0				
Physical Distractions	0	0	0	0	0	0	0				
Asking Questions											

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation	2	8	14								
Minutes into program	7	8									
Eye Contact	10	0									
Concentration	0	7									
Boredom	0	0									
Eagerness to Participate (Over Whole Time)	1	0									
Confusion/Frustration	0	0									
Physical Distractions	0	0									
Asking Questions	0	0									

A

Nadim

Program Name: Forensics
 School: Erasmus College
 Time: 9:00
 Date: 1/13
 Age Group: YA
 Observer: Wah

①

Observation Group # <u>1</u>	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Minutes into program										
Activity students working on										
Discussion (P or O or N)	16P	10P 30	14P	10P 30	14P	8P 30				
Concentration	18	11	12	9	14	6				
Enjoyment/Excitement	6	6	9	9	12	6				
Boredom	0	1	0	0	1	4				
Confusion/Frustration	0	0	1	1	1	3				
Physical Distractions	6	3	7	4	0	5				
Read Instructions at Start										
Teamwork (P or N)	12P	10	13	10P 3N 14P	14P	8P				

Observation Group # <u>2</u>	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

8:45 am
3/19/10
Wes D D
Wes

Wes
①

115 students

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation											
Minutes into program											
Eye Contact	11	4	7	11	10	7					
Concentration	5	7	4	4	5						
Boredom	5	3	2	3	4	0					
Eagerness to Participate (Over Whole Time)	1										
Confusion/Frustration											
Physical Distractions	3		1	4	4	5					
Asking Questions											

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation											
Minutes into program											
Eye Contact	10	5	6								
Concentration	8	8	3								
Boredom	3	1	3								
Eagerness to Participate (Over Whole Time)	4	3	7								
Confusion/Frustration											
Physical Distractions	2										
Asking Questions											

Wes ①

Program Name: Forensics
 School: _____
 Time: 8:45
 Date: 3/19/06
 Age Group: 9th Year
 Observer: Wes Duffin

Observation Group #	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Minutes into program										
Activity students working on	6/8	20	9/30	12/21	19/15	8/10	8/15			
Discussion (P or O or N)	0	1	1	2	3	4	5			
Concentration	1	1	1	1	1	1	1			
Enjoyment/Excitement	1	1	1	1	1	1	1			
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Observation Group #	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Date: 3/19/2010
Program: Forensic Frenzy
School: Eammus College
Number of classes: 2
Session: 2

Was
3-19-10
11:00 am
Success
Eamus College
Feb 9

Wes
②

AN 24

Opening Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program											
Eye Contact	14	3	0	10	16	12	18				
Concentration	5	16	9		2	3	3				
Boredom	2										
Eagerness to Participate (Over Whole Time)	4	5	16	15	6	4	2				
Confusion/Frustration											
Physical Distractions	4	2		1	5	2	1				
Asking Questions											

Closing Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program											
Eye Contact	6	18	#								
Concentration	24	24									
Boredom											
Eagerness to Participate (Over Whole Time)	6	12									
Confusion/Frustration											
Physical Distractions	3	1									
Asking Questions											

Forensics
 Rooms 2
 Vadima
 11:00
 Y4

Was I both did
 Entire Class

Vadim
 (circled) (2)

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation	17	22	10	13	22	21	22				
Minutes into program	9	22	18	16	22	19	20				Student kept looking at me
Eye Contact	6	3	3	5	0	3	4				
Concentration	4	3	7	12	5	18					
Boredom	0	0	1	2	1	1	1				
Eagerness to Participate (Over Whole Time)	2	2	3	2	1	3	3				
Confusion/Frustration	6	0	0	0	0	0	0				Kid playing w/ fact/scissors? w/ Tr
Physical Distractions											
Asking Questions											

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation	6	14	23								
Minutes into program	24	24	23								
Eye Contact	0	0	0								
Concentration	6	16	14								
Boredom	0	0	0								
Eagerness to Participate (Over Whole Time)	2	7	2								
Confusion/Frustration	0	2	2								
Physical Distractions	0	2	0								
Asking Questions											

Focus: Formulas
 Program Name: Formulas College (2)
 School: _____
 Time: 11:00
 Date: 1/13
 Age Group: YA
 Observer: VMG

VMG
 (2)

*Kid working alone?
 Kids got confused / frustrated not interested
 when teacher came over and started harassing them*

Observation Group #	Going down # of Students engaged												
	0	5	10	15	20	25	30	35	40	45			
Minutes into program													
Activity students working on													
Discussion (P or O or N)	11P	11N	13P										
Concentration	12	13	9	10	15P	11N	14P	11P	9P				
Enjoyment/Excitement	8	12	16	11	11	14	15	7	8	12			
Boredom	1	1	0	2	0	0	0	0	0	0			
Confusion/Frustration	0	1	1	2	0	0	0	0	0	0			
Physical Distractions	0	0	1	1	0	1	1	1	1	3			
Read Instructions at Start													
Teamwork (P or N)	11P	11N	13P										
			10P	15P	14P	11P	13P						

Observation Group #	Going down # of Students engaged												
	50	55	60	65	70	75	80	85	90	95			
Minutes into program													
Activity students working on													
Discussion (P or O or N)													
Concentration													
Enjoyment/Excitement													
Boredom													
Confusion/Frustration													
Physical Distractions													
Read Instructions at Start													
Teamwork (P or N)													

Wes
②

Program Name: Francisco
 School: Edmonds College (2)
 Time: 11:50 am
 Date: 3-19-10
 Age Group: Year 9
 Observer: Wes Dutton

Observation Group #	Going down # of Students engaged											
	11:55	12:00	12:05	12:10	12:15	12:20	12:25	12:30	12:35	12:40	12:45	
Minutes into program	0											
Activity students working on												
Discussion (P or O or N)	8/20	9/20	8/20	8/20	8/20	8/20	8/20	8/20	8/20	8/20	8/20	8/20
Concentration	11	9	5	5	5	5	5	5	5	5	5	5
Enjoyment/Excitement												
Boredom												
Confusion/Frustration												
Physical Distractions												
Read Instructions at Start	0	0	0	0	0	0	0	0	0	0	0	0
Teamwork (P or N)	11	11	11	11	11	11	11	11	11	11	11	11

Observation Group #	Going down # of Students engaged										
	50	55	60	65	70	75	80	85	90	95	
Minutes into program											
Activity students working on											
Discussion (P or O or N)											
Concentration											
Enjoyment/Excitement											
Boredom											
Confusion/Frustration											
Physical Distractions											
Read Instructions at Start											
Teamwork (P or N)											

Alex + e
 (2)
 Fri - 8:45
 FL 07

11/19/10
 Emma's Vic
 Edu
 au

FF
 Program Name: Emma's College
 School: 11:00 am
 Time: 3/19/10
 Date: Year 9
 Age Group: Alex
 Observer: *me*

Observation Group #	Going down # of Students engaged									
	5	10	15	20	25	30	35	40	45	
Minutes into program										
Activity students working on	load	1/10/10	gms	gms	SO 11					
Discussion (P or O or N)	P P P	P P P	P P P	P P P	P P P					
Concentration	X X X	X X X	X X X	X X X	X X X					
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	X X X									
Teamwork (P or N)	P P P	P P P	P P P	P P P	P P P					

Observation Group #	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Alex
2

Program Name: PP
 School: Farmington College
 Time: 11 am
 Date: 3/11/80
 Age Group: Y 9
 Observer: Alex

Observation Group # <u>2</u>	Going down # of Students engaged														
	50	55	60	65	70	75	80	85	90	95					
Minutes into program															
Activity students working on	PP	PP	PP	PP	PP	PP	PP	PP	PP	PP					
Discussion (P or O or N)															
Concentration															
Enjoyment/Excitement															
Boredom															
Confusion/Frustration															
Physical Distractions															
Read Instructions at Start															
Teamwork (P or N)															

Observation Group #	Going down # of Students engaged														
	50	55	60	65	70	75	80	85	90	95					
Minutes into program															
Activity students working on															
Discussion (P or O or N)															
Concentration															
Enjoyment/Excitement															
Boredom															
Confusion/Frustration															
Physical Distractions															
Read Instructions at Start															
Teamwork (P or N)															

Alex
2

Program Name: FF
 School: Emphas College
 Time: 11 AM
 Date: 3/19/10
 Age Group: Y9
 Observer: Alex

Observation Group #	Going down # of Students engaged									
	5	10	15	20	25	30	35	40	45	
Minutes into program	0	5	10	15	20	25	30	35	40	45
Activity students working on	P, T, M, S	P, T, M, S	S, O, H, I	O, Y, I	C, H, R, O, M, E	F, I, G, U, R, S				
Discussion (P or O or N)	P, P, P	P, P, P	M, M, M	M, M, M	P, P, P	M, M, M				
Concentration	X, X, X	X, X, X	X, X, X	X, X, X	X, X, X	X, X, X				
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	P, P, P	P, P, P	P, P, P	P, P, P	P, P, P	P, P, P				

Observation Group #	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Alex
②

Program Name: FF
 School: Emmus College
 Time: 11 Am
 Date: 3-19-10
 Age Group: Y-9
 Observer: Alex

Observation Group #	Going down # of Students engaged									
	50	45	40	35	30	25	20	15	10	5
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Observation Group #	Going down # of Students engaged									
	50	45	40	35	30	25	20	15	10	5
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Forensic Forensics
 Emms College
 Year 9 3/19/10
 11 AM
 DAP

Dan
 (2)

Students doing
 1 subject

now ahead of forensic
 units

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation											
Minutes into program	12	13	12	12	17	9	9	8			
Eye Contact	13	12	10	9	6	6	7				
Concentration	3	3	4	2	2	1	1				
Boredom	1	1	1/2	0	0	0	0				
Eagerness to Participate (Over Whole Time)	0	0	0	0	0	0	0				
Confusion/Frustration	4	4	4	2	2	3	3				
Physical Distractions	0	0	0	0	0	0	0				
Asking Questions	0	0	0	0	0	0	0				

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation											
Minutes into program	6	10	9								
Eye Contact	6	7	7								
Concentration	1	1	1								
Boredom	1	1	1								
Eagerness to Participate (Over Whole Time)	0	0	0								
Confusion/Frustration	4	4	4								
Physical Distractions	0	0	0								
Asking Questions	0	0	0								

not
 all present

more
 forensic
 unit

about 1/2 half class
 laughs at jokes

Save students thinking
 critically

asked 2
 questions

1

3 dogs
Dad
2

always have one group
that is not interacting
→ hand to group together

talk to
other groups
skull

Program Name: FF
School: Emmaus College
Time: 11 AM
Date: 3/19/10
Age Group: Y-9
Observer: SAU

Observation Group #	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Minutes into program	BSL	BSL	BSL	BSL						
Activity students working on	BSL	BSL	BSL	BSL						
Discussion (P or O or N)	P	P	P	P						
Concentration	X	X	X	X						
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions			X	X						
Read Instructions at Start	X	X	X	X						
Teamwork (P or N)	P	P	P	P						

Observation Group #	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

2

2 boys SRS

Dan Dan

Program Name: FF
 School: Emmus College
 Time: 11 AM
 Date: 3/19/10
 Age Group: Year 9
 Observer: DAN

SRS

Observation Group #	Stamps: Time										Going down # of Students engaged				
	0	5	10	15	20	25	30	35	40	45					
Minutes into program	IA	IA	IA	IA	IA										
Activity students working on	PN	PN	PN	PN	PN										
Discussion (P or O or N)	X	X	X	X	X										
Concentration	X	X	X	X	X										
Enjoyment/Excitement															
Boredom															
Confusion/Frustration															
Physical Distractions															
Read Instructions at Start	X	X	X	X	X										
Teamwork (P or N)	P	P	P	P	P										

Observation Group #	Stamps: Time										Going down # of Students engaged				
	50	55	60	65	70	75	80	85	90	95					
Minutes into program	FTC	FTC	FTC	FTC	FTC										
Activity students working on	PN	PN	PN	PN	PN										
Discussion (P or O or N)	X	X	X	X	X										
Concentration	X	X	X	X	X										
Enjoyment/Excitement															
Boredom															
Confusion/Frustration															
Physical Distractions															
Read Instructions at Start	X	X	X	X	X										
Teamwork (P or N)	P	P	P	P	P										

65 min
65 min
65 min
65 min

SRS

3

3 boys, 18 Dan
2

Program Name: FF
School: Truman College
Time: 11 AM
Date: 3/19/80
Age Group: Year 9
Observer: DAN

play
group
g. v. m. b. s.
GMB
GMB

Observation Group #	Minutes (Checking down # of Students engaged)									
	0	5	10	15	20	25	30	35	40	45
Minutes into program	GLB	GLB	GLB	GLB	GLB					
Activity students working on	PPP	PPP	PPP	PPP	PPP					
Discussion (P or O or N)	PPP	PPP	PPP	PPP	PPP					
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

play group

Observation Group #	Minutes (Checking down # of Students engaged)									
	50	55	60	65	70	75	80	85	90	95
Minutes into program	GMB	GMB	GMB	GMB	GMB					
Activity students working on	PPP	PPP	PPP	PPP	PPP					
Discussion (P or O or N)	PPP	PPP	PPP	PPP	PPP					
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

play group

Date: 3/18/2010

Program: Physics

School: Bayside Christian College

Number of classes: 1

Physics
 Bayville Christian College
 10:00
 18/13
 4/12
 Vadin™

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation											
Minutes into program	3	4	4	4	3	4					
Eye Contact	4	4	4	4	3	3					
Concentration	0	0	0	2	2	1					
Boredom	0	3	4	0	0	0					
Eagerness to Participate (Over Whole Time)	0	0	0	0	0	0					
Confusion/Frustration	0	1	0	0	0	0					
Physical Distractions	0	0	0	0	0	0					
Asking Questions	0	0	0	0	0	1					

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation											
Minutes into program	3	3									
Eye Contact	1	1									
Concentration	0	0									
Boredom	0	0									
Eagerness to Participate (Over Whole Time)	0	0									
Confusion/Frustration	0	0									
Physical Distractions	0	0									
Asking Questions	0	0									

VCE Physics Year 12 students
 Bayshore Christian College 10:00 am
 18/2/2010 Year 12

	Opening Presentation										Closing Presentation									
	0	5	10	15	20	25	30	35	40	0	5	10	15	20	25	30	35	40		
Minutes into program	3	2	4	4	4	4			4	3	2	1	1	1	1	1	1	1		
Eye Contact	2	4	4	4	4				4	3	2	1	1	1	1	1	1	1		
Concentration	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0		
Boredom	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0		
Eagerness to Participate (Over Whole Time)	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0		
Confusion/Frustration	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0		
Physical Distractions	1	0	0	0	1	1			0	0	0	0	0	0	0	0	0	0		
Asking Questions	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0		
Comments											Teacher asking a lot of questions									

	Opening Presentation										Closing Presentation									
	0	5	10	15	20	25	30	35	40	0	5	10	15	20	25	30	35	40		
Minutes into program	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0		
Eye Contact	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0		
Concentration	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0		
Boredom	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0		
Eagerness to Participate (Over Whole Time)	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0		
Confusion/Frustration	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0		
Physical Distractions	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0		
Asking Questions	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0		
Comments																				

3/18/2010
 MFS
 Alex
 (Diao)
 BaySide Christian
 yr. 12

only 4 students in this group.

	Going down # of Students Engaged									
	0	5	10	15	20	25	30	35	40	Comments
Opening Presentation										
Minutes into program	3	4	4	4	4					
Eye Contact	4	4	4	4	4					
Concentration	0	0	0	0	0					
Boredom	2	3	4	1	2	4				
Eagerness to Participate (Over Whole Time)	0	0	0	0	0					
Confusion/Frustration	0	0	0	0	0					
Physical Distractions	0	0	0	0	0					
Asking Questions	0	0	0	0	0					

	Going down # of Students Engaged									
	0	5	10	15	20	25	30	35	40	Comments
Closing Presentation										
Minutes into program	4	3								
Eye Contact	4	4								
Concentration	0	0								
Boredom	0	0								
Eagerness to Participate (Over Whole Time)	0	0								
Confusion/Frustration	0	0								
Physical Distractions	0	0								
Asking Questions	0	0								

Simon brings
 more energy
 than Sara

3/18/10

10 AM

Year 12

Boy's Life Christian
 Mutual + Structures - R & S

Note: 4 male students

Opening Presentation	Going down # of Students Engaged								Comments	
	0	5	10	15	20	25	30	35		40
Minutes into program	///	///	///	///	///	///				
Eye Contact	///	///	///	///	///	///				
Concentration	///	///	///	///	///	///				
Boredom										
Eagerness to Participate (Over Whole Time)	///	///	///	///	///					
Confusion/Frustration										
Physical Distractions	/									
Asking Questions					/					

Closing Presentation	Going down # of Students Engaged								Comments	
	0	5	10	15	20	25	30	35		40
Minutes into program										
Eye Contact		///								
Concentration		/								
Boredom										
Eagerness to Participate (Over Whole Time)	///	///								
Confusion/Frustration	/									
Physical Distractions	///	///								
Asking Questions	/									

Program Name: Physics
 School: BaySide Christian College
 Time: 10:00
 Date: 1/4/13
 Age Group: Y12
 Observer: Vandim

Observation Group # 1	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Minutes into program	SOM I	SOM I	SOM I	SOM I	SOM I	SOM I (2)	SOM I (2)	Heart beat	Heart beat	Heart beat
Activity students working on	PP	MP	MP	MP	MP	MP	MP	PP	PP	PP
Discussion (P or O or N)	VV	VV	VV	VV	VV	VV	VV	VV	VV	VV
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions	V									
Read Instructions at Start	VV									
Teamwork (P or N)	PP	PP	PP	PP	PP	PP	PP	PP	PP	PP

Observation Group # 1	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program	Truss	Truss	Truss	PVC	Compass					
Activity students working on	PP	PP	PP	PP	PP					
Discussion (P or O or N)	VV	VV	VV	VV	VV					
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	VV									
Teamwork (P or N)	PP	PP	PP	PP	PP					

Yes

Program Name: Physics
 School: Bayside Christian College
 Time: 10
 Date: 10/12
 Age Group: 12
 Observer: Vedyn

Observation Group # <u>1</u>	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Minutes into program										
Activity students working on	Bridge									
Discussion (P or O or N)	P	P	P	P	P	P	P	P	P	P
Concentration	V	V	V	V	V	V	V	V	V	V
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions	V				V					
Read Instructions at Start	V				V					
Teamwork (P or N)	P	P	P	P	P	P	P	P	P	P

Observation Group # <u>2</u>	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on	SOM I									
Discussion (P or O or N)	P	P	P	P	P	P	P	P	P	P
Concentration	V	V	V	V	V	V	V	V	V	V
Enjoyment/Excitement	V	V	V	V	V	V	V	V	V	V
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	V									
Teamwork (P or N)	P	P	P	P	P	P	P	P	P	P

Consistency of the questions from instructor
 throughout program do not include

Program Name: Physics

School: Bay State Christian College

Time: 10 am

Date: 3/18/01

Age Group: Varsity

Observer: Don

Personnel

Personnel

ST - (Personnel)

FO - (Personnel)

Personnel

Personnel

Personnel

Personnel

Observation Group #	F O S F O S F O S F O S F O S									
	0	5	10	15	20	25	30	35	40	45
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Observation Group #	F O S F O S F O S F O S F O S									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Wes

Program Name: PHYSICS
 School: Bay State Christian College
 Time: 10 AM
 Date: 3/18/10
 Age Group: Yrs 12
 Observer: Wes

Observation Group #	1	Going down # of Students engaged																		
		50	55	60	65	70	75	80	85	90	95									
Minutes into program																				
Activity students working on																				
Discussion (P or O or N)																				
Concentration																				
Enjoyment/Excitement																				
Boredom																				
Confusion/Frustration																				
Physical Distractions																				
Read Instructions at Start																				
Teamwork (P or N)																				

Observation Group #	2	Going down # of Students engaged																		
		50	55	60	65	70	75	80	85	90	95									
Minutes into program																				
Activity students working on																				
Discussion (P or O or N)																				
Concentration																				
Enjoyment/Excitement																				
Boredom																				
Confusion/Frustration																				
Physical Distractions																				
Read Instructions at Start																				
Teamwork (P or N)																				

Program Name: Phy 105
 School: Eastside Christian
 Time: 10 am
 Date: 3/18/10
 Age Group: 12-year
 Observer: Wes Dittmsh

Observation Group #	Going down # of Students engaged										
	0	5	10	15	20	25	30	35	40	45	
Minutes into program											
Activity students working on	Step 1										
Discussion (P or O or N)	P										
Concentration	/	/	/	/	/	/	/	/	/	/	
Enjoyment/Excitement	/	/	/	/	/	/	/	/	/	/	
Boredom											
Confusion/Frustration											
Physical Distractions											
Read Instructions at Start	/	/	/	/	/	/	/	/	/	/	
Teamwork (P or N)	/	/	/	/	/	/	/	/	/	/	

Observation Group #	Going down # of Students engaged										
	0	5	10	15	20	25	30	35	40	45	
Minutes into program											
Activity students working on	Step 1										
Discussion (P or O or N)	P										
Concentration	/	/	/	/	/	/	/	/	/	/	
Enjoyment/Excitement	/	/	/	/	/	/	/	/	/	/	
Boredom											
Confusion/Frustration											
Physical Distractions											
Read Instructions at Start	/	/	/	/	/	/	/	/	/	/	
Teamwork (P or N)	/	/	/	/	/	/	/	/	/	/	

Program Name: MDS
 School: Bassick University College
 Time: 18:00
 Date: 3/18/2010
 Age Group: 12
 Observer: Alex

2 students

Observation Group #	Going down # of Students engaged									
	5	10	15	20	25	30	35	40	45	
Minutes into program	5	10	15	20	25	30	35	40	45	
Activity students working on	SI	SI	SI	SI	SI	SI	SI	SI	SI	
Discussion (P or O or N)	PP	PP	PP	PP	PP	PP	PP	PP	PP	
Concentration	X	X	X	X	X	X	X	X	X	
Enjoyment/Excitement	X	X	X	X	X	X	X	X	X	
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	X	X	X	X	X	X	X	X	X	
Teamwork (P or N)	PP	PP	PP	PP	PP	PP	PP	PP	PP	

Observation Group #	Going down # of Students engaged									
	5	10	15	20	25	30	35	40	45	
Minutes into program	5	10	15	20	25	30	35	40	45	
Activity students working on	SI	SI	SI	SI	SI	SI	SI	SI	SI	
Discussion (P or O or N)	PP	PP	PP	PP	PP	PP	PP	PP	PP	
Concentration	X	X	X	X	X	X	X	X	X	
Enjoyment/Excitement	X	X	X	X	X	X	X	X	X	
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	X	X	X	X	X	X	X	X	X	
Teamwork (P or N)	PP	PP	PP	PP	PP	PP	PP	PP	PP	

- ONLY 2 students
 - music would improve atmosphere for small groups.

Program Name: MS
 School: Bayside Christian
 Time: 10:40
 Date: 3/18/2010
 Age Group: 12
 Observer: Alex

Observation Group #	Going down # of Students engaged											
	0	5	10	15	20	25	30	35	40	45		
Minutes into program	PM											
Activity students working on	ExLU	TIUSS	TIUSS	TIUSS	SI	SI	SI	SI	TEMP	TEMP	TEMP	TEMP
Discussion (P or O or N)	MM	PP	PP	PP	PP	PP	PP	PP	PP	PP	PP	PP
Concentration	X	X	X	X	X	X	X	X	X	X	X	X
Enjoyment/Excitement	X	X	X	X	X	X	X	X	X	X	X	X
Boredom												
Confusion/Frustration												
Physical Distractions												
Read Instructions at Start	X											
Teamwork (P or N)	PP	PP	PP	PP	PP	PP	PP	PP	PP	PP	PP	PP

Observation Group #	Going down # of Students engaged											
	50	55	60	65	70	75	80	85	90	95		
Minutes into program												
Activity students working on	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI
Discussion (P or O or N)	PP	MM	PP	PP	PP	PP	PP	PP	PP	PP	PP	PP
Concentration	X	X	X	X	X	X	X	X	X	X	X	X
Enjoyment/Excitement	X	X	X	X	X	X	X	X	X	X	X	X
Boredom												
Confusion/Frustration												
Physical Distractions												
Read Instructions at Start	X											
Teamwork (P or N)	PP	PP	PP	PP	PP	PP	PP	PP	PP	PP	PP	PP

Date: 4/13/2010

Program: Physics

School: Bentley

Number of classes: 1

Program Name: Materials + Structures
 School: Beaumont Secondary College
 Time: 12:00 pm
 Date: 7/13/10
 Age Group: 12
 Observer: WES D

Observation Group #	Going down # of Students engaged										
	0	5	10	15	20	25	30	35	40	45	
Minutes into program	6/10/10										
Activity students working on	Toss 1										
Discussion (P or O or N)	P	P	P	P	P	P	P	P	P	P	P
Concentration	/	/	/	/	/	/	/	/	/	/	/
Enjoyment/Excitement	/	/	/	/	/	/	/	/	/	/	/
Boredom											
Confusion/Frustration											
Physical Distractions											
Read Instructions at Start	/	/	/	/	/	/	/	/	/	/	/
Teamwork (P or N)	/	/	/	/	/	/	/	/	/	/	/

Observation Group #	Going down # of Students engaged										
	50	55	60	65	70	75	80	85	90	95	
Minutes into program	6/10/10										
Activity students working on	Toss 2										
Discussion (P or O or N)	P	P	P	P	P	P	P	P	P	P	P
Concentration	/	/	/	/	/	/	/	/	/	/	/
Enjoyment/Excitement	/	/	/	/	/	/	/	/	/	/	/
Boredom											
Confusion/Frustration											
Physical Distractions											
Read Instructions at Start	/	/	/	/	/	/	/	/	/	/	/
Teamwork (P or N)	/	/	/	/	/	/	/	/	/	/	/

4-13-10

12:00 pm

Materials + distractions

MIS

Year 12

Senior Center

4-13-10

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation	4										
Minutes into program											
Eye Contact	4	4	4	4	4	4	4	4	4	4	
Concentration	4	4	4	4	4	4	4	4	4	4	
Boredom											
Eagerness to Participate (Over Whole Time)	4	2		1							
Confusion/Frustration											
Physical Distractions					2						
Asking Questions											

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation											
Minutes into program											
Eye Contact	0										
Concentration	0										
Boredom											
Eagerness to Participate (Over Whole Time)											
Confusion/Frustration											
Physical Distractions											
Asking Questions	2										

No class
Preceded by

Mt. St.
 11:00
 13/14/10
 Y12
 Jedin

Bentley Secondary

	Going down # of Students Engaged									
	0	5	10	15	20	25	30	35	40	Comments
Opening Presentation										
Minutes into program	4	4	4	4	4	4	4	4		
Eye Contact	4	4	4	4	4	4	4	4		
Concentration	4	4	4	4	4	4	4	4		
Boredom	0	0	0	0	0	0	0	0		
Eagerness to Participate (Over Whole Time)	0	1	0	0	0	0	0	0		
Confusion/Frustration	0	0	0	0	0	0	0	0		
Physical Distractions	0	0	0	0	0	0	0	0		
Asking Questions	0	0	0	0	0	0	0	0		

3

	Going down # of Students Engaged									
	0	5	10	15	20	25	30	35	40	Comments
Closing Presentation										
Minutes into program	0	0	0	0	0	0	0	0		
Eye Contact	0	0	0	0	0	0	0	0		
Concentration	0	0	0	0	0	0	0	0		
Boredom	0	0	0	0	0	0	0	0		
Eagerness to Participate (Over Whole Time)	0	0	0	0	0	0	0	0		
Confusion/Frustration	0	0	0	0	0	0	0	0		
Physical Distractions	0	0	0	0	0	0	0	0		
Asking Questions	0	0	0	0	0	0	0	0		

No Closing Presentation Calmest

Program Name: Math Str.
 School: Barkley Secondary
 Time: 11:00
 Date: 13/14/16
 Age Group: Y12
 Observer: Vealim

composites

Observation Group #	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Minutes into program										
Activity students working on	Bridge	Problem	Problem	SOM 2	SOM 2	SOM 2	SOM 1	SOM 2	SOM 2	Halfway
Discussion (P or O or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P
Concentration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enjoyment/Excitement	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Teamwork (P or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P

Observation Group #	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on	Act Book	Tris	Tris	Tris						
Discussion (P or O or N)	P P P	P P P	P P P	P P P						
Concentration	✓	✓	✓	✓						
Enjoyment/Excitement	✓	✓	✓	✓						
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Teamwork (P or N)	P P P	P P P	P P P	P P P						

4/13/2010
 Physics
 Alex
 Bealigh
 11:00am

Sean describes the activities in more detail.

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation											
Minutes into program											
Eye Contact	3	4	3	4	4	4	4				
Concentration	2	2	3	1	4	2	4				
Boredom	1	1	0	1	0	0	0				
Eagerness to Participate (Over Whole Time)	0	1	0	0	0	0	0				
Confusion/Frustration	0	0	0	0	0	0	0				
Physical Distractions	0	1	0	0	0	0	0				
Asking Questions	0	0	0	0	0	0	0				

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation											
Minutes into program											
Eye Contact	4										
Concentration	3										
Boredom	1										
Eagerness to Participate (Over Whole Time)	0										
Confusion/Frustration	0										
Physical Distractions	0										
Asking Questions	0										

~~No closing presentation~~
 very short closing presentation

Program Name: Physics
 School: Beaumont
 Time: 1:00 PM
 Date: 3/13/2010
 Age Group: 12
 Observer: Alker

Observation Group #	Going down # of Students engaged									
	5	10	15	20	25	30	35	40	45	
Minutes into program	5:00	5:10	5:20	5:30	5:40	5:50	6:00	6:10	6:20	
Activity students working on	Stm 2	Stm 2	bridge	bridge	bridge	Plaster	Heart	Heart	Heart	
Discussion (P or O or N)	PPV	PPV	PPV	PPV	PPV	PPV	PPV	PPV	PPV	
Concentration	X	X	X	X	X	X	X	X	X	
Enjoyment/Excitement	X	X	X	X	X	X	X	X	X	
Boredom										
Confusion/Frustration	X									
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	PPV	PPV	PPV	PPV	PPV	PPV	PPV	PPV	PPV	

Observation Group #	Going down # of Students engaged									
	55	60	65	70	75	80	85	90	95	
Minutes into program	6:30	6:40	6:50	7:00	7:10	7:20	7:30	7:40	7:50	
Activity students working on	Stm 1	Stm 1	Stm 1	Stm 1	Stm 1	Stm 1	Stm 1	Stm 1	Stm 1	
Discussion (P or O or N)	PPV	PPV	PPV	PPV	PPV	PPV	PPV	PPV	PPV	
Concentration	X	X	X	X	X	X	X	X	X	
Enjoyment/Excitement	X	X	X	X	X	X	X	X	X	
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	PPV	PPV	PPV	PPV	PPV	PPV	PPV	PPV	PPV	

Program Name: Physics
 School: Bentley
 Time: 10:00
 Date: 4/13/2010
 Age Group: 12
 Observer: Alex

Observation Group #	Going down # of Students engaged									
	5	10	15	20	25	30	35	40	45	
Minutes into program	5	10	15	20	25	30	35	40	45	
Activity students working on	Heat	Heat	STAM I	STAM I	STAM I	Bridge	Bridge	TRAPS	TRAPS	
Discussion (P or O or N)	MN	PP	MN	PP	PP	PP	PP	MN	MN	
Concentration	X	X	X	X	X	X	X	X	X	
Enjoyment/Excitement	X	X	X	X	X	X	X	X	X	
Boredom										
Confusion/Frustration				X						
Physical Distractions										
Read Instructions at Start			X							
Teamwork (P or N)	PP	PP	PP	PP	PP	PP	PP	PP	PP	

Observation Group #	Going down # of Students engaged									
	55	60	65	70	75	80	85	90	95	
Minutes into program	55	60	65	70	75	80	85	90	95	
Activity students working on	TRAPS	STAM I	STAM I							
Discussion (P or O or N)	MN	PP	MN							
Concentration	X	X	X							
Enjoyment/Excitement	X	X	X							
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	PP	PP	PP							

Bentleigh Secondary College ~~Pre VCE~~ VCE Physics

12 pm

Dem

150%

13/4/2018

*sly, respectful
p 17 10th*

Opening Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	1	3	4	4	4	3	3				
Eye Contact	4	3	4	4	4	3	2				
Concentration	0	2	0	0	0	0	0				
Boredom	2	0	0	0	0	0	0				
Eagerness to Participate (Over Whole Time)	1	0	0	0	0	0	0				
Confusion/Frustration	1	0	0	0	0	1	0				
Physical Distractions	0	0	0	0	0	1	1				
Asking Questions	0	0	0	0	0	0	0				

Closing Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	0										
Eye Contact											
Concentration											
Boredom											
Eagerness to Participate (Over Whole Time)											
Confusion/Frustration											
Physical Distractions											
Asking Questions											

Date: 3/17/2010

Program: Physics

School: Mt. Eliza

Number of classes: 1

PKY 5025
 3/10/00
 10 min
 Monday E12a
 12 min year
 11/05/00

See Can 6/6/00

Program Observation Group 1	Going down # of Students engaged									
	0	10	20	30	40	50	60	70	80	90
Minutes into program	H.T.	H.T.	at 20	SPR 2	Strike	Tough	Strag 1	Step 1	Truss 2	
Activity students working on	P	P	P	P	P	P	P	P	P	P
Discussion (P or O or N)	P	P	P	P	P	P	P	P	P	P
Concentration	/	/	/	/	/	/	/	/	/	/
Enjoyment/Excitement	/	/	/	/	/	/	/	/	/	/
Boredom	/	/	/	/	/	/	/	/	/	/
Confusion/Frustration	/	/	/	/	/	/	/	/	/	/
Physical Distractions	/	/	/	/	/	/	/	/	/	/
Read Instructions at Start	/	/	/	/	/	/	/	/	/	/
Teamwork (P or N)	/	/	/	/	/	/	/	/	/	/

Self Note

Program Observation Group 2	Going down # of Students engaged									
	0	10	20	30	40	50	60	70	80	90
Minutes into program	Back	Back	Strut 1	Strike 1	Read Tr	Truss 2	Truss 2	H.T.	Strag 2	
Activity students working on	P	P	P	P	P	P	P	P	P	P
Discussion (P or O or N)	P	P	P	P	P	P	P	P	P	P
Concentration	/	/	/	/	/	/	/	/	/	/
Enjoyment/Excitement	/	/	/	/	/	/	/	/	/	/
Boredom	/	/	/	/	/	/	/	/	/	/
Confusion/Frustration	/	/	/	/	/	/	/	/	/	/
Physical Distractions	/	/	/	/	/	/	/	/	/	/
Read Instructions at Start	/	/	/	/	/	/	/	/	/	/
Teamwork (P or N)	/	/	/	/	/	/	/	/	/	/

Program : Physics
 Date/Time : 3/17/10 - 10am
 School : Mount Eliza
 Age : 12th Year
 Collector : Wes Dittford

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation											
Minutes into program											
Eye Contact	III	4	III	III	III	III	III	III	III	III	
Concentration	III	2	III	II	II	II	II	II	II	II	
Boredom											
Eagerness to Participate (Over Whole Time)	II	III	III	III	III	III	III	III	III	III	
Confusion/Frustration											
Physical Distractions											
Asking Questions											

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation											
Minutes into program											
Eye Contact	7										
Concentration	6										
Boredom											
Eagerness to Participate (Over Whole Time)	3										
Confusion/Frustration											
Physical Distractions											
Asking Questions											

Name: Physics

Program:

Date/Time: 1/13 10:00

School: Mt. Elm

Observer: Vadim

5 weeks

Opening Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	5	5	5	4	4	5					One kid never really regained eye contact until end
Eye Contact	5	5	5	3	4	5					
Concentration	0	0	2	2	3	3					
Boredom	0	3	2	1	0	0					
Eagerness to Participate (Over Whole Time)	0	1	1	1	0	0					
Confusion/Frustration	0	0	1	1	1	1					
Physical Distractions	0	0	0	0	0	0					
Asking Questions	0	0	0	0	0	0					

Closing Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	4	3									
Eye Contact	4	3									
Concentration	0	1									
Boredom	0	1									
Eagerness to Participate (Over Whole Time)	0	1									
Confusion/Frustration	0	1									
Physical Distractions	0	0									
Asking Questions	0	0									

✓8

Abba

Name: Physics
 Date/Time: 1/13 10:00
 School: Mt. Elizabeth
 Observer: Victoria

HYDROTRUSS

Instructions given by instructor

Pushing to finish early

last 10min

STH 6

Program Observation Group 1	Going down # of Students engaged									
	0	10	20	30	40	50	60	70	80	90
Minutes into program										
Activity students working on										
Discussion (P or O or N)	P	N	N	N	N	N	N	N	N	N
Concentration	V	V	V	V	V	V	V	V	V	V
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	V	V	V	V	V	V	V	V	V	V
Teamwork (P or N)	P	P	P	P	P	P	P	P	P	P
Program Observation Group 2										
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Program Observation Group 1	Going down # of Students engaged									
	0	10	20	30	40	50	60	70	80	90
Minutes into program										
Activity students working on										
Discussion (P or O or N)	P	N	N	N	N	N	N	N	N	N
Concentration	V	V	V	V	V	V	V	V	V	V
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	V	V	V	V	V	V	V	V	V	V
Teamwork (P or N)	P	P	P	P	P	P	P	P	P	P

Program Observation Group 2	Going down # of Students engaged									
	0	10	20	30	40	50	60	70	80	90
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Small Br. edge = Truss

Group took lots of time on truss

Students only kind of read PUC impact needs

Saw unhappy girl smiling when CS110 instructor gave her micrometer

Abba

Program: Physics
 Date/Time: 3/17/10 12:00 AM
 Collector: Alex
 School: Mt. Zion

Opening Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	4	4	4	4	4	4					
Eye Contact	4	4	4	4	4	4					
Concentration	4	4	4	4	4	4					
Boredom	0	0	0	0	0	0					
Eagerness to Participate (Over Whole Time)	3	2	0	3	1	0					Few Q's, just straight-ants.
Confusion/Frustration	0	0	0	0	0	0					
Physical Distractions	0	0	1	0	0	0					
Asking Questions	0	0	0	0	0	0					

Few questions asked by presenter, moving around the room seems good

Closing Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	4	4									
Eye Contact	4	4									
Concentration	3	4									
Boredom	1	0									
Eagerness to Participate (Over Whole Time)	0	0									
Confusion/Frustration	0	0									
Physical Distractions	0	0									
Asking Questions	0	0									

Program: Physics
 Date/Time: 3/07 10:00
 Teacher: Mrs. [unclear]
 School: Mt. Eisenhower

Teacher did most at start
 → difficult to tell Reading instructions
 Language barrier, needed help understanding.
 could have gone over instructions at start

Program Observation Group 1	Going down # of Students engaged									
	0	10	20	30	40	50	60	70	80	90
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Program Observation Group 2	Going down # of Students engaged									
	0	10	20	30	40	50	60	70	80	90
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

→ Missed (ampas) (plc of 10 min interval)
 → Change to every 5 minutes

3/17/10

10:00

mt-eliza

Physics

DA

OR frustrated
 Public eng
 associated
 kills class
 by grader
 over 200
 over 200
 other grader
 head exhibit
 1 grader
 1 grader

Program Observation Group 1	Going down # of Students engaged											
	0	10	20	30	40	50	60	70	80	90		
Minutes into program												
Activity students working on												
Discussion (P or O or N)	X	P	P	P	P	P	P	P	P	P	P	P
Concentration	X	X	X	X	X	X	X	X	X	X	X	X
Enjoyment/Excitement	X	X	X	X	X	X	X	X	X	X	X	X
Boredom												
Confusion/Frustration												
Physical Distractions												
Read Instructions at Start	X	X	X	X	X	X	X	X	X	X	X	X
Teamwork (P or N)	X	X	X	X	X	X	X	X	X	X	X	X

Program Observation Group 2	Going down # of Students engaged											
	0	10	20	30	40	50	60	70	80	90		
Minutes into program												
Activity students working on												
Discussion (P or O or N)												
Concentration												
Enjoyment/Excitement												
Boredom												
Confusion/Frustration												
Physical Distractions												
Read Instructions at Start												
Teamwork (P or N)												

Date: 17/3/2010
 Time: 10am
 School: mt Elizabeth
 Program: M&S
 Observer: Don

19 total

Interested students
 ↳ demonstrate understanding of topic / theoretical students
 ↳ 4 did
 ↳ other not participate

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation	0	5	10	15	20	25	30	35	40		
Minutes into program	5	4	5	5	4	5					
Eye Contact	5	4	5	5	4	5					
Concentration	0	1	1	1	1	0					
Boredom	0	0	1	1	1	0					
Eagerness to Participate (Over Whole Time)	0	0	0	0	0	0					
Confusion/Frustration	0	0	0	0	0	0					
Physical Distractions	0	1	0	0	0	0					
Asking Questions	0	0	0	0	0	0					

one had
 period
 A/D hand
 who's hand
 who's
 assigning

falling asleep / off presenter
 10min - 15min not here present
 delirious / distracted

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation	0	5	10	15	20	25	30	35	40		
Minutes into program	4	4									
Eye Contact	4	4									
Concentration	0	0									
Boredom	0	0									
Eagerness to Participate (Over Whole Time)	0	0									
Confusion/Frustration	0	0									
Physical Distractions	0	0									
Asking Questions	0	0									

Nano Tech

St A

1 Class

3/25/2010

②

Wed 11/10/10
 11:00 AM
 Mrs. [unclear]
 4

50 4

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation	9 x 4										
Minutes into program	6	9	8	9	9	7					
Eye Contact	3	4	4	4	5	2					
Concentration	2	2	4	2	1	3					
Boredom											
Eagerness to Participate (Over Whole Time)			2	1							
Confusion/Frustration											
Physical Distractions	2	2									
Asking Questions											

50 92

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation	9 x 4										
Minutes into program	3	8	9								
Eye Contact	2	0	8								
Concentration											
Boredom			2								
Eagerness to Participate (Over Whole Time)			4								
Confusion/Frustration											
Physical Distractions	3	1									
Asking Questions											

92/100
 92/100
 Question

2

Session 2

3/24/2010

St. A
 Nana
 11:00
 Dan

infractis

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation											
Minutes into program											
Eye Contact	8	9	8	8	9	9					
Concentration	8	8	7	5	9	9					
Boredom	0	0	1	1	0	0					
Eagerness to Participate (Over Whole Time)	4	4	0	0	0	0					
Confusion/Frustration	0	0	0	0	0	0					
Physical Distractions	0	1	0	0	0	0					
Asking Questions	0	0	0	0	0	0					
Excitement	2	2	2	2	2	2					

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation											
Minutes into program											
Eye Contact	2	2	6								
Concentration	4	4	3								
Boredom	0	1	0								
Eagerness to Participate (Over Whole Time)	4	4	0								
Confusion/Frustration	0	0	0								
Physical Distractions	0	0	0								
Asking Questions	0	0	0								
Excitement	0	1	3								

up 1 3
 good job for the program
 down

2/24/2020
 W:00
 Nono
 Gtr Alex's 10:45
 Alex

2
 - Few questions asked
 by presenter.

Opening Presentation	Going down # of Students Engaged									
	0	5	10	15	20	25	30	35	40	Comments
Minutes into program	0	8	8	5	8	6				
Eye Contact	0	8	8	5	8	6				
Concentration	0	8	8	5	8	6				
Boredom	0	1	1	1	1	2				
Eagerness to Participate (Over Whole Time)	0	1	1	1	1	1				
Confusion/Frustration	3	1	0	0	1	0				
Physical Distractions	0	0	0	0	0	0				
Asking Questions	0	0	0	0	0	1				
excited	0	0	0	0	0	0				

Closing Presentation	Going down # of Students Engaged									
	0	5	10	15	20	25	30	35	40	Comments
Minutes into program	0	1	1	1	1					
Eye Contact	1	1	1	1	1					
Concentration	7	3	2							
Boredom	0	6								
Eagerness to Participate (Over Whole Time)	1	1								
Confusion/Frustration	0	0	0							
Physical Distractions	0	0	0							
Asking Questions	0	0	0							

(2)

Program Name: MA10
 School: St. A.
 Time: 11:00
 Date: 7/24
 Age Group: 10
 Observer: DAN

SN: (14)
 BW: BW

confused about bottle

getting out of bottle
 pushing
 BW

Observation Group #	Going down # of Students engaged														
	0	5	10	15	20	25	30	35	40	45					
Minutes into program															
Activity students working on															
Discussion (P or O or N)	O	N	P	P	P	P	P	P	P	P	P	P	P	P	P
Concentration	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Enjoyment/Excitement															
Boredom															
Confusion/Frustration															
Physical Distractions															
Read Instructions at Start	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Teamwork (P or N)	N	P	P	N	P	P	P	P	P	P	P	P	P	P	P

Observation Group #	Going down # of Students engaged														
	50	55	60	65	70	75	80	85	90	95					
Minutes into program															
Activity students working on															
Discussion (P or O or N)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Concentration	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Enjoyment/Excitement															
Boredom															
Confusion/Frustration															
Physical Distractions															
Read Instructions at Start	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Teamwork (P or N)	P	P	P	N	P	P	P	P	P	P	P	P	P	P	P

waiting
 close proximity
 background
 BW

(3)

2

Program Name: Nano
 School: St. A
 Time: 11:04
 Date: 3/24
 Age Group: 1B
 Observer: Dan

not working
 a technology 7
 not working
 a technology 7
 not working
 a technology 7

Observation Group #	SN	SU	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN
Minutes into program	0	5	10	15	20	25	30	35	40	45							
Activity students working on	SN	no activity	no activity	CP	CD	CD	scale										
Discussion (P or O or N)	P N	O O	O P	O N	O N	O N	P N										
Concentration	X N		X X	X	X		X										
Enjoyment/Excitement																	
Boredom																	
Confusion/Frustration																	
Physical Distractions		X P	X	X	X	X											
Read Instructions at Start	X X																
Teamwork (P or N)	P P			N N	N X	N N	P P										

Observation Group #	SN	SU	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN
Minutes into program	50	55	60	65	70	75	80	85	90	95							
Activity students working on																	
Discussion (P or O or N)																	
Concentration																	
Enjoyment/Excitement																	
Boredom																	
Confusion/Frustration																	
Physical Distractions																	
Read Instructions at Start																	
Teamwork (P or N)																	

3

Program Name: NANO
 School: ST. ALI
 Time: 11:00
 Date: 3/24
 Age Group: CP
 Observer: AKA

Observation Group #	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Minutes into program	0	5	10	15	20	25	30	35	40	45
Activity students working on	FUTO	Fabrics	Fabrics	Counting	Counting	Counting	FUV			
Discussion (P or O or N)	NVN	PPP	PPP	PPP	PPP	PPP	PPP			
Concentration	XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Enjoyment/Excitement		XXX	XXX	XXX	XXX	XXX	XXX			
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start		XXX								
Teamwork (P or N)	PPP	PPP	PPP	PPP	PPP	PPP	PPP			

Observation Group #	Going down # of Students engaged									
	0	5	60	65	70	75	80	85	90	95
Minutes into program	0	5	60	65	70	75	80	85	90	95
Activity students working on	UV	Counting	Counting	Counting	Counting	Counting	Counting			
Discussion (P or O or N)	PPP	PPP	PPP	PPP	PPP	PPP	PPP			
Concentration	XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Enjoyment/Excitement	XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	PPP	PPP	PPP	PPP	PPP	PPP	PPP			

2

teacher did
H. for them

Program Name: ST-1A
 School: 1140
 Time: 3:24
 Date: 10
 Age Group: 10
 Observer: APK

Observation Group #	Going down # of Students engaged									
	5	10	15	20	25	30	35	40	45	
Minutes into program	5	10	15	20	25	30	35	40	45	
Activity students working on	U V	Ferro	Ferro	Habes	Ferro	Ferro				
Discussion (P or O or N)	P P P	P P P	P P P	M M M	O O M	P P P				
Concentration	X X X	X X X	X X X	X X X		X X X				
Enjoyment/Excitement	X X X									
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	P P P	P P P	P P P	M N M	M N M	P P P				

Observation Group #	Going down # of Students engaged									
	55	60	65	70	75	80	85	90	95	
Minutes into program	55	60	65	70	75	80	85	90	95	
Activity students working on	Ferro	Gold	Gold	Ferro	Ferro	Ferro				
Discussion (P or O or N)	P P	P P	M	P P	P P	P P				
Concentration	X X	X X	X X	X X	X X	X X				
Enjoyment/Excitement	X X									
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	P P	P P	P P	P P	P P	P P				

2

Program Name: New Tech
 School: Sb. A
 Time: 11:30
 Date: 3/24/2010
 Age Group: 10-12
 Observer: Des. D. Strach

Observation Group #	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Minutes into program										
Activity students working on										
Discussion (P or O or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P
Concentration	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /
Enjoyment/Excitement	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /
Teamwork (P or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P

Observation Group #	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on										
Discussion (P or O or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P
Concentration	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /
Enjoyment/Excitement	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /	/ / /
Teamwork (P or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P

2

Program Name: Navo Tech
 School: SEA
 Time: 11:00 am
 Date: 3/24/010
 Age Group: 10 year
 Observer: Wes Dittrol

Observation Group #	Going down # of Students engaged										
	0	5	10	15	20	25	30	35	40	45	
Minutes into program											
Activity students working on											
Discussion (P or O or N)	P	P	P	P	P	P	P				
Concentration	/	/	/	/	/	/	/				
Enjoyment/Excitement	/	/	/	/	/	/	/				
Boredom											
Confusion/Frustration											
Physical Distractions											
Read Instructions at Start											
Teamwork (P or N)	P	P	P	P	P	P	P				

Observation Group #	Going down # of Students engaged										
	50	55	60	65	70	75	80	85	90	95	
Minutes into program											
Activity students working on											
Discussion (P or O or N)											
Concentration											
Enjoyment/Excitement											
Boredom											
Confusion/Frustration											
Physical Distractions											
Read Instructions at Start											
Teamwork (P or N)											

Nano
 St. Albans
 11:00
 2573
 4/20
 Vacuum

Distractions
 Basin

	Going down # of Students Engaged										Comments	
	0	5	10	15	20	25	30	35	40			
Opening Presentation												
Minutes into program												
Eye Contact	3	2	4	3	3	4	3					
Concentration	3	2	2	2	2	4	2					
Boredom	1	2	2	2	2	2	2					
Eagerness to Participate (Over Whole Time)	0	1	1	1	0	0	0					
Confusion/Frustration	0	0	0	0	1	1	2					
Physical Distractions	1	1	1	3	0	1	2					
Asking Questions	0	0	0	0	0	0	0					

	Going down # of Students Engaged										Comments	
	0	5	10	15	20	25	30	35	40			
Closing Presentation												
Minutes into program												
Eye Contact	1	1	3									
Concentration	1	1	3									
Boredom	1	2	1									
Eagerness to Participate (Over Whole Time)	0	1	0									
Confusion/Frustration	0	2	1									
Physical Distractions	0	3	1									
Asking Questions	0	0	0									

right after
 shirt demo

Wesley Dittrock
 3/25/10
 11:00 am
 SE. Aloysius
 Jane Hook
 Year 10

2

Opening Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program											
Eye Contact	4	4	4	4	4	4	3				
Concentration	2	3	4	3	2						
Boredom											
Eagerness to Participate (Over Whole Time)	2	3	3	2							
Confusion/Frustration											
Physical Distractions					1						
Asking Questions							1				

Closing Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program											
Eye Contact	2	3	3								
Concentration											
Boredom											
Eagerness to Participate (Over Whole Time)	1	2	2								
Confusion/Frustration											
Physical Distractions	1	1									
Asking Questions											

3/25/2010

NAME
ST-A

11:00

yr. 10

Flex

Group is Silent
→ even during Ferris fluid

(2)

Opening Presentation	Going down # of Students Engaged								Comments
	0	5	10	15	20	25	30	35	
Minutes into program	5	4	4	4	5	5	5		
Eye Contact	3	2	4	4	3	4	3		
Concentration	0	1	0	2	1	0	0		
Boredom	0	0	0	0	0	0	0		
Eagerness to Participate (Over Whole Time)	0	0	0	0	0	0	0		
Confusion/Frustration	0	0	0	0	0	0	0		
Physical Distractions	0	0	0	2	0	0	0		
Asking Questions	0	0	0	0	0	0	0		

Closing Presentation	Going down # of Students Engaged								Comments
	0	5	10	15	20	25	30	35	
Minutes into program	3	2	4						
Eye Contact	3	4	4						
Concentration	1	0	0						
Boredom	0	0	0						
Eagerness to Participate (Over Whole Time)	0	0	0						
Confusion/Frustration	0	0	0						
Physical Distractions	0	0	0						
Asking Questions	0	0	0						

1049 ↓ students

2

Program Name: Nano Tech
 School: St Albans
 Time: 11:00 AM
 Date: 3/25/06
 Age Group: 10 year
 Observer: Kathy Dittus

Observation Group # <u>1</u>	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Minutes into program										
Activity students working on	<u>Mr Clay</u>		<u>Lab</u>	<u>Liquid</u>	<u>Clay</u>		<u>Gold</u>			
Discussion (P or O or N)	P P	P P	P P	O O	P P	P P	P P	P P		
Concentration	/	/	/	/	/	/	/	/	/	/
Enjoyment/Excitement	/	/	/	/	/	/	/	/	/	/
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	/	/	/	/	/	/	/	/	/	/
Teamwork (P or N)	P P	P P	P P	P P	P P	P P	P P	P P	P P	P P

Observation Group # <u>2</u>	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on	<u>Mr Clay</u>		<u>Spindle</u>	<u>Carbon</u>	<u>Clay</u>	<u>Fabric</u>	<u>UV</u>	<u>Gold</u>		
Discussion (P or O or N)	P P	P P	P P	P P	P P	P P	P P	P P		
Concentration	/	/	/	/	/	/	/	/	/	/
Enjoyment/Excitement	/	/	/	/	/	/	/	/	/	/
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	/	/	/	/	/	/	/	/	/	/
Teamwork (P or N)	P P	P P	P P	P P	P P	P P	P P	P P	P P	P P

② - students still quiet
 - not showing much excitement

Program Name: Nano
 School: St. A.
 Time: 9:20-11:00
 Date: 3/25
 Age Group: 10
 Observer: Alex

→ split 9 split

Observation Group #	Going down # of Students engaged									
	10	15	20	25	30	35	40	45		
Minutes into program	10:00	10:05	10:10	10:15	10:20	10:25	10:30	10:35	10:40	10:45
Activity students working on	UV	UV	UV	UV	UV	UV	UV	UV	UV	UV
Discussion (P or O or N)	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP
Concentration	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP

Observation Group #	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program	50:00	50:05	50:10	50:15	50:20	50:25	50:30	50:35	50:40	50:45
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										



Program Name: Novo
 School: St. Anns 2005
 Time: 11:00
 Date: 2/13
 Age Group: Y10
 Observer: UJM

Wes - Physical
 Distraction

Observation Group # 1	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Minutes into program	Fabric	Singing	Prayer	Conf. Hugs	Conf. Hugs	Carbon	Humor			
Activity students working on	PP	PP	PP	PP	PP	PP	PP	CD		
Discussion (P or O or N)	V	V	V	V	V	V	V	V		
Concentration	V	V	V	V	V	V	V	V		
Enjoyment/Excitement	V	V	V	V	V	V	V	V		
Boredom										
Confusion/Frustration										
Physical Distractions	V									
Read Instructions at Start	V									
Teamwork (P or N)	PP	PP	PP	PP	PP	PP	PP	PP		

Observation Group # 2	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program	GOLA	GOLA	Lord	Prayer	UV Light	UV Light	Strength	Conf. res		
Activity students working on	PP	PP	PP	PP	PP	PP	PP	N		
Discussion (P or O or N)	V	V	V	V	V	V	V	V		
Concentration	V	V	V	V	V	V	V	V		
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	V									
Teamwork (P or N)	PP	PP	PP	PP	PP	PP	PP	PP		

1
giri disappeared

1
Fabric

3/24/2010

9:00

St. A

Wesley Pittman

Nono deck

DS

	Going down # of Students Engaged										Comments	
	0	5	10	15	20	25	30	35	40			
Opening Presentation												
Minutes into program												
Eye Contact	1	10	9	9	9	4	10	1				
Concentration		5	2	6	4	3						
Boredom					2	1	2					
Eagerness to Participate (Over Whole Time)			3	2	3							
Confusion/Frustration												
Physical Distractions		2										
Asking Questions												

	Going down # of Students Engaged										Comments	
	0	5	10	15	20	25	30	35	40			
Closing Presentation												
Minutes into program												
Eye Contact	7	10										
Concentration	6	5										
Boredom												
Eagerness to Participate (Over Whole Time)			1									
Confusion/Frustration												
Physical Distractions		1	1									
Asking Questions												

3/24/2010
 St. Aloysians
 Nana

- Just

- Visual was good.
 - Fero Snid was a bit

- Few questions from
 presenter = ↓ participation
 than

9:00
 Alex
 year 10

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation	8	8	6	6	4	4	8	8	7		
Minutes into program	8	8	6	6	4	4	8	8	7		
Eye Contact	6	6	6	6	4	4	8	8	7		
Concentration	6	6	6	6	4	4	8	8	7		
Boredom	0	0	0	0	0	0	0	0	0		
Eagerness to Participate (Over Whole Time)	4	0	0	0	0	0	0	0	0		
Confusion/Frustration	0	0	0	0	0	0	0	0	0		
Physical Distractions	0	0	0	0	0	0	0	0	0		
Asking Questions	0	0	0	0	0	0	0	0	0		

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation	7	6	8								
Minutes into program	7	6	8								
Eye Contact	5	4	8								
Concentration	5	4	8								
Boredom	1	1	0								
Eagerness to Participate (Over Whole Time)	3	0	0								
Confusion/Frustration	0	0	0								
Physical Distractions	0	0	0								
Asking Questions	0	0	0								

↓ engaged putting water in packets

①

Nano
St. A
9:00
3/24
Dan

quiet and respectful
→ Several P.s. enjoyed the formal demonstration
↳ many O.H.s and d.s.
→ Formal demonstration very useful

Start with 9:00 and feedback

ff. phone instructions

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation											
Minutes into program	9	9	10	9	9	9	9				
Eye Contact	8	8	10	9	7	9	8				
Concentration	0	1	0	0	0	1	0				
Boredom	2	0	0	0	0	0	0				
Eagerness to Participate (Over Whole Time)	0	1	0	0	0	0	0				
Confusion/Frustration	1	1	0	0	1	0	0				
Physical Distractions	0	0	0	0	0	0	0				
Asking Questions											

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation											
Minutes into program	5	5	10	9							
Eye Contact	7	6	9								
Concentration	0	1	0								
Boredom	3	1	0								
Eagerness to Participate (Over Whole Time)	0	1	0								
Confusion/Frustration	1	2	0								
Physical Distractions	0	0	0								
Asking Questions											

Program Name: Nano
 School: St. A
 Time: 4:02
 Date: 7/24
 Age Group: 10
 Observer: Dan

Observation Group #	Per Going down # of Students engaged										
	0	5	10	15	20	25	30	35	40	45	
Minutes into program											
Activity students working on	Ferrous	Memo Cloth	Fun memo	Debra	Memo 5-8	Ang Conrad	Cardinal				
Discussion (P or O or N)	P	N	N	N	N	P	N				
Concentration	X	X	X	X	X	X	X				
Enjoyment/Excitement	X	X	X	X	X	X	X				
Boredom											
Confusion/Frustration											
Physical Distractions		X			X						
Read Instructions at Start	X										
Teamwork (P or N)	P	N	P	P	N	P	P				

Observation Group #	Per Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on	Bottle	Bottle	Fun memo	Memo Cloth	Memo Cloth	Memo Cloth	Memo Cloth			
Discussion (P or O or N)	P	P	P	N	P	N	P			
Concentration	X	X	X	X	X	X	X			
Enjoyment/Excitement	X	X	X	X	X	X	X			
Boredom										
Confusion/Frustration										
Physical Distractions	X									
Read Instructions at Start	X									
Teamwork (P or N)	P	P	P	N	P	P	P			

9
 2000
 from
 transfer



Program Name: MANO
 School: St-A
 Time: 9:20
 Date: 3/24
 Age Group: 10
 Observer: ATCK

Observation Group #	Going down # of Students engaged									
	5	15	20	25	30	35	40	45		
Minutes into program	CD	CD	Fabric	Fabric	Fabric					
Activity students working on	CD	CD	Fabric	Fabric	Fabric					
Discussion (P or O or N)	PPP	PPP	PPP	PPP	PPP					
Concentration	XXX	XXX	XXX	XXX	XXX					
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	PPP	PPP	PPP	PPP	PPP					

Observation Group #	Going down # of Students engaged									
	55	60	65	70	75	80	85	90	95	
Minutes into program	CD	CD	Fabric	Fabric	Fabric					
Activity students working on	CD	CD	Fabric	Fabric	Fabric					
Discussion (P or O or N)	PPP	PPP	PPP	PPP	PPP					
Concentration	XXX	XXX	XXX	XXX	XXX					
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	PPP	PPP	PPP	PPP	PPP					

①

Program Name: NANO
 School: St. V.
 Time: 9:00
 Date: 3/24
 Age Group: 10
 Observer: ALEX

[Handwritten signature]
[Handwritten signature]

Observation Group #	Going down # of Students engaged									
	5	10	15	20	30	35	40	45		
Minutes into program	5:00	5:30	6:00	6:30	7:00	7:30	8:00	8:30	9:00	
Activity students working on	Math Facts	Math Facts	Math Facts	Math Facts	Math Facts	Math Facts	Math Facts	Math Facts	Math Facts	
Discussion (P or O or N)	P	P	P	P	P	P	P	P	P	
Concentration	X	X	X	X	X	X	X	X	X	
Enjoyment/Excitement	X	X	X	X	X	X	X	X	X	
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	P	P	P	P	P	P	P	P	P	

Observation Group #	Going down # of Students engaged									
	55	60	65	70	75	80	85	90	95	
Minutes into program	4:50	5:00	5:10	5:20	5:30	5:40	5:50	6:00	6:10	
Activity students working on	Math Facts	Math Facts	Math Facts	Math Facts	Math Facts	Math Facts	Math Facts	Math Facts	Math Facts	
Discussion (P or O or N)	P	P	P	P	P	P	P	P	P	
Concentration	X	X	X	X	X	X	X	X	X	
Enjoyment/Excitement	X	X	X	X	X	X	X	X	X	
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)	P	P	P	P	P	P	P	P	P	



Program Name: Nano Tech
 School: St. A
 Time: 9:00 am
 Date: 3/24/2010
 Age Group: 10
 Observer: Mrs. D. Herlihy

Observation Group # / <u>1</u>	Going down # of Students engaged											
	0	5	10	15	20	25	30	35	40	45		
Minutes into program												
Activity students working on												
Discussion (P or O or N)	P	P	P	P	N	P	P					
Concentration	/	/	/	/	/	/	/					
Enjoyment/Excitement	/	/	/	/	/	/	/					
Boredom												
Confusion/Frustration												
Physical Distractions												
Read Instructions at Start												
Teamwork (P or N)	P	P	P	P		P	P					

Observation Group # <u>2</u>	Going down # of Students engaged										
	50	55	60	65	70	75	80	85	90	95	
Minutes into program											
Activity students working on											
Discussion (P or O or N)	P	N	P	P	P	P	P				
Concentration	/	/	/	/	/	/	/				
Enjoyment/Excitement	/	/	/	/	/	/	/				
Boredom											
Confusion/Frustration											
Physical Distractions											
Read Instructions at Start	/										
Teamwork (P or N)	P	P	P	P	P	P	P				



Program Name: Head Tech
 School: St. A
 Time: 9:50am
 Date: 3/24/10
 Age Group: 10
 Observer: Mrs. D. Frank

Minutes into program	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Activity students working on	Discussion (P or O or N)									
Discussion (P or O or N)	P P P	P P P	M O O	P P P	P P P	M M M	O O O			
Concentration	/	/	/	/	/	/	/	/	/	/
Enjoyment/Excitement	/	/	/	/	/	/	/	/	/	/
Boredom										
Confusion/Frustration										
Physical Distractions			/	/	/	/	/	/	/	/
Read Instructions at Start	/	/	/	/	/	/	/	/	/	/
Teamwork (P or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P

Minutes into program	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Activity students working on	Discussion (P or O or N)									
Discussion (P or O or N)	P P P	P P P	M M M	M M M	M M M	M M M	M M M	M M M	M M M	M M M
Concentration	/	/	/	/	/	/	/	/	/	/
Enjoyment/Excitement	/	/	/	/	/	/	/	/	/	/
Boredom										
Confusion/Frustration										
Physical Distractions			/	/	/	/	/	/	/	/
Read Instructions at Start	/	/	/	/	/	/	/	/	/	/
Teamwork (P or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P

Nano

Program Name: ST-A
 School: 8:00
 Time: 3/24
 Date: 10
 Age Group: 2yrs
 Observer: Dan

already completed
 ↑ new child
 BW BW BW BW BW

Observation Group #	Going down # of Students engaged									
	0	5	10	15	20	25	30	35	40	45
Minutes into program										
Activity students working on	Music/Story	program	program	UV	UV	UV	UV	UV	UV	UV
Discussion (P or O or N)	P	N	P	P	P	P	P	P	P	P
Concentration	X	X	X	X	X	X	X	X	X	X
Enjoyment/Excitement	X	X	X	X	X	X	X	X	X	X
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start	X									
Teamwork (P or N)	P	N	P	P	P	P	P	P	P	P

Observation Group #	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on										
Discussion (P or O or N)										
Concentration										
Enjoyment/Excitement										
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start										
Teamwork (P or N)										

Session 1
25/3/2010

Why did you book this program?
 → wants to understand concentration
 → can explain it to them → doesn't like
 → experiments → materials make
 sense more than just explaining it

How often a name limit
 is relevant to explain what name is

Students not
 necessarily excited for
 face first demo

	Instructions										Going down # of Students Engaged				Comments
	0	5	10	15	20	25	30	35	40						
Opening Presentation															
Minutes into program															
Eye Contact	5	5	6	4	6	6	6								
Concentration	4	4	5	2	4	5	5								
Boredom	0	2	0	0	0	0	1								
Eagerness to Participate (Over Whole Time)	1	0	0	0	0	0	0								
Confusion/Frustration	0	0	0	0	0	0	0								
Physical Distractions	0	1	0	3	2	1	0								
Asking Questions	0	0	2	0	0	0	0								
Experiment	2	0	0	0	0	0	0								

	Instructions										Going down # of Students Engaged				Comments
	0	5	10	15	20	25	30	35	40						
Closing Presentation															
Minutes into program															
Eye Contact	2	6													
Concentration	1	5													
Boredom	1	1													
Eagerness to Participate (Over Whole Time)	1	0													
Confusion/Frustration	0	0													
Physical Distractions	0	1	0												
Asking Questions	0	0													

Students
 still working
 on booklets

Pone entering / Udlin

Nono
 St. A
 3/25
 9:00
 Alex

Tough crowd.

done

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Opening Presentation											
Minutes into program	6	5	6	4	6	5	6				
Eye Contact	4	1	4	1	4	1	4				
Concentration	1	3	1	3	1	3	2				
Boredom	3	0	0	0	0	0	0				
Eagerness to Participate (Over Whole Time)	0	0	0	0	0	0	0				
Confusion/Frustration	0	0	0	0	0	0	0				
Physical Distractions	0	0	0	0	0	0	0				
Asking Questions	0	0	0	0	0	0	0				

	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Closing Presentation											
Minutes into program	4	6									
Eye Contact	2	2									
Concentration	1	1									
Boredom	0	0									
Eagerness to Participate (Over Whole Time)	0	0									
Confusion/Frustration	0	0									
Physical Distractions	0	0									
Asking Questions	0	0									

3/15/10
 9:00
 St. Nicholas
 Nov 10
 Mark

①
 ②

Start

Opening Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	5	4	5	5	5	5	2				
Eye Contact	3	3	1	4	3	4					
Concentration											
Boredom	1	1	1								
Eagerness to Participate (Over Whole Time)	1	1									
Confusion/Frustration	1	1									
Physical Distractions	2	4	3	1	1						
Asking Questions											

Closing Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	3	4									
Eye Contact	1	1									
Concentration											
Boredom											
Eagerness to Participate (Over Whole Time)											
Confusion/Frustration											
Physical Distractions											
Asking Questions											

Break class

Hand
St. Aloysius
9:00
25/3
Y10
Madam

Opening Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	6	5	6	5	5	6	6				
Eye Contact	6	5	5	5	6	6					
Concentration	0	3	0	0	1	0	0				
Boredom	0	2	1	0	0	0	0				
Eagerness to Participate (Over Whole Time)	0	1	1	1	1	0	0				
Confusion/Frustration	0	1	0	1	1	0	0				
Physical Distractions	0	0	0	0	0	0	0				
Asking Questions	0	0	0	0	0	0	0				

Closing Presentation	Going down # of Students Engaged										Comments
	0	5	10	15	20	25	30	35	40		
Minutes into program	6	4									
Eye Contact	6	4									
Concentration	0	2									
Boredom	3	1									
Eagerness to Participate (Over Whole Time)	0	0									
Confusion/Frustration	0	0									
Physical Distractions	0	0									
Asking Questions	0	0									

Program Name: St. Augustine
 School: St. Augustine
 Time: 8:00
 Date: 25/3
 Age Group: 710
 Observer: Vedim

did not like calculator - I did start like calc
 Diffraction
 Diffraction

Observation Group #	Going down # of Students engaged										
	0	5	10	15	20	25	30	35	40	45	
Minutes into program	Fabric		Diffraction	Diffraction	Diffraction	News	Sort by	Sort by	Sort by	Sort by	
Activity students working on	P	P	P	P	P	P	P	P	P	P	
Discussion (P or O or N)											
Concentration	V	V	V	V	V	V	V	V	V	V	
Enjoyment/Excitement	V	V	V	V	V	V	V	V	V	V	
Boredom											
Confusion/Frustration			V	V	V	V	V	V	V	V	
Physical Distractions											
Read Instructions at Start	V	V									
Teamwork (P or N)	P	P	P	P	P	P	P	P	P	P	

Program Name: St. Augustine
 School: St. Augustine
 Time: 8:00
 Date: 25/3
 Age Group: 710
 Observer: Vedim

did not like calculator - I did start like calc
 Diffraction
 Diffraction

Observation Group #	Going down # of Students engaged										
	50	55	60	65	70	75	80	85	90	95	
Minutes into program	Gold	Gold	Gold	Fabric	Fabric	Sort by	Sort by	Sort by	Sort by	Sort by	
Activity students working on	P	P	P	P	P	P	P	P	P	P	
Discussion (P or O or N)											
Concentration	V	V	V	V	V	V	V	V	V	V	
Enjoyment/Excitement	V	V	V	V	V	V	V	V	V	V	
Boredom											
Confusion/Frustration											
Physical Distractions											
Read Instructions at Start	V	V	V	V	V	V	V	V	V	V	
Teamwork (P or N)	P	P	P	P	P	P	P	P	P	P	

Fabric's friction
 Did not read
 Did not read
 Did not read
 Did not read

1A - Shirts
 TB

2A - shirt
 2B - shirt
 2C - other

Program Name: Nano Tech
 School: SE A
 Time: 9:00 am
 Date: 3/25/10
 Age Group: Year 10
 Observer: Karley DiHart

Observation Group #	Going down # of Students engaged														
	0	5	10	15	20	25	30	35	40	45					
Minutes into program															
Activity students working on	Lead Book		News Tube	Gold		Base	Water U/s								
Discussion (P or O or N)	P P P	P P P	P P P	O O O	P P P	P P P	P O O	P P P	P P P	P P P					
Concentration	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Enjoyment/Excitement	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Boredom	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Confusion/Frustration	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Physical Distractions	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Read Instructions at Start	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Teamwork (P or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P

Observation Group #	Going down # of Students engaged									
	50	55	60	65	70	75	80	85	90	95
Minutes into program										
Activity students working on	Maths		Trains			Lead Book	UV		Base	
Discussion (P or O or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P
Concentration	/	/	/	/	/	/	/	/	/	/
Enjoyment/Excitement	/	/	/	/	/	/	/	/	/	/
Boredom	/	/	/	/	/	/	/	/	/	/
Confusion/Frustration	/	/	/	/	/	/	/	/	/	/
Physical Distractions	/	/	/	/	/	/	/	/	/	/
Read Instructions at Start	/	/	/	/	/	/	/	/	/	/
Teamwork (P or N)	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P	P P P

Program Name: Moro
 School: SFA
 Time: 9:00
 Date: 3/25
 Age Group: 10
 Observer: ALAK

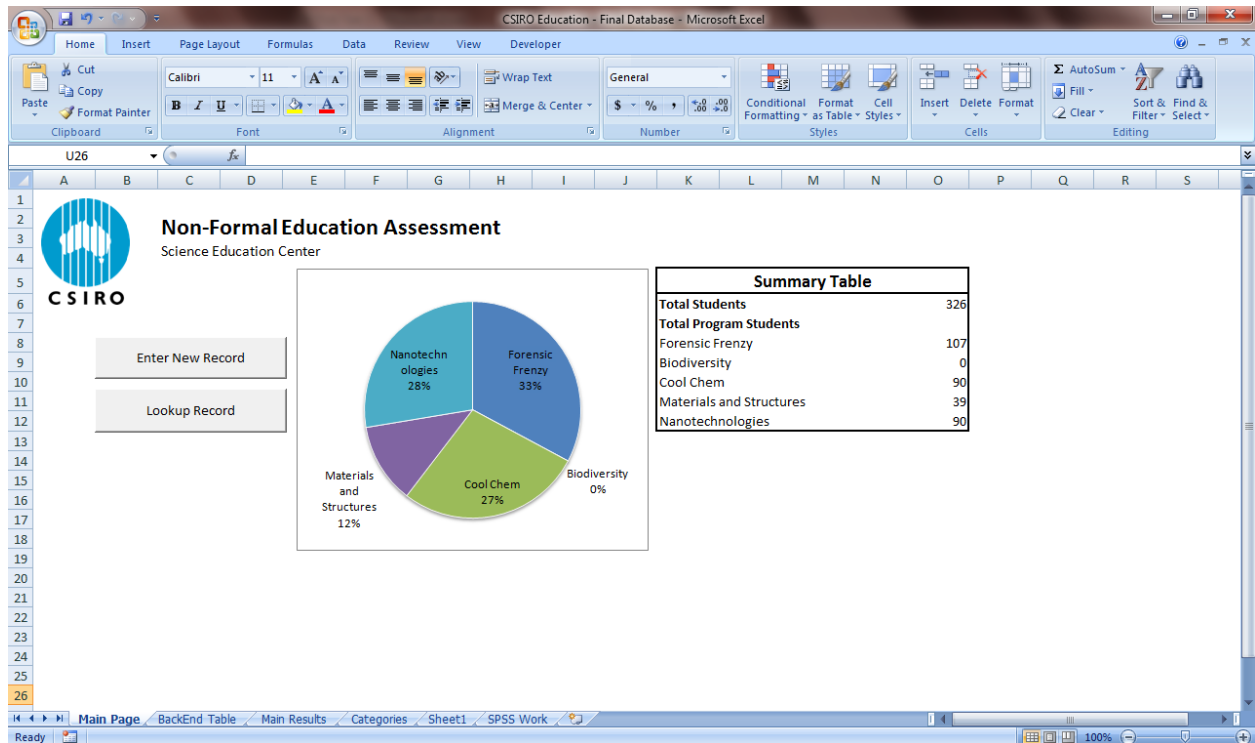
VIMOCI
 STOPS
 CLAS

Observation Group #	Going down # of Students engaged									
	5	10	15	20	25	30	35	40	45	
Minutes into program	5	10	15	20	25	30	35	40	45	
Activity students working on	FCAD	Counting	Counting	UV	Gold	Gold	CD	CD		
Discussion (P or O or N)	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP		
Concentration	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Enjoyment/Excitement	XXX									
Boredom										
Confusion/Frustration		XXX								
Physical Distractions										
Read Instructions at Start					XXX					
Teamwork (P or N)	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP		

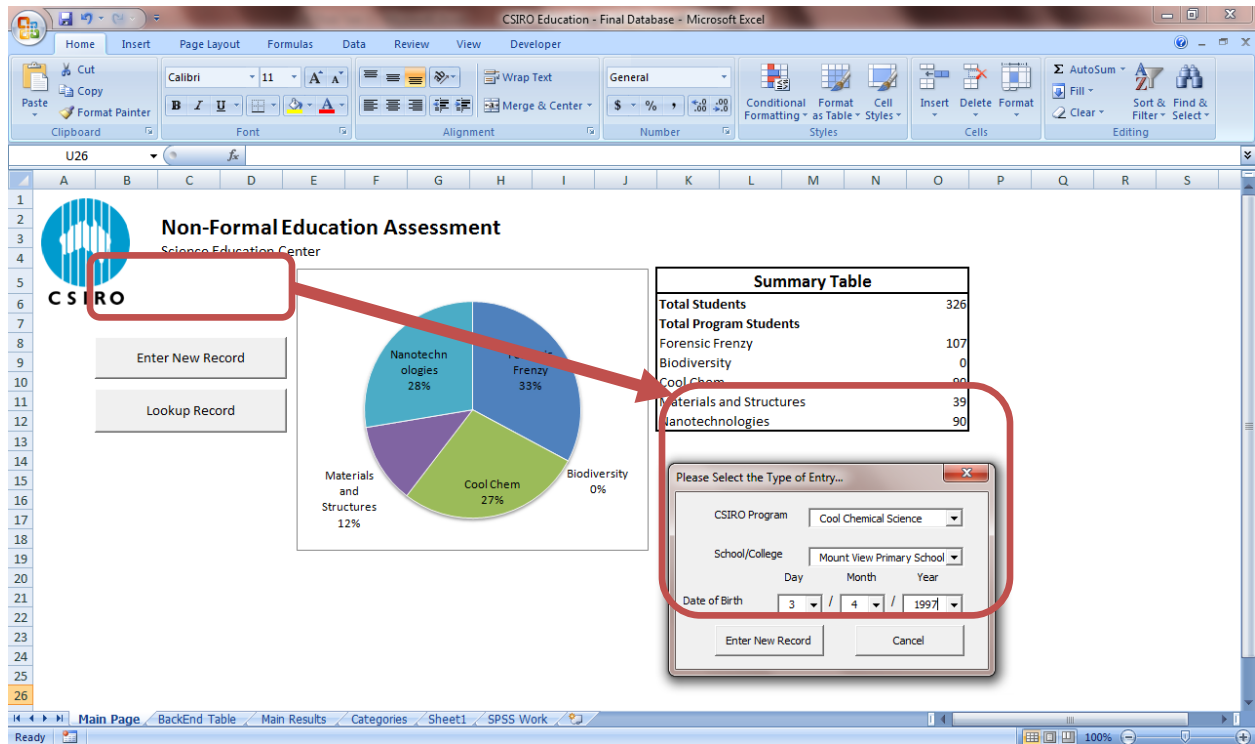
Observation Group #	Going down # of Students engaged									
	55	60	65	70	75	80	85	90	95	
Minutes into program	55	60	65	70	75	80	85	90	95	
Activity students working on	Ferro	Sizer	Sizer	Counting	Filter	Filter	Gold	Gold		
Discussion (P or O or N)	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP		
Concentration	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Enjoyment/Excitement	XXX									
Boredom										
Confusion/Frustration										
Physical Distractions										
Read Instructions at Start					XXX					
Teamwork (P or N)	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP		

APPENDIX N Excel Database Interfaces and Code

Main Screen:



Main Interface Screen:



Initialize Code Used to Load Main Interface Screens:

```
Private Sub UserForm_Initialize()
    Dim a, b, c, d, e, f As Variant

    For Each b In Sheet4.Range("B4:B22").Offset(0, 1)
        If b.Value <> "" Then
            MainScreen.ComboCSIROProgram.AddItem b.Value
        End If
    Next b

    For Each c In Sheet4.Range("B4:B22").Offset(0, 2)
        If c.Value <> "" Then
            MainScreen.ComboSchoolCollege.AddItem c.Value
        End If
    Next c

    For Each d In Sheet4.Range("B4:B37").Offset(0, 3)
        If d.Value <> "" Then
            MainScreen.ComboBDay.AddItem d.Value
        End If
    Next d

    For Each e In Sheet4.Range("B4:B22").Offset(0, 4)
        If e.Value <> "" Then
            MainScreen.ComboBMonth.AddItem e.Value
        End If
    Next e
End Sub
```

```

For Each f In Sheet4.Range("B4:B22").Offset(0, 5)
    If f.Value <> "" Then
        MainScreen.ComboBYear.AddItem f.Value
    End If
Next f

End Sub

```

Main Interface Code (Executed when "Enter New Record" is selected):

```

Private Sub cmdSelectEntry_Click()

Dim schoolcode As String
Sheet4.Range("A25").Value = ComboSchoolCollege.Value
schoolcode = Sheet4.Range("B25").Value

If ComboCSIROProgram.Value = "Forensic Frenzy ( C )" Then
    ForensicFrenzyC.College.Value = ComboSchoolCollege.Value
    ForensicFrenzyC.Program.Value = "Forensic Frenzy"
    ForensicFrenzyC.DOB.Value = ComboBDay.Value
    ForensicFrenzyC.MOB.Value = ComboBMonth.Value
    ForensicFrenzyC.YOB.Value = ComboBYear.Value
    'Remember to put in student id number
    ForensicFrenzyC.SID.Value = "FF-" & schoolcode
    ForensicFrenzyC.optNew.Value = True
    ForensicFrenzyC.Show
    Unload MainScreen

End If

If ComboCSIROProgram.Value = "Forensic Frenzy ( D )" Then
    ForensicFrenzyD.College.Value = ComboSchoolCollege.Value
    ForensicFrenzyD.Program.Value = "Forensic Frenzy"
    ForensicFrenzyD.DOB.Value = ComboBDay.Value
    ForensicFrenzyD.MOB.Value = ComboBMonth.Value
    ForensicFrenzyD.YOB.Value = ComboBYear.Value
    'Remember to put in student id number
    ForensicFrenzyD.SID.Value = "FF-" & schoolcode
    ForensicFrenzyD.optNew.Value = True
    ForensicFrenzyD.Show
    Unload MainScreen

End If

If ComboCSIROProgram.Value = "Cool Chemical Science" Then
    CoolChemScience.College.Value = ComboSchoolCollege.Value
    CoolChemScience.Program.Value = "Cool Chemical Science"
    CoolChemScience.DOB.Value = ComboBDay.Value
    CoolChemScience.MOB.Value = ComboBMonth.Value
    CoolChemScience.YOB.Value = ComboBYear.Value
    'Remember to put in student id number
    CoolChemScience.SID.Value = "CC-" & schoolcode
    CoolChemScience.optNew.Value = True
    CoolChemScience.Show
    Unload MainScreen

End If

If ComboCSIROProgram.Value = "Biodiversity" Then
    Biodiversity.College = ComboSchoolCollege.Value
    Biodiversity.Program = "Biodiversity"
    Biodiversity.DOB.Value = ComboBDay.Value
    Biodiversity.MOB.Value = ComboBMonth.Value
    Biodiversity.YOB.Value = ComboBYear.Value

```

```

'Remember to put in student id number
Biodiversity.SID.Value = "BD-" & schoolcode
Biodiversity.Show
Unload MainScreen
End If

If ComboCSIROProgram.Value = "Materials and Structures" Then
MaterialsandStructures.College = ComboSchoolCollege.Value
MaterialsandStructures.Program = "Materials and Structures"
MaterialsandStructures.DOB.Value = ComboBDay.Value
MaterialsandStructures.MOB.Value = ComboBMonth.Value
MaterialsandStructures.YOB.Value = ComboBYear.Value
'Remember to put in student id number
MaterialsandStructures.SID.Value = "MS-" & schoolcode
MaterialsandStructures.optNew.Value = True
MaterialsandStructures.Show
Unload MainScreen
End If

If ComboCSIROProgram.Value = "Nanotechnologies" Then
Nanotechnologies.College = ComboSchoolCollege.Value
Nanotechnologies.Program = "Nanotechnologies"
Nanotechnologies.DOB.Value = ComboBDay.Value
Nanotechnologies.MOB.Value = ComboBMonth.Value
Nanotechnologies.YOB.Value = ComboBYear.Value
'Remember to put in student id number
Nanotechnologies.SID.Value = "NT-" & schoolcode
Nanotechnologies.optNew.Value = True
Nanotechnologies.Show
Unload MainScreen
End If

End Sub

```

Lookup Entry:

The screenshot displays an Excel spreadsheet titled "CSIRO Education - Final Database - Microsoft Excel". The main content area shows a report for "Non-Formal Education Assessment" by the Science Education Center, featuring the CSIRO logo and a pie chart. The pie chart data is as follows:

Program	Percentage
Nanotechnologies	28%
Forensic Frenzy	33%
Materials and Structures	12%
Cool Chem	27%
Biodiversity	0%

To the right of the pie chart is a "Summary Table":

Summary Table	
Total Students	326
Total Program Students	
Forensic Frenzy	107
Biodiversity	0
Cool Chem	88
Materials and Structures	39
Nanotechnologies	90

A red box highlights two buttons: "Enter New Record" and "Lookup Record". A red arrow points from these buttons to a dialog box titled "Enter Record Information...". The dialog box contains the following fields:

- Program: Materials and Structures
- College: Bentleigh Secondary College
- Student Number: 197
- Student ID: MS BS 197

Buttons at the bottom of the dialog box are "Find and Display Record" and "Cancel".

Code for Loading Appropriate Choices into Drop-Down Menus:

```
Private Sub UserForm_Initialize()  
  
Dim b, c As Variant  
  
For Each b In Sheet4.Range("B4:B22").Offset(0, 1)  
    If b.Value <> "" Then  
        FindRecord.ComboCSIROProgram.AddItem b.Value  
    End If  
Next b  
  
For Each c In Sheet4.Range("B4:B22").Offset(0, 2)  
    If c.Value <> "" Then  
        FindRecord.ComboSchoolCollege.AddItem c.Value  
    End If  
Next c  
  
End Sub
```

Lookup Entry Code (executed when “Find and Display Record” is pressed):

```
Private Sub cmdFindDisplay_Click()  
Dim studentid, Program, College, studentno As String  
Dim a As Variant  
  
Program = txtProgram.Value  
College = txtCollege.Value  
studentno = txtStudentNo.Value  
  
txtStudentID.Value = Program & "-" & College & "-" & studentno  
studentid = txtStudentID.Value  
  
For Each a In Sheet2.Range("E8:E1000")  
    If studentid = a.Value Then  
        chkFound.Value = True  
        If a.Offset(0, -4).Value = "Forensic Frenzy" Then  
            ForensicFrenzyD.SID.Value = studentid  
            'Entry Code for the PreTest  
            ForensicFrenzyD.DOB.Value = a.Offset(0, 1).Value  
            ForensicFrenzyD.MOB.Value = a.Offset(0, 2).Value  
            ForensicFrenzyD.YOB.Value = a.Offset(0, 3).Value  
  
            'Gender  
            If a.Offset(0, 5).Value = "Male" Then  
                ForensicFrenzyD.optPRMale.Value = True  
            End If  
  
            If a.Offset(0, 5).Value = "Female" Then  
                ForensicFrenzyD.optPRFemale.Value = True  
            End If  
  
            'English  
            If a.Offset(0, 6).Value = "Yes" Then  
                ForensicFrenzyD.optPRYesEng.Value = True  
            End If  
  
            If a.Offset(0, 6).Value = "No" Then  
                ForensicFrenzyD.optPRNoEng.Value = True  
            End If  
        End If  
    End If  
Next a  
End Sub
```


ForensicFrenzyD.txtPROtherLang.Value = a.Offset(0, 7).Value

'C Term Questions

ForensicFrenzyD.txtPRKnowScience.Value = a.Offset(0, 8).Value

ForensicFrenzyD.txtPRKnowSubj.Value = a.Offset(0, 9).Value

ForensicFrenzyD.txtPRInterestSciTech.Value = a.Offset(0, 10).Value

ForensicFrenzyD.txtPRInterestNewTech.Value = a.Offset(0, 11).Value

ForensicFrenzyD.txtPRInterestEvery.Value = a.Offset(0, 12).Value

'TOSRA Questions

ForensicFrenzyD.txtPRTOSRA_ToldvExp.Value = a.Offset(0, 13).Value

ForensicFrenzyD.txtPRTOSRA_LivesBetter.Value = a.Offset(0, 14).Value

ForensicFrenzyD.txtPRTOSRA_JobSci.Value = a.Offset(0, 15).Value

ForensicFrenzyD.txtPRTOSRA_OutSchool.Value = a.Offset(0, 16).Value

'Parents Work Field

ForensicFrenzyD.ComboPRParentsWork1.Value = a.Offset(0, 17).Value

ForensicFrenzyD.ComboPRParentsWork2.Value = a.Offset(0, 18).Value

ForensicFrenzyD.ComboPRParentsWork3.Value = a.Offset(0, 19).Value

ForensicFrenzyD.ComboPRParentsWork4.Value = a.Offset(0, 20).Value

'Career Interests

ForensicFrenzyD.ComboPR_CareerInt1.Value = a.Offset(0, 21).Value

ForensicFrenzyD.ComboPR_CareerInt2.Value = a.Offset(0, 22).Value

ForensicFrenzyD.ComboPR_CareerInt3.Value = a.Offset(0, 23).Value

ForensicFrenzyD.ComboPR_CareerInt4.Value = a.Offset(0, 24).Value

'Words and Phrases

ForensicFrenzyD.txtPRWPhaRAW1.Value = a.Offset(0, 25).Value

ForensicFrenzyD.txtPRWPhaRAW2.Value = a.Offset(0, 26).Value

ForensicFrenzyD.txtPRWPhaRAW3.Value = a.Offset(0, 27).Value

ForensicFrenzyD.txtPRWPhaRAW4.Value = a.Offset(0, 28).Value

ForensicFrenzyD.ComboPRWPhaCAT1.Value = a.Offset(0, 29).Value

ForensicFrenzyD.ComboPRWPhaCAT2.Value = a.Offset(0, 30).Value

ForensicFrenzyD.ComboPRWPhaCAT3.Value = a.Offset(0, 31).Value

ForensicFrenzyD.ComboPRWPhaCAT4.Value = a.Offset(0, 32).Value

'What does a Forensic Scientist Do?

ForensicFrenzyD.txtPRFSJobRAW.Value = a.Offset(0, 33).Value

ForensicFrenzyD.ComboPRFSJobCAT1.Value = a.Offset(0, 34).Value

ForensicFrenzyD.ComboPRFSJobCAT2.Value = a.Offset(0, 35).Value

ForensicFrenzyD.ComboPRFSJobCAT3.Value = a.Offset(0, 36).Value

ForensicFrenzyD.ComboPRFSJobCAT4.Value = a.Offset(0, 37).Value

'What branches of science does a Forensics Scientist use?

ForensicFrenzyD.txtPRBranchesFSRAW.Value = a.Offset(0, 38).Value

ForensicFrenzyD.ComboPRBranchesFSCAT1.Value = a.Offset(0, 39).Value

ForensicFrenzyD.ComboPRBranchesFSCAT2.Value = a.Offset(0, 40).Value

ForensicFrenzyD.ComboPRBranchesFSCAT3.Value = a.Offset(0, 41).Value

ForensicFrenzyD.ComboPRBranchesFSCAT4.Value = a.Offset(0, 42).Value

'What crimes do forensic scientists solve?

ForensicFrenzyD.txtPRFSCrimesRAW.Value = a.Offset(0, 43).Value

ForensicFrenzyD.ComboPRFSCrimesCAT1.Value = a.Offset(0, 44).Value

ForensicFrenzyD.ComboPRFSCrimesCAT2.Value = a.Offset(0, 45).Value

ForensicFrenzyD.ComboPRFSCrimesCAT3.Value = a.Offset(0, 46).Value

ForensicFrenzyD.ComboPRFSCrimesCAT4.Value = a.Offset(0, 47).Value

'Enter Fields for Post-Test 1

```

'Importance of science
ForensicFrenzyD.ComboP1DImportantSci.Value = a.Offset(0, 93).Value
ForensicFrenzyD.txtP1DImportantSciWhyRAW.Value = a.Offset(0, 94).Value
ForensicFrenzyD.ComboP1DImportantSciWhyCAT.Value = a.Offset(0, 95).Value

'Best School Subjects
ForensicFrenzyD.ComboP1DBestSubj1.Value = a.Offset(0, 96).Value
ForensicFrenzyD.ComboP1DBestSubj2.Value = a.Offset(0, 97).Value
ForensicFrenzyD.ComboP1DBestSubj3.Value = a.Offset(0, 98).Value
ForensicFrenzyD.ComboP1DBestSubj4.Value = a.Offset(0, 99).Value
ForensicFrenzyD.ComboP1DBestSubj5.Value = a.Offset(0, 100).Value
ForensicFrenzyD.ComboP1DBestSubj6.Value = a.Offset(0, 101).Value

'VCE
If a.Offset(0, 120).Value = "Yes" Then
    ForensicFrenzyD.OptP1DVCEYes.Value = True
End If

If a.Offset(0, 120).Value = "No" Then
    ForensicFrenzyD.OptP1DVCENo.Value = False
End If

ForensicFrenzyD.txtP1DVCECAT1.Value = a.Offset(0, 121).Value
ForensicFrenzyD.txtP1DVCECAT2.Value = a.Offset(0, 122).Value
ForensicFrenzyD.txtP1DVCECAT3.Value = a.Offset(0, 123).Value

'What do FS do?
ForensicFrenzyD.txtP1DFSJobRAW.Value = a.Offset(0, 129).Value
ForensicFrenzyD.ComboP1DFSJobCAT1.Value = a.Offset(0, 339).Value
ForensicFrenzyD.ComboP1DFSJobCAT2.Value = a.Offset(0, 340).Value
ForensicFrenzyD.ComboP1DFSJobCAT3.Value = a.Offset(0, 341).Value
ForensicFrenzyD.ComboP1DFSJobCAT4.Value = a.Offset(0, 342).Value

'What branches of science?
ForensicFrenzyD.txtP1DBranchSciRAW.Value = a.Offset(0, 130).Value
ForensicFrenzyD.ComboP1DBranchSciCAT1.Value = a.Offset(0, 131).Value
ForensicFrenzyD.ComboP1DBranchSciCAT2.Value = a.Offset(0, 132).Value
ForensicFrenzyD.ComboP1DBranchSciCAT3.Value = a.Offset(0, 133).Value
ForensicFrenzyD.ComboP1DBranchSciCAT4.Value = a.Offset(0, 134).Value

'What Crimes for FS solve?
a.Offset(0, 135).Value = ForensicFrenzyD.txtP1DCrimesInvestRAW.Value
a.Offset(0, 136).Value = ForensicFrenzyD.ComboP1DCrimesInvestCAT1.Value
a.Offset(0, 137).Value = ForensicFrenzyD.ComboP1DCrimesInvestCAT2.Value
a.Offset(0, 138).Value = ForensicFrenzyD.ComboP1DCrimesInvestCAT3.Value
a.Offset(0, 139).Value = ForensicFrenzyD.ComboP1DCrimesInvestCAT4.Value

'TOSRA Questions
ForensicFrenzyD.txtP1DHandsOnAct.Value = a.Offset(0, 102).Value
ForensicFrenzyD.txtP1DObsThink.Value = a.Offset(0, 103).Value
ForensicFrenzyD.txtP1DExpHelp.Value = a.Offset(0, 104).Value
ForensicFrenzyD.txtP1DPresent.Value = a.Offset(0, 105).Value
ForensicFrenzyD.txtP1DOverallProgram.Value = a.Offset(0, 106).Value
ForensicFrenzyD.txtP1DIntTVSci.Value = a.Offset(0, 107).Value
ForensicFrenzyD.txtP1DIntPrintSci.Value = a.Offset(0, 108).Value
ForensicFrenzyD.txtP1DIntOnlineSci.Value = a.Offset(0, 109).Value
ForensicFrenzyD.txtP1DIntLiveSci.Value = a.Offset(0, 110).Value
ForensicFrenzyD.txtP1DTOSRA_LearnOnOwn.Value = a.Offset(0, 111).Value
ForensicFrenzyD.txtP1DTOSRA_IntSci.Value = a.Offset(0, 112).Value
ForensicFrenzyD.txtP1DTOSRA_SciClass.Value = a.Offset(0, 113).Value
ForensicFrenzyD.txtP1DTOSRA_NotEnjoyCareer.Value = a.Offset(0, 114).Value
ForensicFrenzyD.txtP1DTOSRA_NewTech.Value = a.Offset(0, 115).Value
ForensicFrenzyD.txtP1DTOSRA_SciKnow.Value = a.Offset(0, 116).Value

```

```

ForensicFrenzyD.txtP1DTOSRA_SciPositive.Value = a.Offset(0, 117).Value
ForensicFrenzyD.txtP1DTOSRA_SubjectKnow.Value = a.Offset(0, 118).Value
ForensicFrenzyD.txtP1DTOSRA_Function.Value = a.Offset(0, 119).Value

'CSIRO Programs
ForensicFrenzyD.txtP1DLikedProgram.Value = a.Offset(0, 124).Value
ForensicFrenzyD.ComboP1DLikedProgram.Value = a.Offset(0, 310).Value
ForensicFrenzyD.txtP1DNotLikedProgram.Value = a.Offset(0, 125).Value
ForensicFrenzyD.ComboP1DNotLikedProgram.Value = a.Offset(0, 311).Value

'Entry Fields for Post-Test 2
'Interest in Science Category
ForensicFrenzyD.ComboP2DGenInterest.Value = a.Offset(0, 221).Value
ForensicFrenzyD.ComboP2DSeekInfo.Value = a.Offset(0, 222).Value
ForensicFrenzyD.ComboP2DUnderstandInfo.Value = a.Offset(0, 223).Value

'Learned About Topics
If a.Offset(0, 272).Value = "Yes" Then
    ForensicFrenzyD.chkP2DLearnedAboutTopics1.Value = True
End If

If a.Offset(0, 273).Value = "Yes" Then
    ForensicFrenzyD.chkP2DLearnedAboutTopics2.Value = True
End If

If a.Offset(0, 274).Value = "Yes" Then
    ForensicFrenzyD.chkP2DLearnedAboutTopics3.Value = True
End If

If a.Offset(0, 275).Value = "Yes" Then
    ForensicFrenzyD.chkP2DLearnedAboutTopics4.Value = True
End If

If a.Offset(0, 276).Value = "Yes" Then
    ForensicFrenzyD.chkP2DLearnedAboutTopics5.Value = True
End If

If a.Offset(0, 277).Value = "Yes" Then
    ForensicFrenzyD.chkP2DLearnedAboutTopics6.Value = True
End If

If a.Offset(0, 278).Value = "Yes" Then
    ForensicFrenzyD.chkP2DLearnedAboutTopics7.Value = True
End If

If a.Offset(0, 279).Value = "Yes" Then
    ForensicFrenzyD.chkP2DLearnedAboutTopics8.Value = True
End If

If a.Offset(0, 280).Value = "Yes" Then
    ForensicFrenzyD.chkP2DLearnedAboutTopics9.Value = True
End If

'TOSRA and Other Questions
ForensicFrenzyD.txtP2DKnowSci.Value = a.Offset(0, 226).Value
ForensicFrenzyD.txtP2DKnowSubj.Value = a.Offset(0, 227).Value
ForensicFrenzyD.txtP2DInterestSciTech.Value = a.Offset(0, 228).Value
ForensicFrenzyD.txtP2DInterestNewTech.Value = a.Offset(0, 229).Value
ForensicFrenzyD.txtP2DInterestEvery.Value = a.Offset(0, 230).Value

```

```
ForensicFrenzyD.txtP2DTOSRA_ToldvExp.Value = a.Offset(0, 240).Value
ForensicFrenzyD.txtP2DTOSRA_LivesBetter.Value = a.Offset(0, 241).Value
ForensicFrenzyD.txtP2DTOSRA_JobSci.Value = a.Offset(0, 242).Value
ForensicFrenzyD.txtP2DTOSRA_OutSchool.Value = a.Offset(0, 243).Value
```

```
'Favourite Topic in science?
```

```
ForensicFrenzyD.txtP2DLikeTypeSciRAW.Value = a.Offset(0, 231).Value
ForensicFrenzyD.ComboP2DLikeTypeSciCAT1.Value = a.Offset(0, 232).Value
ForensicFrenzyD.ComboP2DLikeTypeSciCAT2.Value = a.Offset(0, 233).Value
ForensicFrenzyD.ComboP2DLikeTypeSciCAT3.Value = a.Offset(0, 234).Value
ForensicFrenzyD.ComboP2DLikeTypeSciCAT4.Value = a.Offset(0, 235).Value
```

```
'School Subject You are best at?
```

```
ForensicFrenzyD.ComboP2DSchoolSubj1.Value = a.Offset(0, 236).Value
ForensicFrenzyD.ComboP2DSchoolSubj2.Value = a.Offset(0, 237).Value
ForensicFrenzyD.ComboP2DSchoolSubj3.Value = a.Offset(0, 238).Value
ForensicFrenzyD.ComboP2DSchoolSubj4.Value = a.Offset(0, 239).Value
```

```
'Name 1 Experiment
```

```
ForensicFrenzyD.txtP2DName1ExpRAW.Value = a.Offset(0, 281).Value
ForensicFrenzyD.ComboP2DName1ExpCAT.Value = a.Offset(0, 282).Value
```

```
'What stands out most?
```

```
ForensicFrenzyD.txtP2DStandOutRAW.Value = a.Offset(0, 283).Value
ForensicFrenzyD.ComboP2DStandOutCAT.Value = a.Offset(0, 284).Value
```

```
'Words and Phrases
```

```
ForensicFrenzyD.txtP2DWPPhaRAW1.Value = a.Offset(0, 244).Value
ForensicFrenzyD.txtP2DWPPhaRAW2.Value = a.Offset(0, 245).Value
ForensicFrenzyD.txtP2DWPPhaRAW3.Value = a.Offset(0, 246).Value
ForensicFrenzyD.txtP2DWPPhaRAW4.Value = a.Offset(0, 247).Value
```

```
ForensicFrenzyD.ComboP2DWPPhaCAT1.Value = a.Offset(0, 248).Value
ForensicFrenzyD.ComboP2DWPPhaCAT2.Value = a.Offset(0, 249).Value
ForensicFrenzyD.ComboP2DWPPhaCAT3.Value = a.Offset(0, 250).Value
ForensicFrenzyD.ComboP2DWPPhaCAT4.Value = a.Offset(0, 251).Value
```

```
'What Physical Characteristics can ID a suspect?
```

```
ForensicFrenzyD.txtP2DCharactSuspectRAW.Value = a.Offset(0, 260).Value
ForensicFrenzyD.ComboP2DCharactSuspectCAT1.Value = a.Offset(0, 261).Value
ForensicFrenzyD.ComboP2DCharactSuspectCAT2.Value = a.Offset(0, 262).Value
ForensicFrenzyD.ComboP2DCharactSuspectCAT3.Value = a.Offset(0, 263).Value
```

```
ForensicFrenzyD.optUpdate.Value = True
ForensicFrenzyD.txtPRBranchesFSRAW.Value = "test"
Unload FindRecord
ForensicFrenzyD.Show
Unload FindRecord
```

```
End If
```

```
If a.Offset(0, -4).Value = "Cool Chemical Science" Then
```

```
    CoolChemScience.SID.Value = studentid
    CoolChemScience.optUpdate.Value = True
    'Entry Code for the PreTest
CoolChemScience.DOB.Value = a.Offset(0, 1).Value
CoolChemScience.MOB.Value = a.Offset(0, 2).Value
CoolChemScience.YOB.Value = a.Offset(0, 3).Value
```

```
'Gender
```

```
If a.Offset(0, 5).Value = "Male" Then
    CoolChemScience.optPRMale.Value = True
```

```

End If

If a.Offset(0, 5).Value = "Female" Then
    CoolChemScience.optPRFemale.Value = True
End If

'English
If a.Offset(0, 6).Value = "Yes" Then
    CoolChemScience.optPRYesEng.Value = True
End If

If a.Offset(0, 6).Value = "No" Then
    CoolChemScience.optPRNoEng.Value = True
End If

CoolChemScience.txtPROtherLang.Value = a.Offset(0, 7).Value

'C Term Questions
CoolChemScience.txtPRKnowScience.Value = a.Offset(0, 8).Value
CoolChemScience.txtPRKnowSubj.Value = a.Offset(0, 9).Value
CoolChemScience.txtPRInterestSciTech.Value = a.Offset(0, 10).Value
CoolChemScience.txtPRInterestNewTech.Value = a.Offset(0, 11).Value
CoolChemScience.txtPRInterestEvery.Value = a.Offset(0, 12).Value

'TOSRA Questions
CoolChemScience.txtPRTOSRA_ToldvExp.Value = a.Offset(0, 13).Value
CoolChemScience.txtPRTOSRA_LivesBetter.Value = a.Offset(0, 14).Value
CoolChemScience.txtPRTOSRA_JobSci.Value = a.Offset(0, 15).Value
CoolChemScience.txtPRTOSRA_OutSchool.Value = a.Offset(0, 16).Value

'Parents Work Field
CoolChemScience.ComboPRParentsWork1.Value = a.Offset(0, 17).Value
CoolChemScience.ComboPRParentsWork2.Value = a.Offset(0, 18).Value
CoolChemScience.ComboPRParentsWork3.Value = a.Offset(0, 19).Value
CoolChemScience.ComboPRParentsWork4.Value = a.Offset(0, 20).Value

'Career Interests
CoolChemScience.ComboPR_CareerInt1.Value = a.Offset(0, 21).Value
CoolChemScience.ComboPR_CareerInt2.Value = a.Offset(0, 22).Value
CoolChemScience.ComboPR_CareerInt3.Value = a.Offset(0, 23).Value
CoolChemScience.ComboPR_CareerInt4.Value = a.Offset(0, 24).Value

'Words and Phrases
CoolChemScience.txtPRWPhaRAW1.Value = a.Offset(0, 25).Value
CoolChemScience.txtPRWPhaRAW2.Value = a.Offset(0, 26).Value
CoolChemScience.txtPRWPhaRAW3.Value = a.Offset(0, 27).Value
CoolChemScience.txtPRWPhaRAW4.Value = a.Offset(0, 28).Value

CoolChemScience.ComboPRWPhaCAT1.Value = a.Offset(0, 29).Value
CoolChemScience.ComboPRWPhaCAT2.Value = a.Offset(0, 30).Value
CoolChemScience.ComboPRWPhaCAT3.Value = a.Offset(0, 31).Value
CoolChemScience.ComboPRWPhaCAT4.Value = a.Offset(0, 32).Value

'What do chemists do?
CoolChemScience.txtPRChmJobRAW.Value = a.Offset(0, 88).Value
CoolChemScience.ComboPRFSJobCAT1.Value = a.Offset(0, 89).Value

'What problems do chemists help solve?
CoolChemScience.txtPRBranchesChmRAW.Value = a.Offset(0, 90).Value
CoolChemScience.ComboPRBranchesFSCAT1.Value = a.Offset(0, 91).Value

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'Enter Fields for Post-Test 1
'Importance of science
CoolChemScience.ComboP1DImportantSci.Value = a.Offset(0, 93).Value
CoolChemScience.txtP1DImportantSciWhyRAW.Value = a.Offset(0, 94).Value
CoolChemScience.ComboP1DImportantSciWhyCAT.Value = a.Offset(0, 95).Value

'Best School Subjects
CoolChemScience.ComboP1DBestSubj1.Value = a.Offset(0, 96).Value
CoolChemScience.ComboP1DBestSubj2.Value = a.Offset(0, 97).Value
CoolChemScience.ComboP1DBestSubj3.Value = a.Offset(0, 98).Value
CoolChemScience.ComboP1DBestSubj4.Value = a.Offset(0, 99).Value
CoolChemScience.ComboP1DBestSubj5.Value = a.Offset(0, 100).Value
CoolChemScience.ComboP1DBestSubj6.Value = a.Offset(0, 101).Value

'VCE
If a.Offset(0, 120).Value = "Yes" Then
    CoolChemScience.OptP1DVCEYes.Value = True
End If

If a.Offset(0, 120).Value = "No" Then
    CoolChemScience.OptP1DVCENo.Value = False
End If

CoolChemScience.txtP1DVCECAT1.Value = a.Offset(0, 121).Value
CoolChemScience.txtP1DVCECAT2.Value = a.Offset(0, 122).Value
CoolChemScience.txtP1DVCECAT3.Value = a.Offset(0, 123).Value

'What does a Chemist do?
CoolChemScience.txtP1DChmJobRAW.Value = a.Offset(0, 213).Value
CoolChemScience.ComboP1DChmJobCAT1.Value = a.Offset(0, 214).Value

'What industries do chemists work in?
CoolChemScience.txtP1DChmIndRAW.Value = a.Offset(0, 215).Value
CoolChemScience.ComboP1DChmIndCAT1.Value = a.Offset(0, 216).Value
CoolChemScience.ComboP1DChmIndCAT2.Value = a.Offset(0, 217).Value

'What problems do chemists help solve?
CoolChemScience.txtP1DChemSolverRAW.Value = a.Offset(0, 218).Value
CoolChemScience.ComboP1DChemSolveCAT1.Value = a.Offset(0, 219).Value

'TOSRA Questions
CoolChemScience.txtP1DHandsOnAct.Value = a.Offset(0, 102).Value
CoolChemScience.txtP1DObsThink.Value = a.Offset(0, 103).Value
CoolChemScience.txtP1DExpHelp.Value = a.Offset(0, 104).Value
CoolChemScience.txtP1DPresent.Value = a.Offset(0, 105).Value
CoolChemScience.txtP1DOverallProgram.Value = a.Offset(0, 106).Value
CoolChemScience.txtP1DIntTVSci.Value = a.Offset(0, 107).Value
CoolChemScience.txtP1DIntPrintSci.Value = a.Offset(0, 108).Value
CoolChemScience.txtP1DIntOnlineSci.Value = a.Offset(0, 109).Value
CoolChemScience.txtP1DIntLiveSci.Value = a.Offset(0, 110).Value
CoolChemScience.txtP1DTOSRA_LearnOnOwn.Value = a.Offset(0, 111).Value
CoolChemScience.txtP1DTOSRA_IntSci.Value = a.Offset(0, 112).Value
CoolChemScience.txtP1DTOSRA_SciClass.Value = a.Offset(0, 113).Value
CoolChemScience.txtP1DTOSRA_NotEnjoyCareer.Value = a.Offset(0, 114).Value
CoolChemScience.txtP1DTOSRA_NewTech.Value = a.Offset(0, 115).Value
CoolChemScience.txtP1DTOSRA_SciKnow.Value = a.Offset(0, 116).Value
CoolChemScience.txtP1DTOSRA_SciPositive.Value = a.Offset(0, 117).Value
CoolChemScience.txtP1DTOSRA_SubjectKnow.Value = a.Offset(0, 118).Value
CoolChemScience.txtP1DTOSRA_Function.Value = a.Offset(0, 119).Value

'CSIRO Programs

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CoolChemScience.txtP1DLikedProgram.Value = a.Offset(0, 124).Value
CoolChemScience.ComboP1DLikedProgram.Value = a.Offset(0, 310).Value
CoolChemScience.txtP1DNotLikedProgram.Value = a.Offset(0, 125).Value
CoolChemScience.ComboP1DNotLikedProgram.Value = a.Offset(0, 311).Value

'I learned about the following topics today:
If a.Offset(0, 345).Value = "Acids and Bases" Then
    CoolChemScience.chkP1LearnedAbout1.Value = True
End If

If a.Offset(0, 346).Value = "Reactions" Then
    CoolChemScience.chkP1LearnedAbout2.Value = True
End If

If a.Offset(0, 347).Value = "Physical Changes of Materials" Then
    CoolChemScience.chkP1LearnedAbout3.Value = True
End If

If a.Offset(0, 348).Value = "Physical Properties of Materials" Then
    CoolChemScience.chkP1LearnedAbout4.Value = True
End If

If a.Offset(0, 349).Value = "Water Absorbing Materials" Then
    CoolChemScience.chkP1LearnedAbout5.Value = True
End If

If a.Offset(0, 350).Value = "Effect of Light on Reactions" Then
    CoolChemScience.chkP1LearnedAbout6.Value = True
End If

'Entry Fields for Post-Test 2
'Interest in Science Category
CoolChemScience.ComboP2DGenInterest.Value = a.Offset(0, 221).Value
CoolChemScience.ComboP2DSeekInfo.Value = a.Offset(0, 222).Value
CoolChemScience.ComboP2DUnderstandInfo.Value = a.Offset(0, 223).Value

'TOSRA and Other Questions
CoolChemScience.txtP2DKnowSci.Value = a.Offset(0, 226).Value
CoolChemScience.txtP2DKnowSubj.Value = a.Offset(0, 227).Value
CoolChemScience.txtP2DInterestSciTech.Value = a.Offset(0, 228).Value
CoolChemScience.txtP2DInterestNewTech.Value = a.Offset(0, 229).Value
CoolChemScience.txtP2DInterestEvery.Value = a.Offset(0, 230).Value

CoolChemScience.txtP2DTOSRA_ToldvExp.Value = a.Offset(0, 240).Value
CoolChemScience.txtP2DTOSRA_LivesBetter.Value = a.Offset(0, 241).Value
CoolChemScience.txtP2DTOSRA_JobSci.Value = a.Offset(0, 242).Value
CoolChemScience.txtP2DTOSRA_OutSchool.Value = a.Offset(0, 243).Value

'Favourite Topic in science?
CoolChemScience.txtP2DLikeTypeSciRAW.Value = a.Offset(0, 231).Value
CoolChemScience.ComboP2DLikeTypeSciCAT1.Value = a.Offset(0, 232).Value
CoolChemScience.ComboP2DLikeTypeSciCAT2.Value = a.Offset(0, 233).Value
CoolChemScience.ComboP2DLikeTypeSciCAT3.Value = a.Offset(0, 234).Value
CoolChemScience.ComboP2DLikeTypeSciCAT4.Value = a.Offset(0, 235).Value

'School Subject You are best at?
CoolChemScience.ComboP2DSchoolSubj1.Value = a.Offset(0, 236).Value
CoolChemScience.ComboP2DSchoolSubj2.Value = a.Offset(0, 237).Value
CoolChemScience.ComboP2DSchoolSubj3.Value = a.Offset(0, 238).Value
CoolChemScience.ComboP2DSchoolSubj4.Value = a.Offset(0, 239).Value

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'Name 1 Experiment
CoolChemScience.txtP2DName1ExpRAW.Value = a.Offset(0, 305).Value
CoolChemScience.ComboP2DName1ExpCAT.Value = a.Offset(0, 306).Value

'What stands out most?
CoolChemScience.txtP2DStandOutRAW.Value = a.Offset(0, 307).Value
CoolChemScience.ComboP2DStandOutCAT.Value = a.Offset(0, 308).Value

'Words and Phrases
CoolChemScience.txtP2DWPPhaRAW1.Value = a.Offset(0, 244).Value
CoolChemScience.txtP2DWPPhaRAW2.Value = a.Offset(0, 245).Value
CoolChemScience.txtP2DWPPhaRAW3.Value = a.Offset(0, 246).Value
CoolChemScience.txtP2DWPPhaRAW4.Value = a.Offset(0, 247).Value

CoolChemScience.ComboP2DWPPhaCAT1.Value = a.Offset(0, 248).Value
CoolChemScience.ComboP2DWPPhaCAT2.Value = a.Offset(0, 249).Value
CoolChemScience.ComboP2DWPPhaCAT3.Value = a.Offset(0, 250).Value
CoolChemScience.ComboP2DWPPhaCAT4.Value = a.Offset(0, 251).Value

Unload FindRecord
CoolChemScience.Show

End If

If a.Offset(0, -4).Value = "Biodiversity" Then
    Biodiversity.SID.Value = studentid
    Biodiversity.optUpdate.Value = True
    Unload FindRecord
    Biodiversity.Show

End If

If a.Offset(0, -4).Value = "Nanotechnologies" Then
    Nanotechnologies.SID.Value = studentid
    Nanotechnologies.optUpdate.Value = True
    'Entry Code for the PreTest
    Nanotechnologies.DOB.Value = a.Offset(0, 1).Value
    Nanotechnologies.MOB.Value = a.Offset(0, 2).Value
    Nanotechnologies.YOB.Value = a.Offset(0, 3).Value

'Gender
If a.Offset(0, 5).Value = "Male" Then
    Nanotechnologies.optPRMale.Value = True
End If

If a.Offset(0, 5).Value = "Female" Then
    Nanotechnologies.optPRFemale.Value = True
End If

'English
If a.Offset(0, 6).Value = "Yes" Then
    Nanotechnologies.optPRYesEng.Value = True
End If

If a.Offset(0, 6).Value = "No" Then
    Nanotechnologies.optPRNoEng.Value = True
End If

Nanotechnologies.txtPROtherLang.Value = a.Offset(0, 7).Value

'C Term Questions

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Nanotechnologies.txtPRKnowScience.Value = a.Offset(0, 8).Value
Nanotechnologies.txtPRKnowSubj.Value = a.Offset(0, 9).Value
Nanotechnologies.txtPRInterestSciTech.Value = a.Offset(0, 10).Value
Nanotechnologies.txtPRInterestNewTech.Value = a.Offset(0, 11).Value
Nanotechnologies.txtPRInterestEvery.Value = a.Offset(0, 12).Value

'TOSRA Questions
Nanotechnologies.txtPRTOSRA_ToldvExp.Value = a.Offset(0, 13).Value
Nanotechnologies.txtPRTOSRA_LivesBetter.Value = a.Offset(0, 14).Value
Nanotechnologies.txtPRTOSRA_JobSci.Value = a.Offset(0, 15).Value
Nanotechnologies.txtPRTOSRA_OutSchool.Value = a.Offset(0, 16).Value

'Parents Work Field
Nanotechnologies.ComboPRParentsWork1.Value = a.Offset(0, 17).Value
Nanotechnologies.ComboPRParentsWork2.Value = a.Offset(0, 18).Value
Nanotechnologies.ComboPRParentsWork3.Value = a.Offset(0, 19).Value
Nanotechnologies.ComboPRParentsWork4.Value = a.Offset(0, 20).Value

'Career Interests
Nanotechnologies.ComboPR_CareerInt1.Value = a.Offset(0, 21).Value
Nanotechnologies.ComboPR_CareerInt2.Value = a.Offset(0, 22).Value
Nanotechnologies.ComboPR_CareerInt3.Value = a.Offset(0, 23).Value
Nanotechnologies.ComboPR_CareerInt4.Value = a.Offset(0, 24).Value

'Words and Phrases
Nanotechnologies.txtPRWPhaRAW1.Value = a.Offset(0, 25).Value
Nanotechnologies.txtPRWPhaRAW2.Value = a.Offset(0, 26).Value
Nanotechnologies.txtPRWPhaRAW3.Value = a.Offset(0, 27).Value
Nanotechnologies.txtPRWPhaRAW4.Value = a.Offset(0, 28).Value

Nanotechnologies.ComboPRWPhaCAT1.Value = a.Offset(0, 29).Value
Nanotechnologies.ComboPRWPhaCAT2.Value = a.Offset(0, 30).Value
Nanotechnologies.ComboPRWPhaCAT3.Value = a.Offset(0, 31).Value
Nanotechnologies.ComboPRWPhaCAT4.Value = a.Offset(0, 32).Value

'What is Nanotechnology?
Nanotechnologies.txtPRFSJobRAW.Value = a.Offset(0, 58).Value
Nanotechnologies.ComboPRFSJobCAT1.Value = a.Offset(0, 59).Value

'What branches of science does Nanotechnology use?
Nanotechnologies.txtPRBranchesFSRAW.Value = a.Offset(0, 60).Value
Nanotechnologies.ComboPRBranchesFSCAT1.Value = a.Offset(0, 61).Value
Nanotechnologies.ComboPRBranchesFSCAT2.Value = a.Offset(0, 62).Value
Nanotechnologies.ComboPRBranchesFSCAT3.Value = a.Offset(0, 63).Value
Nanotechnologies.ComboPRBranchesFSCAT4.Value = a.Offset(0, 64).Value

'Enter Fields for Post-Test 1
'Importance of science
Nanotechnologies.ComboP1DImportantSci.Value = a.Offset(0, 93).Value
Nanotechnologies.txtP1DImportantSciWhyRAW.Value = a.Offset(0, 94).Value
Nanotechnologies.ComboP1DImportantSciWhyCAT.Value = a.Offset(0, 95).Value

'Best School Subjects
Nanotechnologies.ComboP1DBestSubj1.Value = a.Offset(0, 96).Value
Nanotechnologies.ComboP1DBestSubj2.Value = a.Offset(0, 97).Value
Nanotechnologies.ComboP1DBestSubj3.Value = a.Offset(0, 98).Value
Nanotechnologies.ComboP1DBestSubj4.Value = a.Offset(0, 99).Value
Nanotechnologies.ComboP1DBestSubj5.Value = a.Offset(0, 100).Value
Nanotechnologies.ComboP1DBestSubj6.Value = a.Offset(0, 101).Value

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'VCE
If a.Offset(0, 120).Value = "Yes" Then
    Nanotechnologies.OptP1VCEYes.Value = True
End If

If a.Offset(0, 120).Value = "No" Then
    Nanotechnologies.OptP1VCENo.Value = False
End If

Nanotechnologies.txtP1VCECAT1.Value = a.Offset(0, 121).Value
Nanotechnologies.txtP1VCECAT2.Value = a.Offset(0, 122).Value
Nanotechnologies.txtP1VCECAT3.Value = a.Offset(0, 123).Value

'What is nanotechnology?
Nanotechnologies.txtP1DWhatisNTRAW.Value = a.Offset(0, 199).Value
Nanotechnologies.ComboP1DWhatisNTCAT.Value = a.Offset(0, 200).Value

'What topics of science does nanotechnology use?
Nanotechnologies.txtP1DBranchSciRAW.Value = a.Offset(0, 201).Value
Nanotechnologies.ComboP1DBranchSciCAT1.Value = a.Offset(0, 202).Value
Nanotechnologies.ComboP1DBranchSciCAT2.Value = a.Offset(0, 203).Value
Nanotechnologies.ComboP1DBranchSciCAT3.Value = a.Offset(0, 204).Value
Nanotechnologies.ComboP1DBranchSciCAT4.Value = a.Offset(0, 205).Value

'I learned about the following topics today:
If a.Offset(0, 206).Value = "Yes" Then
    Nanotechnologies.chkP1LearnedAboutTopics1.Value = True
End If

If a.Offset(0, 207).Value = "Yes" Then
    Nanotechnologies.chkP1LearnedAboutTopics2.Value = True
End If

If a.Offset(0, 208).Value = "Yes" Then
    Nanotechnologies.chkP1LearnedAboutTopics3.Value = True
End If

If a.Offset(0, 209).Value = "Yes" Then
    Nanotechnologies.chkP1LearnedAboutTopics4.Value = True
End If

If a.Offset(0, 210).Value = "Yes" Then
    Nanotechnologies.chkP1LearnedAboutTopics5.Value = True
End If

If a.Offset(0, 211).Value = "Yes" Then
    Nanotechnologies.chkP1LearnedAboutTopics6.Value = True
End If

'TOSRA Questions
Nanotechnologies.txtP1DHandsOnAct.Value = a.Offset(0, 102).Value
Nanotechnologies.txtP1DObsThink.Value = a.Offset(0, 103).Value
Nanotechnologies.txtP1DExpHelp.Value = a.Offset(0, 104).Value
Nanotechnologies.txtP1DPresent.Value = a.Offset(0, 105).Value
Nanotechnologies.txtP1DOverallProgram.Value = a.Offset(0, 106).Value
Nanotechnologies.txtP1DIntTVSci.Value = a.Offset(0, 107).Value
Nanotechnologies.txtP1DIntPrintSci.Value = a.Offset(0, 108).Value
Nanotechnologies.txtP1DIntOnlineSci.Value = a.Offset(0, 109).Value
Nanotechnologies.txtP1DIntLiveSci.Value = a.Offset(0, 110).Value
Nanotechnologies.txtP1DTOSRA_LearnOnOwn.Value = a.Offset(0, 111).Value

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Nanotechnologies.txtP1DTOSRA_IntSci.Value = a.Offset(0, 112).Value
Nanotechnologies.txtP1DTOSRA_SciClass.Value = a.Offset(0, 113).Value
Nanotechnologies.txtP1DTOSRA_NotEnjoyCareer.Value = a.Offset(0, 114).Value
Nanotechnologies.txtP1DTOSRA_NewTech.Value = a.Offset(0, 115).Value
Nanotechnologies.txtP1DTOSRA_SciKnow.Value = a.Offset(0, 116).Value
Nanotechnologies.txtP1DTOSRA_SciPositive.Value = a.Offset(0, 117).Value
Nanotechnologies.txtP1DTOSRA_SubjectKnow.Value = a.Offset(0, 118).Value
Nanotechnologies.txtP1DTOSRA_Function.Value = a.Offset(0, 119).Value

'CSIRO Programs

Nanotechnologies.txtP1DLikedProgram.Value = a.Offset(0, 124).Value
Nanotechnologies.ComboP1DLikedProgram.Value = a.Offset(0, 310).Value
Nanotechnologies.txtP1DNotLikedProgram.Value = a.Offset(0, 125).Value
Nanotechnologies.ComboP1DNotLikedProgram.Value = a.Offset(0, 311).Value

'Entry Fields for Post-Test 2

'Interest in Science Category

Nanotechnologies.ComboP2DGenInterest.Value = a.Offset(0, 221).Value
Nanotechnologies.ComboP2DSeekInfo.Value = a.Offset(0, 222).Value
Nanotechnologies.ComboP2DUnderstandInfo.Value = a.Offset(0, 223).Value

'TOSRA and Other Questions

Nanotechnologies.txtP2DKnowSci.Value = a.Offset(0, 226).Value
Nanotechnologies.txtP2DKnowSubj.Value = a.Offset(0, 227).Value
Nanotechnologies.txtP2DInterestSciTech.Value = a.Offset(0, 228).Value
Nanotechnologies.txtP2DInterestNewTech.Value = a.Offset(0, 229).Value
Nanotechnologies.txtP2DInterestEvery.Value = a.Offset(0, 230).Value

Nanotechnologies.txtP2DTOSRA_ToldvExp.Value = a.Offset(0, 240).Value
Nanotechnologies.txtP2DTOSRA_LivesBetter.Value = a.Offset(0, 241).Value
Nanotechnologies.txtP2DTOSRA_JobSci.Value = a.Offset(0, 242).Value
Nanotechnologies.txtP2DTOSRA_OutSchool.Value = a.Offset(0, 243).Value

'Favourite Topic in science?

Nanotechnologies.txtP2DLikeTypeSciRAW.Value = a.Offset(0, 231).Value
Nanotechnologies.ComboP2DLikeTypeSciCAT1.Value = a.Offset(0, 232).Value
Nanotechnologies.ComboP2DLikeTypeSciCAT2.Value = a.Offset(0, 233).Value
Nanotechnologies.ComboP2DLikeTypeSciCAT3.Value = a.Offset(0, 234).Value
Nanotechnologies.ComboP2DLikeTypeSciCAT4.Value = a.Offset(0, 235).Value

'School Subject You are best at?

Nanotechnologies.ComboP2DSchoolSubj1.Value = a.Offset(0, 236).Value
Nanotechnologies.ComboP2DSchoolSubj2.Value = a.Offset(0, 237).Value
Nanotechnologies.ComboP2DSchoolSubj3.Value = a.Offset(0, 238).Value
Nanotechnologies.ComboP2DSchoolSubj4.Value = a.Offset(0, 239).Value

'Name 1 Experiment

Nanotechnologies.txtP2DName1ExpRAW.Value = a.Offset(0, 351).Value
Nanotechnologies.ComboP2DName1ExpCAT.Value = a.Offset(0, 352).Value

'What stands out most?

Nanotechnologies.txtP2DStandOutRAW.Value = a.Offset(0, 353).Value
Nanotechnologies.ComboP2DStandOutCAT.Value = a.Offset(0, 354).Value

'Words and Phrases

Nanotechnologies.txtP2DWPPhaRAW1.Value = a.Offset(0, 244).Value
Nanotechnologies.txtP2DWPPhaRAW2.Value = a.Offset(0, 245).Value
Nanotechnologies.txtP2DWPPhaRAW3.Value = a.Offset(0, 246).Value
Nanotechnologies.txtP2DWPPhaRAW4.Value = a.Offset(0, 247).Value

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Nanotechnologies.ComboP2DWPhaCAT1.Value = a.Offset(0, 248).Value
Nanotechnologies.ComboP2DWPhaCAT2.Value = a.Offset(0, 249).Value
Nanotechnologies.ComboP2DWPhaCAT3.Value = a.Offset(0, 250).Value
Nanotechnologies.ComboP2DWPhaCAT4.Value = a.Offset(0, 251).Value

    'What is Nanotechnology?
Nanotechnologies.txtP2DWhatIsNTRAW.Value = a.Offset(0, 355).Value
Nanotechnologies.ComboP2DWhatIsNTCAT.Value = a.Offset(0, 356).Value

        Unload FindRecord
        Nanotechnologies.Show

    End If

    If a.Offset(0, -4).Value = "Materials and Structures" Then
        MaterialsandStructures.SID.Value = studentid
        MaterialsandStructures.optUpdate.Value = True
        'Entry Code for the PreTest
        MaterialsandStructures.DOB.Value = a.Offset(0, 1).Value
        MaterialsandStructures.MOB.Value = a.Offset(0, 2).Value
        MaterialsandStructures.YOB.Value = a.Offset(0, 3).Value

        'Gender
        If a.Offset(0, 5).Value = "Male" Then
            MaterialsandStructures.optPRMale.Value = True
        End If

        If a.Offset(0, 5).Value = "Female" Then
            MaterialsandStructures.optPRFemale.Value = True
        End If

        'English
        If a.Offset(0, 6).Value = "Yes" Then
            MaterialsandStructures.optPRYesEng.Value = True
        End If

        If a.Offset(0, 6).Value = "No" Then
            MaterialsandStructures.optPRNoEng.Value = True
        End If

        MaterialsandStructures.txtPROtherLang.Value = a.Offset(0, 7).Value

        'C Term Questions
        MaterialsandStructures.txtPRKnowScience.Value = a.Offset(0, 8).Value
        MaterialsandStructures.txtPRKnowSubj.Value = a.Offset(0, 9).Value
        MaterialsandStructures.txtPRInterestSciTech.Value = a.Offset(0, 10).Value
        MaterialsandStructures.txtPRInterestNewTech.Value = a.Offset(0, 11).Value
        MaterialsandStructures.txtPRInterestEvery.Value = a.Offset(0, 12).Value

        'TOSRA Questions
        MaterialsandStructures.txtPRTOSRA_ToldvExp.Value = a.Offset(0, 13).Value
        MaterialsandStructures.txtPRTOSRA_LivesBetter.Value = a.Offset(0, 14).Value
        MaterialsandStructures.txtPRTOSRA_JobSci.Value = a.Offset(0, 15).Value
        MaterialsandStructures.txtPRTOSRA_OutSchool.Value = a.Offset(0, 16).Value

        'Parents Work Field
        MaterialsandStructures.ComboPRParentsWork1.Value = a.Offset(0, 17).Value
        MaterialsandStructures.ComboPRParentsWork2.Value = a.Offset(0, 18).Value
        MaterialsandStructures.ComboPRParentsWork3.Value = a.Offset(0, 19).Value
        MaterialsandStructures.ComboPRParentsWork4.Value = a.Offset(0, 20).Value

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'Career Interests
MaterialsandStructures.ComboPR_CareerInt1.Value = a.Offset(0, 21).Value
MaterialsandStructures.ComboPR_CareerInt2.Value = a.Offset(0, 22).Value
MaterialsandStructures.ComboPR_CareerInt3.Value = a.Offset(0, 23).Value
MaterialsandStructures.ComboPR_CareerInt4.Value = a.Offset(0, 24).Value

'Words and Phrases
MaterialsandStructures.txtPRWPhaRAW1.Value = a.Offset(0, 25).Value
MaterialsandStructures.txtPRWPhaRAW2.Value = a.Offset(0, 26).Value
MaterialsandStructures.txtPRWPhaRAW3.Value = a.Offset(0, 27).Value
MaterialsandStructures.txtPRWPhaRAW4.Value = a.Offset(0, 28).Value

MaterialsandStructures.ComboPRWPhaCAT1.Value = a.Offset(0, 29).Value
MaterialsandStructures.ComboPRWPhaCAT2.Value = a.Offset(0, 30).Value
MaterialsandStructures.ComboPRWPhaCAT3.Value = a.Offset(0, 31).Value
MaterialsandStructures.ComboPRWPhaCAT4.Value = a.Offset(0, 32).Value

'Additional Questions for the Pre-Test
'Why Are you taking this course?
If a.Offset(0, 66).Value = "Interested in Subject Matter" Then
    MaterialsandStructures.chkPRTakeCourse1.Value = True
End If

If a.Offset(0, 67).Value = "Getting into University" Then
    MaterialsandStructures.chkPRTakeCourse2.Value = True
End If

If a.Offset(0, 68).Value = "I wanted a challenge" Then
    MaterialsandStructures.chkPRTakeCourse3.Value = True
End If

If a.Offset(0, 69).Value = "Needed an extra course" Then
    MaterialsandStructures.chkPRTakeCourse4.Value = True
End If

If a.Offset(0, 70).Value = "Pursue Career in Field" Then
    MaterialsandStructures.chkPRTakeCourse5.Value = True
End If

If a.Offset(0, 71).Value = "For Fun" Then
    MaterialsandStructures.chkPRTakeCourse6.Value = True
End If

If a.Offset(0, 72).Value = "Parents" Then
    MaterialsandStructures.chkPRTakeCourse7.Value = True
End If

MaterialsandStructures.txtPRTakeCourseOther.Value = a.Offset(0, 73).Value

'I have studied the following topics in class:
If a.Offset(0, 74).Value = "Stress" Then
    MaterialsandStructures.chkPRLearnStress.Value = True
End If

If a.Offset(0, 75).Value = "Strain" Then
    MaterialsandStructures.chkPRLearnStrain.Value = True
End If

If a.Offset(0, 76).Value = "Creep" Then
    MaterialsandStructures.chkPRLearnCreep.Value = True
End If

If a.Offset(0, 77).Value = "Elasticity" Then

```

```

        MaterialsandStructures.chkPRLearnElasticity.Value = True
    End If

    If a.Offset(0, 78).Value = "Toughness" Then
        MaterialsandStructures.chkPRLearnToughness.Value = True
    End If

    'What quantities are used to calculate Young's Modulus
    If a.Offset(0, 80).Value = "Strain" Then
        MaterialsandStructures.chkPRCalcStrain.Value = True
    End If

    If a.Offset(0, 81).Value = "Yield Strength" Then
        MaterialsandStructures.chkPRCalcYieldStrength.Value = True
    End If

    If a.Offset(0, 82).Value = "Elasticity" Then
        MaterialsandStructures.chkPRCalcElasticity.Value = True
    End If

    If a.Offset(0, 83).Value = "Stress" Then
        MaterialsandStructures.chkPRCalcStress.Value = True
    End If

    If a.Offset(0, 84).Value = "Temperature" Then
        MaterialsandStructures.chkPRCalcTemperature.Value = True
    End If

    'What material is more brittle?
    If a.Offset(0, 85).Value = "Glass" Then
        MaterialsandStructures.OptPRGlass.Value = True
    End If

    If a.Offset(0, 85).Value = "Aluminum" Then
        MaterialsandStructures.OptPRAluminum.Value = True
    End If

    'What is the elemental shape of a truss?
    MaterialsandStructures.txtPRElemShape.Value = a.Offset(0, 86).Value

    'Enter Fields for Post-Test 1
    'Importance of science
    MaterialsandStructures.ComboP1DImportantSci.Value = a.Offset(0, 93).Value
    MaterialsandStructures.txtP1DImportantSciWhyRAW.Value = a.Offset(0, 94).Value
    MaterialsandStructures.ComboP1DImportantSciWhyCAT.Value = a.Offset(0, 95).Value

    'Best School Subjects
    MaterialsandStructures.ComboP1DBestSubj1.Value = a.Offset(0, 96).Value
    MaterialsandStructures.ComboP1DBestSubj2.Value = a.Offset(0, 97).Value
    MaterialsandStructures.ComboP1DBestSubj3.Value = a.Offset(0, 98).Value
    MaterialsandStructures.ComboP1DBestSubj4.Value = a.Offset(0, 99).Value
    MaterialsandStructures.ComboP1DBestSubj5.Value = a.Offset(0, 100).Value
    MaterialsandStructures.ComboP1DBestSubj6.Value = a.Offset(0, 101).Value

    'TOSRA Questions
    MaterialsandStructures.txtP1DHandsOnAct.Value = a.Offset(0, 102).Value
    MaterialsandStructures.txtP1DObsThink.Value = a.Offset(0, 103).Value
    MaterialsandStructures.txtP1DExpHelp.Value = a.Offset(0, 104).Value
    MaterialsandStructures.txtP1DPresent.Value = a.Offset(0, 105).Value
    MaterialsandStructures.txtP1DOverallProgram.Value = a.Offset(0, 106).Value
    MaterialsandStructures.txtP1DIntTVSci.Value = a.Offset(0, 107).Value

```

```

MaterialsandStructures.txtP1DIntPrintSci.Value = a.Offset(0, 108).Value
MaterialsandStructures.txtP1DIntOnlineSci.Value = a.Offset(0, 109).Value
MaterialsandStructures.txtP1DIntLiveSci.Value = a.Offset(0, 110).Value
MaterialsandStructures.txtP1DTOSRA_LearnOnOwn.Value = a.Offset(0, 111).Value
MaterialsandStructures.txtP1DTOSRA_IntSci.Value = a.Offset(0, 112).Value
MaterialsandStructures.txtP1DTOSRA_SciClass.Value = a.Offset(0, 113).Value
MaterialsandStructures.txtP1DTOSRA_NotEnjoyCareer.Value = a.Offset(0, 114).Value
MaterialsandStructures.txtP1DTOSRA_NewTech.Value = a.Offset(0, 115).Value
MaterialsandStructures.txtP1DTOSRA_SciKnow.Value = a.Offset(0, 116).Value
MaterialsandStructures.txtP1DTOSRA_SciPositive.Value = a.Offset(0, 117).Value
MaterialsandStructures.txtP1DTOSRA_SubjectKnow.Value = a.Offset(0, 118).Value
MaterialsandStructures.txtP1DTOSRA_Function.Value = a.Offset(0, 119).Value

```

'CSIRO Programs

```

MaterialsandStructures.txtP1DLikedProgram.Value = a.Offset(0, 124).Value
MaterialsandStructures.ComboP1DLikedProgram.Value = a.Offset(0, 310).Value
MaterialsandStructures.txtP1DNotLikedProgram.Value = a.Offset(0, 125).Value
MaterialsandStructures.ComboP1DNotLikedProgram.Value = a.Offset(0, 311).Value

```

'Glass vs. Aluminum = True or False?

```

If a.Offset(0, 183).Value = "True" Then
    MaterialsandStructures.OptP1GlassTrue.Value = True
End If

```

```

If a.Offset(0, 183).Value = "False" Then
    MaterialsandStructures.OptP1GlassFalse.Value = True
End If

```

'Stress and Strain are used to calculate what quantity?

```

If a.Offset(0, 186).Value = "Toughness" Then
    MaterialsandStructures.chkP1DToughness.Value = True
End If

```

```

If a.Offset(0, 336).Value = "Yield Strength" Then
    MaterialsandStructures.chkP1DYStrength.Value = True
End If

```

```

If a.Offset(0, 337).Value = "Youngs Modulus" Then
    MaterialsandStructures.chkP1DYMod.Value = True
End If

```

```

If a.Offset(0, 338).Value = "Elasticity" Then
    MaterialsandStructures.chkP1DElasticity.Value = True
End If

```

'Entry Fields for Post-Test 2

'Interest in Science Category

```

MaterialsandStructures.ComboP2DGenInterest.Value = a.Offset(0, 221).Value
MaterialsandStructures.ComboP2DSeekInfo.Value = a.Offset(0, 222).Value
MaterialsandStructures.ComboP2DUnderstandInfo.Value = a.Offset(0, 223).Value

```

'TOSRA and Other Questions

```

MaterialsandStructures.txtP2DKnowSci.Value = a.Offset(0, 226).Value
MaterialsandStructures.txtP2DKnowSubj.Value = a.Offset(0, 227).Value
MaterialsandStructures.txtP2DInterestSciTech.Value = a.Offset(0, 228).Value
MaterialsandStructures.txtP2DInterestNewTech.Value = a.Offset(0, 229).Value
MaterialsandStructures.txtP2DInterestEvery.Value = a.Offset(0, 230).Value

```

```

MaterialsandStructures.txtP2DTOSRA_ToldvExp.Value = a.Offset(0, 240).Value
MaterialsandStructures.txtP2DTOSRA_LivesBetter.Value = a.Offset(0, 241).Value
MaterialsandStructures.txtP2DTOSRA_JobSci.Value = a.Offset(0, 242).Value

```

```
MaterialsandStructures.txtP2DTOSRA_OutSchool.Value = a.Offset(0, 243).Value
```

```
'I have studied the following topics in class:
```

```
If a.Offset(0, 290).Value = "Stress" Then  
    MaterialsandStructures.chkP2StudyStress.Value = True  
End If
```

```
If a.Offset(0, 291).Value = "Strain" Then  
    MaterialsandStructures.chkP2StudyStrain.Value = True  
End If
```

```
If a.Offset(0, 292).Value = "Creep" Then  
    MaterialsandStructures.chkP2StudyCreep.Value = True  
End If
```

```
If a.Offset(0, 293).Value = "Elasticity" Then  
    MaterialsandStructures.chkP2StudyElasticity.Value = True  
End If
```

```
If a.Offset(0, 294).Value = "Toughness" Then  
    MaterialsandStructures.chkP2StudyToughness.Value = True  
End If
```

```
'What quantities are used to calculate Young's Modulus
```

```
If a.Offset(0, 296).Value = "Strain" Then  
    MaterialsandStructures.chkP2CalcStrain.Value = True  
End If
```

```
If a.Offset(0, 297).Value = "Yield Strength" Then  
    MaterialsandStructures.chkP2CalcYieldStrength.Value = True  
End If
```

```
If a.Offset(0, 298).Value = "Elasticity" Then  
    MaterialsandStructures.chkP2CalcElasticity.Value = True  
End If
```

```
If a.Offset(0, 299).Value = "Stress" Then  
    MaterialsandStructures.chkP2CalcStress.Value = True  
End If
```

```
If a.Offset(0, 300).Value = "Temperature" Then  
    MaterialsandStructures.chkP2CalcTemperature.Value = True  
End If
```

```
'School Subject You are best at?
```

```
MaterialsandStructures.ComboP2DBestSubj1.Value = a.Offset(0, 236).Value  
MaterialsandStructures.ComboP2DBestSubj2.Value = a.Offset(0, 237).Value  
MaterialsandStructures.ComboP2DBestSubj3.Value = a.Offset(0, 238).Value  
MaterialsandStructures.ComboP2DBestSubj4.Value = a.Offset(0, 239).Value
```

```
'Check Offsets on these values
```

```
'Name 1 Experiment
```

```
MaterialsandStructures.txtP2DName1ExpRAW.Value = a.Offset(0, 286).Value  
MaterialsandStructures.ComboP2DName1ExpCAT.Value = a.Offset(0, 287).Value
```

```
'What stands out most?
```

```
MaterialsandStructures.txtP2DStandOutRAW.Value = a.Offset(0, 288).Value  
MaterialsandStructures.ComboP2DStandOutCAT.Value = a.Offset(0, 289).Value
```

```
'Words and Phrases
```

```
MaterialsandStructures.txtP2DWPPhaRAW1.Value = a.Offset(0, 244).Value  
MaterialsandStructures.txtP2DWPPhaRAW2.Value = a.Offset(0, 245).Value
```



```

MaterialsandStructures.txtP2DWPhaRAW3.Value = a.Offset(0, 246).Value
MaterialsandStructures.txtP2DWPhaRAW4.Value = a.Offset(0, 247).Value

MaterialsandStructures.ComboP2DWPhaCAT1.Value = a.Offset(0, 248).Value
MaterialsandStructures.ComboP2DWPhaCAT2.Value = a.Offset(0, 249).Value
MaterialsandStructures.ComboP2DWPhaCAT3.Value = a.Offset(0, 250).Value
MaterialsandStructures.ComboP2DWPhaCAT4.Value = a.Offset(0, 251).Value

        Unload FindRecord
        MaterialsandStructures.Show

    End If

        'MsgBox "Record " & studentid & " found.", vbInformation

    End If
Next a

If chkFound.Value = False Then
    MsgBox "Record not found.", vbExclamation, "Error"
End If

End Sub

```

Code for Forensic Frenzy:

Initialize Code to Load Drop-Down Menus:

```

Private Sub UserForm_Initialize()

Dim a, b, c, d, e, f, g, h, i, j, k, l, m, n, o As Variant
Dim studentid As String
Dim Record As Range

For Each a In Sheet4.Range("H4:H22")
    If a.Value <> "" Then
        ForensicFrenzyD.ComboP1DImportantSciWhyCAT.AddItem a.Value
    End If
Next a

For Each b In Sheet4.Range("M4:M22")
    If b.Value <> "" Then
        ForensicFrenzyD.ComboPRParentsWork1.AddItem b.Value
        ForensicFrenzyD.ComboPRParentsWork2.AddItem b.Value
        ForensicFrenzyD.ComboPRParentsWork3.AddItem b.Value
        ForensicFrenzyD.ComboPRParentsWork4.AddItem b.Value

        ForensicFrenzyD.ComboPR_CareerInt1.AddItem b.Value
        ForensicFrenzyD.ComboPR_CareerInt2.AddItem b.Value
        ForensicFrenzyD.ComboPR_CareerInt3.AddItem b.Value
        ForensicFrenzyD.ComboPR_CareerInt4.AddItem b.Value
    End If
Next b

For Each c In Sheet4.Range("R4:R22")
    If c.Value <> "" Then
        ForensicFrenzyD.ComboPRFSJobCAT1.AddItem c.Value
        ForensicFrenzyD.ComboPRFSJobCAT2.AddItem c.Value
    End If
Next c

```

```

ForensicFrenzyD.ComboPRFSJobCAT3.AddItem c.Value
ForensicFrenzyD.ComboPRFSJobCAT4.AddItem c.Value

ForensicFrenzyD.ComboP1DFSJobCAT1.AddItem c.Value
ForensicFrenzyD.ComboP1DFSJobCAT2.AddItem c.Value
ForensicFrenzyD.ComboP1DFSJobCAT3.AddItem c.Value
ForensicFrenzyD.ComboP1DFSJobCAT4.AddItem c.Value
End If
Next c

For Each d In Sheet4.Range("S4:S22")
If d.Value <> "" Then
ForensicFrenzyD.ComboPRBranchesFSCAT1.AddItem d.Value
ForensicFrenzyD.ComboPRBranchesFSCAT2.AddItem d.Value
ForensicFrenzyD.ComboPRBranchesFSCAT3.AddItem d.Value
ForensicFrenzyD.ComboPRBranchesFSCAT4.AddItem d.Value

ForensicFrenzyD.ComboP1DBranchSciCAT1.AddItem d.Value
ForensicFrenzyD.ComboP1DBranchSciCAT2.AddItem d.Value
ForensicFrenzyD.ComboP1DBranchSciCAT3.AddItem d.Value
ForensicFrenzyD.ComboP1DBranchSciCAT4.AddItem d.Value
End If
Next d

For Each e In Sheet4.Range("T4:T22")
If e.Value <> "" Then
ForensicFrenzyD.ComboPRFSCrimesCAT1.AddItem e.Value
ForensicFrenzyD.ComboPRFSCrimesCAT2.AddItem e.Value
ForensicFrenzyD.ComboPRFSCrimesCAT3.AddItem e.Value
ForensicFrenzyD.ComboPRFSCrimesCAT4.AddItem e.Value

ForensicFrenzyD.ComboP1DCrimesInvestCAT1.AddItem e.Value
ForensicFrenzyD.ComboP1DCrimesInvestCAT2.AddItem e.Value
ForensicFrenzyD.ComboP1DCrimesInvestCAT3.AddItem e.Value
ForensicFrenzyD.ComboP1DCrimesInvestCAT4.AddItem e.Value
End If
Next e

For Each f In Sheet4.Range("O4:O22")
If f.Value <> "" Then
ForensicFrenzyD.ComboP2DName1ExpCAT.AddItem f.Value
End If
Next f

For Each g In Sheet4.Range("P4:P22")
If g.Value <> "" Then
ForensicFrenzyD.ComboP2DStandOutCAT.AddItem g.Value
End If
Next g

For Each h In Sheet4.Range("Q4:Q22")
If h.Value <> "" Then
ForensicFrenzyD.ComboP2DCharactSuspectCAT1.AddItem h.Value
ForensicFrenzyD.ComboP2DCharactSuspectCAT2.AddItem h.Value
ForensicFrenzyD.ComboP2DCharactSuspectCAT3.AddItem h.Value
ForensicFrenzyD.ComboP2DCharactSuspectCAT4.AddItem h.Value
End If
Next h

For Each i In Sheet4.Range("N4:N22")
If i.Value <> "" Then
ForensicFrenzyD.ComboP2DLikeTypeSciCAT1.AddItem i.Value
ForensicFrenzyD.ComboP2DLikeTypeSciCAT2.AddItem i.Value

```

```

        ForensicFrenzyD.ComboP2DLikeTypeSciCAT3.AddItem i.Value
        ForensicFrenzyD.ComboP2DLikeTypeSciCAT4.AddItem i.Value
    End If
Next i

For Each j In Sheet4.Range("L4:L22")
    If j.Value <> "" Then
        ForensicFrenzyD.ComboP2DSchoolSubj1.AddItem j.Value
        ForensicFrenzyD.ComboP2DSchoolSubj2.AddItem j.Value
        ForensicFrenzyD.ComboP2DSchoolSubj3.AddItem j.Value
        ForensicFrenzyD.ComboP2DSchoolSubj4.AddItem j.Value

        ForensicFrenzyD.ComboP1DBestSubj1.AddItem j.Value
        ForensicFrenzyD.ComboP1DBestSubj2.AddItem j.Value
        ForensicFrenzyD.ComboP1DBestSubj3.AddItem j.Value
        ForensicFrenzyD.ComboP1DBestSubj4.AddItem j.Value
        ForensicFrenzyD.ComboP1DBestSubj5.AddItem j.Value
        ForensicFrenzyD.ComboP1DBestSubj6.AddItem j.Value
    End If
Next j

For Each k In Sheet4.Range("J4:J22")
    If k.Value <> "" Then
        ForensicFrenzyD.ComboP1DLikedProgram.AddItem k.Value
    End If
Next k

For Each l In Sheet4.Range("K4:K22")
    If l.Value <> "" Then
        ForensicFrenzyD.ComboP1DNotLikedProgram.AddItem l.Value
    End If
Next l

For Each m In Sheet4.Range("AH4:AH22")
    If m.Value <> "" Then
        ForensicFrenzyD.ComboP2DGenInterest.AddItem m.Value
    End If
Next m

For Each n In Sheet4.Range("AI4:AI22")
    If n.Value <> "" Then
        ForensicFrenzyD.ComboP2DSeekInfo.AddItem n.Value
    End If
Next n

For Each o In Sheet4.Range("AJ4:AJ22")
    If o.Value <> "" Then
        ForensicFrenzyD.ComboP2DUnderstandInfo.AddItem o.Value
    End If
Next o

For Each p In Sheet4.Range("AK4:AK22")
    If p.Value <> "" Then
        ForensicFrenzyD.ComboP1DImportantSci.AddItem p.Value
    End If
Next p

For Each q In Sheet4.Range("AL4:AL22")
    If q.Value <> "" Then
        ForensicFrenzyD.ComboPRWPhaCAT1.AddItem q.Value
        ForensicFrenzyD.ComboPRWPhaCAT2.AddItem q.Value
        ForensicFrenzyD.ComboPRWPhaCAT3.AddItem q.Value
        ForensicFrenzyD.ComboPRWPhaCAT4.AddItem q.Value
    End If
Next q

```

```

        ForensicFrenzyD.ComboP2DWPhaCAT1.AddItem q.Value
        ForensicFrenzyD.ComboP2DWPhaCAT2.AddItem q.Value
        ForensicFrenzyD.ComboP2DWPhaCAT3.AddItem q.Value
        ForensicFrenzyD.ComboP2DWPhaCAT4.AddItem q.Value
    End If
Next q

```

```
End Sub
```

Enter/Update Code:

```

Private Sub cmdEnter_Click()

    Dim j, studentno As Integer
    Dim studentid As String
    Dim Record As Range

    If optNew.Value = True Then

        For Each a In Sheet2.Range("E8:E1000")
            If a.Value = "" Then
                a.Value = ForensicFrenzyD.SID.Value
                j = a.Offset(-1, -2).Value
                a.Offset(0, -2).Value = j + 1
                studentno = a.Offset(0, -2).Value
                a.Offset(0, -4).Value = Program.Value
                a.Offset(0, -3).Value = College.Value
                a.Value = ForensicFrenzyD.SID.Value & "-" & studentno
                studentid = a.Value

                'Entry Code for the PreTest
                a.Offset(0, 1).Value = DOB.Value
                a.Offset(0, 2).Value = MOB.Value
                a.Offset(0, 3).Value = YOY.Value

                'Gender
                If optPRMale.Value = True Then
                    a.Offset(0, 5).Value = "Male"
                End If

                If optPRFemale.Value = True Then
                    a.Offset(0, 5).Value = "Female"
                End If

                'English
                If optPRYesEng.Value = True Then
                    a.Offset(0, 6).Value = "Yes"
                End If

                If optPRNoEng.Value = True Then
                    a.Offset(0, 6).Value = "No"
                End If

                a.Offset(0, 7).Value = txtPROtherLang.Value

                'C Term Questions
            End If
        Next a
    End If
End Sub

```

```

a.Offset(0, 8).Value = txtPRKnowScience.Value
a.Offset(0, 9).Value = txtPRKnowSubj.Value
a.Offset(0, 10).Value = txtPRInterestSciTech.Value
a.Offset(0, 11).Value = txtPRInterestNewTech.Value
a.Offset(0, 12).Value = txtPRInterestEvery.Value

'TOSRA Questions
a.Offset(0, 13).Value = txtPRTOSRA_ToldvExp.Value
a.Offset(0, 14).Value = txtPRTOSRA_LivesBetter.Value
a.Offset(0, 15).Value = txtPRTOSRA_JobSci.Value
a.Offset(0, 16).Value = txtPRTOSRA_OutSchool.Value

'Parents Work Field
a.Offset(0, 17).Value = ComboPRParentsWork1.Value
a.Offset(0, 18).Value = ComboPRParentsWork2.Value
a.Offset(0, 19).Value = ComboPRParentsWork3.Value
a.Offset(0, 20).Value = ComboPRParentsWork4.Value

'Career Interests
a.Offset(0, 21).Value = ComboPR_CareerInt1.Value
a.Offset(0, 22).Value = ComboPR_CareerInt2.Value
a.Offset(0, 23).Value = ComboPR_CareerInt3.Value
a.Offset(0, 24).Value = ComboPR_CareerInt4.Value

'Words and Phrases
a.Offset(0, 25).Value = txtPRWPhaRAW1.Value
a.Offset(0, 26).Value = txtPRWPhaRAW2.Value
a.Offset(0, 27).Value = txtPRWPhaRAW3.Value
a.Offset(0, 28).Value = txtPRWPhaRAW4.Value

a.Offset(0, 29).Value = ComboPRWPhaCAT1.Value
a.Offset(0, 30).Value = ComboPRWPhaCAT2.Value
a.Offset(0, 31).Value = ComboPRWPhaCAT3.Value
a.Offset(0, 32).Value = ComboPRWPhaCAT4.Value

'What does a Forensic Scientist Do?
a.Offset(0, 33).Value = txtPRFSJobRAW.Value
a.Offset(0, 34).Value = ComboPRFSJobCAT1.Value
a.Offset(0, 35).Value = ComboPRFSJobCAT2.Value
a.Offset(0, 36).Value = ComboPRFSJobCAT3.Value
a.Offset(0, 37).Value = ComboPRFSJobCAT4.Value

'What branches of science does a Forensics Scientist use?
a.Offset(0, 38).Value = txtPRBranchesFSRAW.Value
a.Offset(0, 39).Value = ComboPRBranchesFSCAT1.Value
a.Offset(0, 40).Value = ComboPRBranchesFSCAT2.Value
a.Offset(0, 41).Value = ComboPRBranchesFSCAT3.Value
a.Offset(0, 42).Value = ComboPRBranchesFSCAT4.Value

'What crimes do forensic scientists solve?
a.Offset(0, 43).Value = txtPRFSCrimesRAW.Value
a.Offset(0, 44).Value = ComboPRFSCrimesCAT1.Value
a.Offset(0, 45).Value = ComboPRFSCrimesCAT2.Value
a.Offset(0, 46).Value = ComboPRFSCrimesCAT3.Value
a.Offset(0, 47).Value = ComboPRFSCrimesCAT4.Value

'Enter Fields for Post-Test 1
'Importance of science
a.Offset(0, 93).Value = ComboP1DImportantSci.Value
a.Offset(0, 94).Value = txtP1DImportantSciWhyRAW.Value
a.Offset(0, 95).Value = ComboP1DImportantSciWhyCAT.Value

```

```

'Best School Subjects
a.Offset(0, 96).Value = ComboP1DBestSubj1.Value
a.Offset(0, 97).Value = ComboP1DBestSubj2.Value
a.Offset(0, 98).Value = ComboP1DBestSubj3.Value
a.Offset(0, 99).Value = ComboP1DBestSubj4.Value
a.Offset(0, 100).Value = ComboP1DBestSubj5.Value
a.Offset(0, 101).Value = ComboP1DBestSubj6.Value

'VCE
If OptP1DVCEYes.Value = True Then
    a.Offset(0, 120).Value = "Yes"
End If

If OptP1DVCENo.Value = False Then
    a.Offset(0, 120).Value = "No"
End If

a.Offset(0, 121).Value = txtP1DVCECAT1.Value
a.Offset(0, 122).Value = txtP1DVCECAT2.Value
a.Offset(0, 123).Value = txtP1DVCECAT3.Value

'What do FS do?
a.Offset(0, 129).Value = txtP1DFSJobRAW.Value
a.Offset(0, 339).Value = ComboP1DFSJobCAT1.Value
a.Offset(0, 340).Value = ComboP1DFSJobCAT2.Value
a.Offset(0, 341).Value = ComboP1DFSJobCAT3.Value
a.Offset(0, 342).Value = ComboP1DFSJobCAT4.Value

'What branches of science?
a.Offset(0, 130).Value = txtP1DBranchSciRAW.Value
a.Offset(0, 131).Value = ComboP1DBranchSciCAT1.Value
a.Offset(0, 132).Value = ComboP1DBranchSciCAT2.Value
a.Offset(0, 133).Value = ComboP1DBranchSciCAT3.Value
a.Offset(0, 134).Value = ComboP1DBranchSciCAT4.Value

'What Crimes for FS solve?
a.Offset(0, 135).Value = txtP1DCrimesInvestRAW.Value
a.Offset(0, 136).Value = ComboP1DCrimesInvestCAT1.Value
a.Offset(0, 137).Value = ComboP1DCrimesInvestCAT2.Value
a.Offset(0, 138).Value = ComboP1DCrimesInvestCAT3.Value
a.Offset(0, 139).Value = ComboP1DCrimesInvestCAT4.Value

'TOSRA Questions
a.Offset(0, 102).Value = txtP1DHandsOnAct.Value
a.Offset(0, 103).Value = txtP1DObsThink.Value
a.Offset(0, 104).Value = txtP1DExpHelp.Value
a.Offset(0, 105).Value = txtP1DPresent.Value
a.Offset(0, 106).Value = txtP1DOverallProgram.Value
a.Offset(0, 107).Value = txtP1DIntTVSci.Value
a.Offset(0, 108).Value = txtP1DIntPrintSci.Value
a.Offset(0, 109).Value = txtP1DIntOnlineSci.Value
a.Offset(0, 110).Value = txtP1DIntLiveSci.Value
a.Offset(0, 111).Value = txtP1DTOSRA_LearnOnOwn.Value
a.Offset(0, 112).Value = txtP1DTOSRA_IntSci.Value
a.Offset(0, 113).Value = txtP1DTOSRA_SciClass.Value
a.Offset(0, 114).Value = txtP1DTOSRA_NotEnjoyCareer.Value
a.Offset(0, 115).Value = txtP1DTOSRA_NewTech.Value
a.Offset(0, 116).Value = txtP1DTOSRA_SciKnow.Value
a.Offset(0, 117).Value = txtP1DTOSRA_SciPositive.Value
a.Offset(0, 118).Value = txtP1DTOSRA_SubjectKnow.Value
a.Offset(0, 119).Value = txtP1DTOSRA_Function.Value

```

```

'CSIRO Programs
a.Offset(0, 124).Value = txtP1DLikedProgram.Value
a.Offset(0, 310).Value = ComboP1DLikedProgram.Value
a.Offset(0, 125).Value = txtP1DNotLikedProgram.Value
a.Offset(0, 311).Value = ComboP1DNotLikedProgram.Value

'Entry Fields for Post-Test 2
'Interest in Science Category
a.Offset(0, 221).Value = ComboP2DGenInterest.Value
a.Offset(0, 222).Value = ComboP2DSeekInfo.Value
a.Offset(0, 223).Value = ComboP2DUnderstandInfo.Value

'Logic Block for Determining D Term Category
If ComboP2DGenInterest.Value = "Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        If ComboP2DUnderstandInfo.Value = "Do Understand" Then
            a.Offset(0, 224).Value = "Interested, Seek info, understand"
        End If

        If ComboP2DUnderstandInfo.Value = "Do Not Understand" Then
            a.Offset(0, 224).Value = "Interested, seek info, do not
understand"
        End If
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        a.Offset(0, 224).Value = "Interested, Do Not Seek Info"
    End If
End If

If ComboP2DGenInterest.Value = "Neutral" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        a.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        a.Offset(0, 224).Value = "Neutral, do not seek info"
    End If
End If

If ComboP2DGenInterest.Value = "Not Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        a.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        a.Offset(0, 224).Value = "Not Interested, do not seek info"
    End If
End If

'Logic Block for Determining C Term Category
If ComboP2DGenInterest.Value = "Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        a.Offset(0, 225).Value = "Interested, seek info"
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        a.Offset(0, 225).Value = "Interested, Do Not Seek Info"
    End If
End If

```

```

    If ComboP2DGenInterest.Value = "Neutral" Then
        a.Offset(0, 225).Value = "Neutral and do not seek info"
    End If

    If ComboP2DGenInterest.Value = "Not Interested" Then
        a.Offset(0, 225).Value = "Not interested"
    End If

'Learned About Topics
If chkP2DLearnedAboutTopics1.Value = True Then
    a.Offset(0, 272).Value = "Yes"
End If

If chkP2DLearnedAboutTopics2.Value = True Then
    a.Offset(0, 273).Value = "Yes"
End If

If chkP2DLearnedAboutTopics3.Value = True Then
    a.Offset(0, 274).Value = "Yes"
End If

If chkP2DLearnedAboutTopics4.Value = True Then
    a.Offset(0, 275).Value = "Yes"
End If

If chkP2DLearnedAboutTopics5.Value = True Then
    a.Offset(0, 276).Value = "Yes"
End If

If chkP2DLearnedAboutTopics6.Value = True Then
    a.Offset(0, 277).Value = "Yes"
End If

If chkP2DLearnedAboutTopics7.Value = True Then
    a.Offset(0, 278).Value = "Yes"
End If

If chkP2DLearnedAboutTopics8.Value = True Then
    a.Offset(0, 279).Value = "Yes"
End If

If chkP2DLearnedAboutTopics9.Value = True Then
    a.Offset(0, 280).Value = "Yes"
End If

'TOSRA and Other Questions
a.Offset(0, 226).Value = txtP2DKnowSci.Value
a.Offset(0, 227).Value = txtP2DKnowSubj.Value
a.Offset(0, 228).Value = txtP2DInterestSciTech.Value
a.Offset(0, 229).Value = txtP2DInterestNewTech.Value
a.Offset(0, 230).Value = txtP2DInterestEvery.Value

a.Offset(0, 240).Value = txtP2DTOSRA_ToldvExp.Value
a.Offset(0, 241).Value = txtP2DTOSRA_LivesBetter.Value
a.Offset(0, 242).Value = txtP2DTOSRA_JobSci.Value
a.Offset(0, 243).Value = txtP2DTOSRA_OutSchool.Value

'Favourite Topic in science?
a.Offset(0, 231).Value = txtP2DLikeTypeSciRAW.Value
a.Offset(0, 232).Value = ComboP2DLikeTypeSciCAT1.Value
a.Offset(0, 233).Value = ComboP2DLikeTypeSciCAT2.Value
a.Offset(0, 234).Value = ComboP2DLikeTypeSciCAT3.Value
a.Offset(0, 235).Value = ComboP2DLikeTypeSciCAT4.Value

```



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'School Subject You are best at?
a.Offset(0, 236).Value = ComboP2DSchoolSubj1.Value
a.Offset(0, 237).Value = ComboP2DSchoolSubj2.Value
a.Offset(0, 238).Value = ComboP2DSchoolSubj3.Value
a.Offset(0, 239).Value = ComboP2DSchoolSubj4.Value

'Name 1 Experiment
a.Offset(0, 281).Value = txtP2DName1ExpRAW.Value
a.Offset(0, 282).Value = ComboP2DName1ExpCAT.Value

'What stands out most?
a.Offset(0, 283).Value = txtP2DStandOutRAW.Value
a.Offset(0, 284).Value = ComboP2DStandOutCAT.Value

'Words and Phrases
a.Offset(0, 244).Value = txtP2DWPPhaRAW1.Value
a.Offset(0, 245).Value = txtP2DWPPhaRAW2.Value
a.Offset(0, 246).Value = txtP2DWPPhaRAW3.Value
a.Offset(0, 247).Value = txtP2DWPPhaRAW4.Value

a.Offset(0, 248).Value = ComboP2DWPPhaCAT1.Value
a.Offset(0, 249).Value = ComboP2DWPPhaCAT2.Value
a.Offset(0, 250).Value = ComboP2DWPPhaCAT3.Value
a.Offset(0, 251).Value = ComboP2DWPPhaCAT4.Value

'What Physical Characteristics can ID a suspect?
a.Offset(0, 260).Value = txtP2DCharactSuspectRAW.Value
a.Offset(0, 261).Value = ComboP2DCharactSuspectCAT1.Value
a.Offset(0, 262).Value = ComboP2DCharactSuspectCAT2.Value
a.Offset(0, 263).Value = ComboP2DCharactSuspectCAT3.Value

Exit For
End If
Next a

'Write in entry code for all of the fields

MsgBox "Record for student " & studentid & " has been entered.", vbInformation
End If

If optUpdate.Value = True Then
studentid = SID.Value
For Each b In Sheet2.Range("E8:E1000")
    If b.Value = studentid Then

'Entry Code for the PreTest
        b.Offset(0, 1).Value = DOB.Value
        b.Offset(0, 2).Value = MOB.Value
        b.Offset(0, 3).Value = YOB.Value

        'Gender
        If optPRMale.Value = True Then
            b.Offset(0, 5).Value = "Male"
        End If

        If optPRFemale.Value = True Then
            b.Offset(0, 5).Value = "Female"
        End If

        'English

```

```

If optPRYesEng.Value = True Then
    b.Offset(0, 6).Value = "Yes"
End If

If optPRNoEng.Value = True Then
    b.Offset(0, 6).Value = "No"
End If

b.Offset(0, 7).Value = txtPROtherLang.Value

'C Term Questions
b.Offset(0, 8).Value = txtPRKnowScience.Value
b.Offset(0, 9).Value = txtPRKnowSubj.Value
b.Offset(0, 10).Value = txtPRInterestSciTech.Value
b.Offset(0, 11).Value = txtPRInterestNewTech.Value
b.Offset(0, 12).Value = txtPRInterestEvery.Value

'TOSRA Questions
b.Offset(0, 13).Value = txtPRTOSRA_ToldvExp.Value
b.Offset(0, 14).Value = txtPRTOSRA_LivesBetter.Value
b.Offset(0, 15).Value = txtPRTOSRA_JobSci.Value
b.Offset(0, 16).Value = txtPRTOSRA_OutSchool.Value

'Parents Work Field
b.Offset(0, 17).Value = ComboPRParentsWork1.Value
b.Offset(0, 18).Value = ComboPRParentsWork2.Value
b.Offset(0, 19).Value = ComboPRParentsWork3.Value
b.Offset(0, 20).Value = ComboPRParentsWork4.Value

'Career Interests
b.Offset(0, 21).Value = ComboPR_CareerInt1.Value
b.Offset(0, 22).Value = ComboPR_CareerInt2.Value
b.Offset(0, 23).Value = ComboPR_CareerInt3.Value
b.Offset(0, 24).Value = ComboPR_CareerInt4.Value

'Words and Phrases
b.Offset(0, 25).Value = txtPRWPhaRAW1.Value
b.Offset(0, 26).Value = txtPRWPhaRAW2.Value
b.Offset(0, 27).Value = txtPRWPhaRAW3.Value
b.Offset(0, 28).Value = txtPRWPhaRAW4.Value

b.Offset(0, 29).Value = ComboPRWPhaCAT1.Value
b.Offset(0, 30).Value = ComboPRWPhaCAT2.Value
b.Offset(0, 31).Value = ComboPRWPhaCAT3.Value
b.Offset(0, 32).Value = ComboPRWPhaCAT4.Value

'What does a Forensic Scientist Do?
b.Offset(0, 33).Value = txtPRFSJobRAW.Value
b.Offset(0, 34).Value = ComboPRFSJobCAT1.Value
b.Offset(0, 35).Value = ComboPRFSJobCAT2.Value
b.Offset(0, 36).Value = ComboPRFSJobCAT3.Value
b.Offset(0, 37).Value = ComboPRFSJobCAT4.Value

'What branches of science does a Forensics Scientist use?
b.Offset(0, 38).Value = txtPRBranchesFSRAW.Value
b.Offset(0, 39).Value = ComboPRBranchesFSCAT1.Value
b.Offset(0, 40).Value = ComboPRBranchesFSCAT2.Value
b.Offset(0, 41).Value = ComboPRBranchesFSCAT3.Value
b.Offset(0, 42).Value = ComboPRBranchesFSCAT4.Value

'What crimes do forensic scientists solve?
b.Offset(0, 43).Value = txtPRFSCrimesRAW.Value

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b.Offset(0, 44).Value = ComboPRFSCrimesCAT1.Value
b.Offset(0, 45).Value = ComboPRFSCrimesCAT2.Value
b.Offset(0, 46).Value = ComboPRFSCrimesCAT3.Value
b.Offset(0, 47).Value = ComboPRFSCrimesCAT4.Value

'Enter Fields for Post-Test 1
  'Importance of science
  b.Offset(0, 93).Value = ComboP1DImportantSci.Value
  b.Offset(0, 94).Value = txtP1DImportantSciWhyRAW.Value
  b.Offset(0, 95).Value = ComboP1DImportantSciWhyCAT.Value

  'Best School Subjects
  b.Offset(0, 96).Value = ComboP1DBestSubj1.Value
  b.Offset(0, 97).Value = ComboP1DBestSubj2.Value
  b.Offset(0, 98).Value = ComboP1DBestSubj3.Value
  b.Offset(0, 99).Value = ComboP1DBestSubj4.Value
  b.Offset(0, 100).Value = ComboP1DBestSubj5.Value
  b.Offset(0, 101).Value = ComboP1DBestSubj6.Value

  'VCE
  If OptP1DVCEYes.Value = True Then
    b.Offset(0, 120).Value = "Yes"
  End If

  If OptP1DVCENo.Value = False Then
    b.Offset(0, 120).Value = "No"
  End If

  b.Offset(0, 121).Value = txtP1DVCECAT1.Value
  b.Offset(0, 122).Value = txtP1DVCECAT2.Value
  b.Offset(0, 123).Value = txtP1DVCECAT3.Value

  'What do FS do?
  b.Offset(0, 129).Value = txtP1DFSJobRAW.Value
  b.Offset(0, 339).Value = ComboP1DFSJobCAT1.Value
  b.Offset(0, 340).Value = ComboP1DFSJobCAT2.Value
  b.Offset(0, 341).Value = ComboP1DFSJobCAT3.Value
  b.Offset(0, 342).Value = ComboP1DFSJobCAT4.Value

  'What branches of science?
  b.Offset(0, 130).Value = txtP1DBranchSciRAW.Value
  b.Offset(0, 131).Value = ComboP1DBranchSciCAT1.Value
  b.Offset(0, 132).Value = ComboP1DBranchSciCAT2.Value
  b.Offset(0, 133).Value = ComboP1DBranchSciCAT3.Value
  b.Offset(0, 134).Value = ComboP1DBranchSciCAT4.Value

  'What Crimes for FS solve?
  b.Offset(0, 135).Value = txtP1DCrimesInvestRAW.Value
  b.Offset(0, 136).Value = ComboP1DCrimesInvestCAT1.Value
  b.Offset(0, 137).Value = ComboP1DCrimesInvestCAT2.Value
  b.Offset(0, 138).Value = ComboP1DCrimesInvestCAT3.Value
  b.Offset(0, 139).Value = ComboP1DCrimesInvestCAT4.Value

  'TOSRA Questions
  b.Offset(0, 102).Value = txtP1DHandsOnAct.Value
  b.Offset(0, 103).Value = txtP1DObsThink.Value
  b.Offset(0, 104).Value = txtP1DExpHelp.Value
  b.Offset(0, 105).Value = txtP1DPresent.Value
  b.Offset(0, 106).Value = txtP1DOverallProgram.Value
  b.Offset(0, 107).Value = txtP1DIntTVSci.Value
  b.Offset(0, 108).Value = txtP1DIntPrintSci.Value
  b.Offset(0, 109).Value = txtP1DIntOnlineSci.Value

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b.Offset(0, 110).Value = txtP1DIntLiveSci.Value
b.Offset(0, 111).Value = txtP1DTOSRA_LearnOnOwn.Value
b.Offset(0, 112).Value = txtP1DTOSRA_IntSci.Value
b.Offset(0, 113).Value = txtP1DTOSRA_SciClass.Value
b.Offset(0, 114).Value = txtP1DTOSRA_NotEnjoyCareer.Value
b.Offset(0, 115).Value = txtP1DTOSRA_NewTech.Value
b.Offset(0, 116).Value = txtP1DTOSRA_SciKnow.Value
b.Offset(0, 117).Value = txtP1DTOSRA_SciPositive.Value
b.Offset(0, 118).Value = txtP1DTOSRA_SubjectKnow.Value
b.Offset(0, 119).Value = txtP1DTOSRA_Function.Value

'CSIRO Programs
b.Offset(0, 124).Value = txtP1DLikedProgram.Value
b.Offset(0, 310).Value = ComboP1DLikedProgram.Value
b.Offset(0, 125).Value = txtP1DNotLikedProgram.Value
b.Offset(0, 311).Value = ComboP1DNotLikedProgram.Value

'Entry Fields for Post-Test 2
'Interest in Science Category
b.Offset(0, 221).Value = ComboP2DGenInterest.Value
b.Offset(0, 222).Value = ComboP2DSeekInfo.Value
b.Offset(0, 223).Value = ComboP2DUnderstandInfo.Value

'Logic Block for Determining D Term Category
If ComboP2DGenInterest.Value = "Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        If ComboP2DUnderstandInfo.Value = "Do Understand" Then
            b.Offset(0, 224).Value = "Interested, Seek info, understand"
        End If

        If ComboP2DUnderstandInfo.Value = "Do Not Understand" Then
            b.Offset(0, 224).Value = "Interested, seek info, do not
understand"
        End If
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        b.Offset(0, 224).Value = "Interested, Do Not Seek Info"
    End If
End If

If ComboP2DGenInterest.Value = "Neutral" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        b.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        b.Offset(0, 224).Value = "Neutral, do not seek info"
    End If
End If

If ComboP2DGenInterest.Value = "Not Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        b.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        b.Offset(0, 224).Value = "Not Interested, do not seek info"
    End If
End If

'Logic Block for Determining C Term Category

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```

If ComboP2DGenInterest.Value = "Interested" Then
  If ComboP2DSeekInfo.Value = "Seek Info" Then
    b.Offset(0, 225).Value = "Interested, seek info"
  End If

  If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
    b.Offset(0, 225).Value = "Interested, Do Not Seek Info"
  End If
End If

If ComboP2DGenInterest.Value = "Neutral" Then
  b.Offset(0, 225).Value = "Neutral and do not seek info"
End If

If ComboP2DGenInterest.Value = "Not Interested" Then
  b.Offset(0, 225).Value = "Not interested"
End If

'Learned About Topics
If chkP2DLearnedAboutTopics1.Value = True Then
  b.Offset(0, 272).Value = "Yes"
End If

If chkP2DLearnedAboutTopics2.Value = True Then
  b.Offset(0, 273).Value = "Yes"
End If

If chkP2DLearnedAboutTopics3.Value = True Then
  b.Offset(0, 274).Value = "Yes"
End If

If chkP2DLearnedAboutTopics4.Value = True Then
  b.Offset(0, 275).Value = "Yes"
End If

If chkP2DLearnedAboutTopics5.Value = True Then
  b.Offset(0, 276).Value = "Yes"
End If

If chkP2DLearnedAboutTopics6.Value = True Then
  b.Offset(0, 277).Value = "Yes"
End If

If chkP2DLearnedAboutTopics7.Value = True Then
  b.Offset(0, 278).Value = "Yes"
End If

If chkP2DLearnedAboutTopics8.Value = True Then
  b.Offset(0, 279).Value = "Yes"
End If

If chkP2DLearnedAboutTopics9.Value = True Then
  b.Offset(0, 280).Value = "Yes"
End If

'TOSRA and Other Questions
b.Offset(0, 226).Value = txtP2DKnowSci.Value
b.Offset(0, 227).Value = txtP2DKnowSubj.Value
b.Offset(0, 228).Value = txtP2DInterestSciTech.Value
b.Offset(0, 229).Value = txtP2DInterestNewTech.Value
b.Offset(0, 230).Value = txtP2DInterestEvery.Value

b.Offset(0, 240).Value = txtP2DTOSRA_ToldvExp.Value

```

```

b.Offset(0, 241).Value = txtP2DTOSRA_LivesBetter.Value
b.Offset(0, 242).Value = txtP2DTOSRA_JobSci.Value
b.Offset(0, 243).Value = txtP2DTOSRA_OutSchool.Value

'Favourite Topic in science?
b.Offset(0, 231).Value = txtP2DLikeTypeSciRAW.Value
b.Offset(0, 232).Value = ComboP2DLikeTypeSciCAT1.Value
b.Offset(0, 233).Value = ComboP2DLikeTypeSciCAT2.Value
b.Offset(0, 234).Value = ComboP2DLikeTypeSciCAT3.Value
b.Offset(0, 235).Value = ComboP2DLikeTypeSciCAT4.Value

'School Subject You are best at?
b.Offset(0, 236).Value = ComboP2DSchoolSubj1.Value
b.Offset(0, 237).Value = ComboP2DSchoolSubj2.Value
b.Offset(0, 238).Value = ComboP2DSchoolSubj3.Value
b.Offset(0, 239).Value = ComboP2DSchoolSubj4.Value

'Name 1 Experiment
b.Offset(0, 281).Value = txtP2DName1ExpRAW.Value
b.Offset(0, 282).Value = ComboP2DName1ExpCAT.Value

'What stands out most?
b.Offset(0, 283).Value = txtP2DStandOutRAW.Value
b.Offset(0, 284).Value = ComboP2DStandOutCAT.Value

'Words and Phrases
b.Offset(0, 244).Value = txtP2DWPPhaRAW1.Value
b.Offset(0, 245).Value = txtP2DWPPhaRAW2.Value
b.Offset(0, 246).Value = txtP2DWPPhaRAW3.Value
b.Offset(0, 247).Value = txtP2DWPPhaRAW4.Value

b.Offset(0, 248).Value = ComboP2DWPPhaCAT1.Value
b.Offset(0, 249).Value = ComboP2DWPPhaCAT2.Value
b.Offset(0, 250).Value = ComboP2DWPPhaCAT3.Value
b.Offset(0, 251).Value = ComboP2DWPPhaCAT4.Value

'What Physical Characteristics can ID a suspect?
b.Offset(0, 260).Value = txtP2DCharactSuspectRAW.Value
b.Offset(0, 261).Value = ComboP2DCharactSuspectCAT1.Value
b.Offset(0, 262).Value = ComboP2DCharactSuspectCAT2.Value
b.Offset(0, 263).Value = ComboP2DCharactSuspectCAT3.Value

Exit For

End If
Next b

End If

Unload ForensicFrenzyD

End Sub

```

Code for Cool Chemical Science:

Initialize Code to Load Drop-Down Menus:

```
Private Sub UserForm_Initialize()

Dim a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q As Variant

For Each b In Sheet4.Range("M4:M22")
  If b.Value <> "" Then
    CoolChemScience.ComboPRParentsWork1.AddItem b.Value
    CoolChemScience.ComboPRParentsWork2.AddItem b.Value
    CoolChemScience.ComboPRParentsWork3.AddItem b.Value
    CoolChemScience.ComboPRParentsWork4.AddItem b.Value

    CoolChemScience.ComboPR_CareerInt1.AddItem b.Value
    CoolChemScience.ComboPR_CareerInt2.AddItem b.Value
    CoolChemScience.ComboPR_CareerInt3.AddItem b.Value
    CoolChemScience.ComboPR_CareerInt4.AddItem b.Value
  End If
Next b

For Each c In Sheet4.Range("AC4:AC22")
  If c.Value <> "" Then
    CoolChemScience.ComboPRFSJobCAT1.AddItem c.Value
    CoolChemScience.ComboP1DChmJobCAT1.AddItem c.Value
  End If
Next c

For Each d In Sheet4.Range("AD4:AD22")
  If d.Value <> "" Then
    CoolChemScience.ComboPRBranchesFSCAT1.AddItem d.Value
    CoolChemScience.ComboP1DChemSolveCAT1.AddItem d.Value
  End If
Next d

For Each e In Sheet4.Range("AN4:AN22")
  If e.Value <> "" Then
    CoolChemScience.ComboPRWPhaCAT1.AddItem e.Value
    CoolChemScience.ComboPRWPhaCAT2.AddItem e.Value
    CoolChemScience.ComboPRWPhaCAT3.AddItem e.Value
    CoolChemScience.ComboPRWPhaCAT4.AddItem e.Value

    CoolChemScience.ComboP2DWPhaCAT1.AddItem e.Value
    CoolChemScience.ComboP2DWPhaCAT2.AddItem e.Value
    CoolChemScience.ComboP2DWPhaCAT3.AddItem e.Value
    CoolChemScience.ComboP2DWPhaCAT4.AddItem e.Value
  End If
Next e

For Each f In Sheet4.Range("AK4:AK22")
  If f.Value <> "" Then
    CoolChemScience.ComboP1DImportantSci.AddItem f.Value
  End If
Next f

For Each g In Sheet4.Range("H4:H22")
  If g.Value <> "" Then
    CoolChemScience.ComboP1DImportantSciWhyCAT.AddItem g.Value
  End If
End If
```

```

Next g

For Each h In Sheet4.Range("L4:L22")
    If h.Value <> "" Then
        CoolChemScience.ComboP1DBestSubj1.AddItem h.Value
        CoolChemScience.ComboP1DBestSubj2.AddItem h.Value
        CoolChemScience.ComboP1DBestSubj3.AddItem h.Value
        CoolChemScience.ComboP1DBestSubj4.AddItem h.Value
        CoolChemScience.ComboP1DBestSubj5.AddItem h.Value
        CoolChemScience.ComboP1DBestSubj6.AddItem h.Value

        CoolChemScience.ComboP2DSchoolSubj1.AddItem h.Value
        CoolChemScience.ComboP2DSchoolSubj2.AddItem h.Value
        CoolChemScience.ComboP2DSchoolSubj3.AddItem h.Value
        CoolChemScience.ComboP2DSchoolSubj4.AddItem h.Value
    End If
Next h

For Each i In Sheet4.Range("N4:N22")
    If i.Value <> "" Then
        CoolChemScience.ComboP2DLikeTypeSciCAT1.AddItem i.Value
        CoolChemScience.ComboP2DLikeTypeSciCAT2.AddItem i.Value
        CoolChemScience.ComboP2DLikeTypeSciCAT3.AddItem i.Value
        CoolChemScience.ComboP2DLikeTypeSciCAT4.AddItem i.Value
    End If
Next i

For Each j In Sheet4.Range("AE4:AE22")
    If j.Value <> "" Then
        CoolChemScience.ComboP1DChmIndCAT1.AddItem j.Value
        CoolChemScience.ComboP1DChmIndCAT2.AddItem j.Value
    End If
Next j

For Each k In Sheet4.Range("AH4:AH22")
    If k.Value <> "" Then
        CoolChemScience.ComboP2DGenInterest.AddItem k.Value
    End If
Next k

For Each l In Sheet4.Range("AI4:AI22")
    If l.Value <> "" Then
        CoolChemScience.ComboP2DSeekInfo.AddItem l.Value
    End If
Next l

For Each m In Sheet4.Range("AJ4:AJ22")
    If m.Value <> "" Then
        CoolChemScience.ComboP2DUnderstandInfo.AddItem m.Value
    End If
Next m

For Each n In Sheet4.Range("AF4:AF22")
    If n.Value <> "" Then
        CoolChemScience.ComboP2DName1ExpCAT.AddItem n.Value
    End If
Next n

For Each o In Sheet4.Range("AG4:AG22")
    If o.Value <> "" Then
        CoolChemScience.ComboP2DStandOutCAT.AddItem o.Value
    End If
Next o

```



```

For Each p In Sheet4.Range("J4:J22")
    If p.Value <> "" Then
        CoolChemScience.ComboP1DLikedProgram.AddItem p.Value
    End If
Next p

For Each q In Sheet4.Range("K4:K22")
    If q.Value <> "" Then
        CoolChemScience.ComboP1DNotLikedProgram.AddItem q.Value
    End If
Next q

End Sub

```

Entry/Update Code:

```

Private Sub cmdEnter_Click()
    Dim j, studentno As Integer
    Dim studentid As String

    If optNew.Value = True Then

        For Each a In Sheet2.Range("E8:E1000")
            If a.Value = "" Then
                a.Value = CoolChemScience.SID.Value
                j = a.Offset(-1, -2).Value
                a.Offset(0, -2).Value = j + 1
                studentno = a.Offset(0, -2).Value
                a.Offset(0, -4).Value = Program.Value
                a.Offset(0, -3).Value = College.Value
                a.Value = CoolChemScience.SID.Value & "-" & studentno
                studentid = a.Value

                'Entry Code for the PreTest
                a.Offset(0, 1).Value = DOB.Value
                a.Offset(0, 2).Value = MOB.Value
                a.Offset(0, 3).Value = YOB.Value

                'Gender
                If optPRMale.Value = True Then
                    a.Offset(0, 5).Value = "Male"
                End If

                If optPRFemale.Value = True Then
                    a.Offset(0, 5).Value = "Female"
                End If

                'English
                If optPRYesEng.Value = True Then
                    a.Offset(0, 6).Value = "Yes"
                End If

                If optPRNoEng.Value = True Then
                    a.Offset(0, 6).Value = "No"
                End If

                a.Offset(0, 7).Value = txtPROtherLang.Value
            End If
        Next a
    End If
End Sub

```

```

'C Term Questions
a.Offset(0, 8).Value = txtPRKnowScience.Value
a.Offset(0, 9).Value = txtPRKnowSubj.Value
a.Offset(0, 10).Value = txtPRInterestSciTech.Value
a.Offset(0, 11).Value = txtPRInterestNewTech.Value
a.Offset(0, 12).Value = txtPRInterestEvery.Value

'TOSRA Questions
a.Offset(0, 13).Value = txtPRTOSRA_ToldvExp.Value
a.Offset(0, 14).Value = txtPRTOSRA_LivesBetter.Value
a.Offset(0, 15).Value = txtPRTOSRA_JobSci.Value
a.Offset(0, 16).Value = txtPRTOSRA_OutSchool.Value

'Parents Work Field
a.Offset(0, 17).Value = ComboPRParentsWork1.Value
a.Offset(0, 18).Value = ComboPRParentsWork2.Value
a.Offset(0, 19).Value = ComboPRParentsWork3.Value
a.Offset(0, 20).Value = ComboPRParentsWork4.Value

'Career Interests
a.Offset(0, 21).Value = ComboPR_CareerInt1.Value
a.Offset(0, 22).Value = ComboPR_CareerInt2.Value
a.Offset(0, 23).Value = ComboPR_CareerInt3.Value
a.Offset(0, 24).Value = ComboPR_CareerInt4.Value

'Words and Phrases
a.Offset(0, 25).Value = txtPRWPhaRAW1.Value
a.Offset(0, 26).Value = txtPRWPhaRAW2.Value
a.Offset(0, 27).Value = txtPRWPhaRAW3.Value
a.Offset(0, 28).Value = txtPRWPhaRAW4.Value

a.Offset(0, 29).Value = ComboPRWPhaCAT1.Value
a.Offset(0, 30).Value = ComboPRWPhaCAT2.Value
a.Offset(0, 31).Value = ComboPRWPhaCAT3.Value
a.Offset(0, 32).Value = ComboPRWPhaCAT4.Value

'What do chemists do?
a.Offset(0, 88).Value = txtPRChmJobRAW.Value
a.Offset(0, 89).Value = ComboPRFSJobCAT1.Value

'What problems do chemists help solve?
a.Offset(0, 90).Value = txtPRBranchesChmRAW.Value
a.Offset(0, 91).Value = ComboPRBranchesFSCAT1.Value

'Enter Fields for Post-Test 1
'Importance of science
a.Offset(0, 93).Value = ComboP1DImportantSci.Value
a.Offset(0, 94).Value = txtP1DImportantSciWhyRAW.Value
a.Offset(0, 95).Value = ComboP1DImportantSciWhyCAT.Value

'Best School Subjects
a.Offset(0, 96).Value = ComboP1DBestSubj1.Value
a.Offset(0, 97).Value = ComboP1DBestSubj2.Value
a.Offset(0, 98).Value = ComboP1DBestSubj3.Value
a.Offset(0, 99).Value = ComboP1DBestSubj4.Value
a.Offset(0, 100).Value = ComboP1DBestSubj5.Value
a.Offset(0, 101).Value = ComboP1DBestSubj6.Value

'VCE
If OptP1DVCEYes.Value = True Then

```

```

    a.Offset(0, 120).Value = "Yes"
End If

If OptP1DVCENo.Value = False Then
    a.Offset(0, 120).Value = "No"
End If

a.Offset(0, 121).Value = txtP1DVCECAT1.Value
a.Offset(0, 122).Value = txtP1DVCECAT2.Value
a.Offset(0, 123).Value = txtP1DVCECAT3.Value

'What does a Chemist do?
a.Offset(0, 213).Value = txtP1DChmJobRAW.Value
a.Offset(0, 214).Value = ComboP1DChmJobCAT1.Value

'What industries do chemists work in?
a.Offset(0, 215).Value = txtP1DChmIndRAW.Value
a.Offset(0, 216).Value = ComboP1DChmIndCAT1.Value
a.Offset(0, 217).Value = ComboP1DChmIndCAT2.Value

'What problems do chemists help solve?
a.Offset(0, 218).Value = txtP1DChemSolveRAW.Value
a.Offset(0, 219).Value = ComboP1DChemSolveCAT1.Value

'TOSRA Questions
a.Offset(0, 102).Value = txtP1DHandsOnAct.Value
a.Offset(0, 103).Value = txtP1DObsThink.Value
a.Offset(0, 104).Value = txtP1DExpHelp.Value
a.Offset(0, 105).Value = txtP1DPresent.Value
a.Offset(0, 106).Value = txtP1DOverallProgram.Value
a.Offset(0, 107).Value = txtP1DIntTVSci.Value
a.Offset(0, 108).Value = txtP1DIntPrintSci.Value
a.Offset(0, 109).Value = txtP1DIntOnlineSci.Value
a.Offset(0, 110).Value = txtP1DIntLiveSci.Value
a.Offset(0, 111).Value = txtP1DTOSRA_LearnOnOwn.Value
a.Offset(0, 112).Value = txtP1DTOSRA_IntSci.Value
a.Offset(0, 113).Value = txtP1DTOSRA_SciClass.Value
a.Offset(0, 114).Value = txtP1DTOSRA_NotEnjoyCareer.Value
a.Offset(0, 115).Value = txtP1DTOSRA_NewTech.Value
a.Offset(0, 116).Value = txtP1DTOSRA_SciKnow.Value
a.Offset(0, 117).Value = txtP1DTOSRA_SciPositive.Value
a.Offset(0, 118).Value = txtP1DTOSRA_SubjectKnow.Value
a.Offset(0, 119).Value = txtP1DTOSRA_Function.Value

'CSIRO Programs
a.Offset(0, 124).Value = txtP1DLikedProgram.Value
a.Offset(0, 310).Value = ComboP1DLikedProgram.Value
a.Offset(0, 125).Value = txtP1DNotLikedProgram.Value
a.Offset(0, 311).Value = ComboP1DNotLikedProgram.Value

'I learned about the following topics today:
If chkP1LearnedAbout1.Value = True Then
    a.Offset(0, 345).Value = "Acids and Bases"
End If

If chkP1LearnedAbout2.Value = True Then
    a.Offset(0, 346).Value = "Reactions"
End If

If chkP1LearnedAbout3.Value = True Then
    a.Offset(0, 347).Value = "Physical Changes of Materials"
End If

```

```

If chkP1LearnedAbout4.Value = True Then
  a.Offset(0, 348).Value = "Physical Properties of Materials"
End If

If chkP1LearnedAbout5.Value = True Then
  a.Offset(0, 349).Value = "Water Absorbing Materials"
End If

If chkP1LearnedAbout6.Value = True Then
  a.Offset(0, 350).Value = "Effect of Light on Reactions"
End If

'Entry Fields for Post-Test 2
'Interest in Science Category
a.Offset(0, 221).Value = ComboP2DGenInterest.Value
a.Offset(0, 222).Value = ComboP2DSeekInfo.Value
a.Offset(0, 223).Value = ComboP2DUnderstandInfo.Value

'Logic Block for Determining D Term Category
If ComboP2DGenInterest.Value = "Interested" Then
  If ComboP2DSeekInfo.Value = "Seek Info" Then
    If ComboP2DUnderstandInfo.Value = "Do Understand" Then
      a.Offset(0, 224).Value = "Interested, Seek info, understand"
    End If

    If ComboP2DUnderstandInfo.Value = "Do Not Understand" Then
      a.Offset(0, 224).Value = "Interested, seek info, do not
understand"
    End If
  End If
End If

  If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
    a.Offset(0, 224).Value = "Interested, Do Not Seek Info"
  End If
End If

If ComboP2DGenInterest.Value = "Neutral" Then
  If ComboP2DSeekInfo.Value = "Seek Info" Then
    a.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
  End If

  If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
    a.Offset(0, 224).Value = "Neutral, do not seek info"
  End If
End If

If ComboP2DGenInterest.Value = "Not Interested" Then
  If ComboP2DSeekInfo.Value = "Seek Info" Then
    a.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
  End If

  If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
    a.Offset(0, 224).Value = "Not Interested, do not seek info"
  End If
End If

'Logic Block for Determining C Term Category
If ComboP2DGenInterest.Value = "Interested" Then
  If ComboP2DSeekInfo.Value = "Seek Info" Then
    a.Offset(0, 225).Value = "Interested, seek info"
  End If

```

```

        If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
            a.Offset(0, 225).Value = "Interested, Do Not Seek Info"
        End If
    End If

    If ComboP2DGenInterest.Value = "Neutral" Then
        a.Offset(0, 225).Value = "Neutral and do not seek info"
    End If

    If ComboP2DGenInterest.Value = "Not Interested" Then
        a.Offset(0, 225).Value = "Not interested"
    End If

'TOSRA and Other Questions
a.Offset(0, 226).Value = txtP2DKnowSci.Value
a.Offset(0, 227).Value = txtP2DKnowSubj.Value
a.Offset(0, 228).Value = txtP2DInterestSciTech.Value
a.Offset(0, 229).Value = txtP2DInterestNewTech.Value
a.Offset(0, 230).Value = txtP2DInterestEvery.Value

a.Offset(0, 240).Value = txtP2DTOSRA_ToldvExp.Value
a.Offset(0, 241).Value = txtP2DTOSRA_LivesBetter.Value
a.Offset(0, 242).Value = txtP2DTOSRA_JobSci.Value
a.Offset(0, 243).Value = txtP2DTOSRA_OutSchool.Value

'Favourite Topic in science?
a.Offset(0, 231).Value = txtP2DLikeTypeSciRAW.Value
a.Offset(0, 232).Value = ComboP2DLikeTypeSciCAT1.Value
a.Offset(0, 233).Value = ComboP2DLikeTypeSciCAT2.Value
a.Offset(0, 234).Value = ComboP2DLikeTypeSciCAT3.Value
a.Offset(0, 235).Value = ComboP2DLikeTypeSciCAT4.Value

'School Subject You are best at?
a.Offset(0, 236).Value = ComboP2DSchoolSubj1.Value
a.Offset(0, 237).Value = ComboP2DSchoolSubj2.Value
a.Offset(0, 238).Value = ComboP2DSchoolSubj3.Value
a.Offset(0, 239).Value = ComboP2DSchoolSubj4.Value

'Name 1 Experiment
a.Offset(0, 305).Value = txtP2DName1ExpRAW.Value
a.Offset(0, 306).Value = ComboP2DName1ExpCAT.Value

'What stands out most?
a.Offset(0, 307).Value = txtP2DStandOutRAW.Value
a.Offset(0, 308).Value = ComboP2DStandOutCAT.Value

'Words and Phrases
a.Offset(0, 244).Value = txtP2DWPPhaRAW1.Value
a.Offset(0, 245).Value = txtP2DWPPhaRAW2.Value
a.Offset(0, 246).Value = txtP2DWPPhaRAW3.Value
a.Offset(0, 247).Value = txtP2DWPPhaRAW4.Value

a.Offset(0, 248).Value = ComboP2DWPPhaCAT1.Value
a.Offset(0, 249).Value = ComboP2DWPPhaCAT2.Value
a.Offset(0, 250).Value = ComboP2DWPPhaCAT3.Value
a.Offset(0, 251).Value = ComboP2DWPPhaCAT4.Value

Exit For
End If
Next a

```

'Write in entry code for all of the fields

```
MsgBox "Record for student " & studentid & " has been entered.", vbInformation  
End If
```

```
If optUpdate.Value = True Then
```

```
studentid = SID.Value
```

```
For Each b In Sheet2.Range("E8:E1000")
```

```
    If b.Value = studentid Then
```

```
        'Entry Code for the PreTest
```

```
            b.Offset(0, 1).Value = DOB.Value
```

```
            b.Offset(0, 2).Value = MOB.Value
```

```
            b.Offset(0, 3).Value = YOB.Value
```

```
        'Gender
```

```
        If optPRMale.Value = True Then
```

```
            b.Offset(0, 5).Value = "Male"
```

```
        End If
```

```
        If optPRFemale.Value = True Then
```

```
            b.Offset(0, 5).Value = "Female"
```

```
        End If
```

```
        'English
```

```
        If optPRYesEng.Value = True Then
```

```
            b.Offset(0, 6).Value = "Yes"
```

```
        End If
```

```
        If optPRNoEng.Value = True Then
```

```
            b.Offset(0, 6).Value = "No"
```

```
        End If
```

```
        b.Offset(0, 7).Value = txtPROtherLang.Value
```

```
        'C Term Questions
```

```
        b.Offset(0, 8).Value = txtPRKnowScience.Value
```

```
        b.Offset(0, 9).Value = txtPRKnowSubj.Value
```

```
        b.Offset(0, 10).Value = txtPRInterestSciTech.Value
```

```
        b.Offset(0, 11).Value = txtPRInterestNewTech.Value
```

```
        b.Offset(0, 12).Value = txtPRInterestEvery.Value
```

```
        'TOSRA Questions
```

```
        b.Offset(0, 13).Value = txtPRTOSRA_ToldvExp.Value
```

```
        b.Offset(0, 14).Value = txtPRTOSRA_LivesBetter.Value
```

```
        b.Offset(0, 15).Value = txtPRTOSRA_JobSci.Value
```

```
        b.Offset(0, 16).Value = txtPRTOSRA_OutSchool.Value
```

```
        'Parents Work Field
```

```
        b.Offset(0, 17).Value = ComboPRParentsWork1.Value
```

```
        b.Offset(0, 18).Value = ComboPRParentsWork2.Value
```

```
        b.Offset(0, 19).Value = ComboPRParentsWork3.Value
```

```
        b.Offset(0, 20).Value = ComboPRParentsWork4.Value
```

```
        'Career Interests
```

```
        b.Offset(0, 21).Value = ComboPR_CareerInt1.Value
```

```
        b.Offset(0, 22).Value = ComboPR_CareerInt2.Value
```

```
        b.Offset(0, 23).Value = ComboPR_CareerInt3.Value
```

```
        b.Offset(0, 24).Value = ComboPR_CareerInt4.Value
```

```

'Words and Phrases
b.Offset(0, 25).Value = txtPRWPhaRAW1.Value
b.Offset(0, 26).Value = txtPRWPhaRAW2.Value
b.Offset(0, 27).Value = txtPRWPhaRAW3.Value
b.Offset(0, 28).Value = txtPRWPhaRAW4.Value

b.Offset(0, 29).Value = ComboPRWPhaCAT1.Value
b.Offset(0, 30).Value = ComboPRWPhaCAT2.Value
b.Offset(0, 31).Value = ComboPRWPhaCAT3.Value
b.Offset(0, 32).Value = ComboPRWPhaCAT4.Value

'What do chemists do?
b.Offset(0, 88).Value = txtPRChmJobRAW.Value
b.Offset(0, 89).Value = ComboPRFSJobCAT1.Value

'What problems do chemists help solve?
b.Offset(0, 90).Value = txtPRBranchesChmRAW.Value
b.Offset(0, 91).Value = ComboPRBranchesFSCAT1.Value

'Enter Fields for Post-Test 1
'Importance of science
b.Offset(0, 93).Value = ComboP1DImportantSci.Value
b.Offset(0, 94).Value = txtP1DImportantSciWhyRAW.Value
b.Offset(0, 95).Value = ComboP1DImportantSciWhyCAT.Value

'Best School Subjects
b.Offset(0, 96).Value = ComboP1DBestSubj1.Value
b.Offset(0, 97).Value = ComboP1DBestSubj2.Value
b.Offset(0, 98).Value = ComboP1DBestSubj3.Value
b.Offset(0, 99).Value = ComboP1DBestSubj4.Value
b.Offset(0, 100).Value = ComboP1DBestSubj5.Value
b.Offset(0, 101).Value = ComboP1DBestSubj6.Value

'VCE
If OptP1DVCEYes.Value = True Then
    b.Offset(0, 120).Value = "Yes"
End If

If OptP1DVCENo.Value = False Then
    b.Offset(0, 120).Value = "No"
End If

b.Offset(0, 121).Value = txtP1DVCECAT1.Value
b.Offset(0, 122).Value = txtP1DVCECAT2.Value
b.Offset(0, 123).Value = txtP1DVCECAT3.Value

'What does a Chemist do?
b.Offset(0, 213).Value = txtP1DChmJobRAW.Value
b.Offset(0, 214).Value = ComboP1DChmJobCAT1.Value

'What industries do chemists work in?
b.Offset(0, 215).Value = txtP1DChmIndRAW.Value
b.Offset(0, 216).Value = ComboP1DChmIndCAT1.Value
b.Offset(0, 217).Value = ComboP1DChmIndCAT2.Value

'What problems do chemists help solve?
b.Offset(0, 218).Value = txtP1DChemSolveRAW.Value
b.Offset(0, 219).Value = ComboP1DChemSolveCAT1.Value

```

```

'TOSRA Questions
b.Offset(0, 102).Value = txtP1DHandsOnAct.Value
b.Offset(0, 103).Value = txtP1DObsThink.Value
b.Offset(0, 104).Value = txtP1DExpHelp.Value
b.Offset(0, 105).Value = txtP1DPresent.Value
b.Offset(0, 106).Value = txtP1DOverallProgram.Value
b.Offset(0, 107).Value = txtP1DIntTVSci.Value
b.Offset(0, 108).Value = txtP1DIntPrintSci.Value
b.Offset(0, 109).Value = txtP1DIntOnlineSci.Value
b.Offset(0, 110).Value = txtP1DIntLiveSci.Value
b.Offset(0, 111).Value = txtP1DTOSRA_LearnOnOwn.Value
b.Offset(0, 112).Value = txtP1DTOSRA_IntSci.Value
b.Offset(0, 113).Value = txtP1DTOSRA_SciClass.Value
b.Offset(0, 114).Value = txtP1DTOSRA_NotEnjoyCareer.Value
b.Offset(0, 115).Value = txtP1DTOSRA_NewTech.Value
b.Offset(0, 116).Value = txtP1DTOSRA_SciKnow.Value
b.Offset(0, 117).Value = txtP1DTOSRA_SciPositive.Value
b.Offset(0, 118).Value = txtP1DTOSRA_SubjectKnow.Value
b.Offset(0, 119).Value = txtP1DTOSRA_Function.Value

'CSIRO Programs
b.Offset(0, 124).Value = txtP1DLikedProgram.Value
b.Offset(0, 310).Value = ComboP1DLikedProgram.Value
b.Offset(0, 125).Value = txtP1DNotLikedProgram.Value
b.Offset(0, 311).Value = ComboP1DNotLikedProgram.Value

'I learned about the following topics today:
If chkP1LearnedAbout1.Value = True Then
    b.Offset(0, 345).Value = "Acids and Bases"
End If

If chkP1LearnedAbout2.Value = True Then
    b.Offset(0, 346).Value = "Reactions"
End If

If chkP1LearnedAbout3.Value = True Then
    b.Offset(0, 347).Value = "Physical Changes of Materials"
End If

If chkP1LearnedAbout4.Value = True Then
    b.Offset(0, 348).Value = "Physical Properties of Materials"
End If

If chkP1LearnedAbout5.Value = True Then
    b.Offset(0, 349).Value = "Water Absorbing Materials"
End If

If chkP1LearnedAbout6.Value = True Then
    b.Offset(0, 350).Value = "Effect of Light on Reactions"
End If

'Entry Fields for Post-Test 2
'Interest in Science Category
b.Offset(0, 221).Value = ComboP2DGenInterest.Value
b.Offset(0, 222).Value = ComboP2DSeekInfo.Value
b.Offset(0, 223).Value = ComboP2DUnderstandInfo.Value

'Logic Block for Determining D Term Category
If ComboP2DGenInterest.Value = "Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        If ComboP2DUnderstandInfo.Value = "Do Understand" Then
            b.Offset(0, 224).Value = "Interested, Seek info, understand"
        End If
    End If
End If

```



```

        End If

        If ComboP2DUnderstandInfo.Value = "Do Not Understand" Then
            b.Offset(0, 224).Value = "Interested, seek info, do not
understand"
        End If
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        b.Offset(0, 224).Value = "Interested, Do Not Seek Info"
    End If
End If

If ComboP2DGenInterest.Value = "Neutral" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        b.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        b.Offset(0, 224).Value = "Neutral, do not seek info"
    End If
End If

If ComboP2DGenInterest.Value = "Not Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        b.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        b.Offset(0, 224).Value = "Not Interested, do not seek info"
    End If
End If

'Logic Block for Determining C Term Category
If ComboP2DGenInterest.Value = "Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        b.Offset(0, 225).Value = "Interested, seek info"
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        b.Offset(0, 225).Value = "Interested, Do Not Seek Info"
    End If
End If

If ComboP2DGenInterest.Value = "Neutral" Then
    b.Offset(0, 225).Value = "Neutral and do not seek info"
End If

If ComboP2DGenInterest.Value = "Not Interested" Then
    b.Offset(0, 225).Value = "Not interested"
End If

'TOSRA and Other Questions
b.Offset(0, 226).Value = txtP2DKnowSci.Value
b.Offset(0, 227).Value = txtP2DKnowSubj.Value
b.Offset(0, 228).Value = txtP2DInterestSciTech.Value
b.Offset(0, 229).Value = txtP2DInterestNewTech.Value
b.Offset(0, 230).Value = txtP2DInterestEvery.Value

b.Offset(0, 240).Value = txtP2DTOSRA_ToldvExp.Value
b.Offset(0, 241).Value = txtP2DTOSRA_LivesBetter.Value

```

```

b.Offset(0, 242).Value = txtP2DTOSRA_JobSci.Value
b.Offset(0, 243).Value = txtP2DTOSRA_OutSchool.Value

'Favourite Topic in science?
b.Offset(0, 231).Value = txtP2DLikeTypeSciRAW.Value
b.Offset(0, 232).Value = ComboP2DLikeTypeSciCAT1.Value
b.Offset(0, 233).Value = ComboP2DLikeTypeSciCAT2.Value
b.Offset(0, 234).Value = ComboP2DLikeTypeSciCAT3.Value
b.Offset(0, 235).Value = ComboP2DLikeTypeSciCAT4.Value

'School Subject You are best at?
b.Offset(0, 236).Value = ComboP2DSchoolSubj1.Value
b.Offset(0, 237).Value = ComboP2DSchoolSubj2.Value
b.Offset(0, 238).Value = ComboP2DSchoolSubj3.Value
b.Offset(0, 239).Value = ComboP2DSchoolSubj4.Value

'Name 1 Experiment
b.Offset(0, 305).Value = txtP2DName1ExpRAW.Value
b.Offset(0, 306).Value = ComboP2DName1ExpCAT.Value

'What stands out most?
b.Offset(0, 307).Value = txtP2DStandOutRAW.Value
b.Offset(0, 308).Value = ComboP2DStandOutCAT.Value

'Words and Phrases
b.Offset(0, 244).Value = txtP2DWPPhaRAW1.Value
b.Offset(0, 245).Value = txtP2DWPPhaRAW2.Value
b.Offset(0, 246).Value = txtP2DWPPhaRAW3.Value
b.Offset(0, 247).Value = txtP2DWPPhaRAW4.Value

b.Offset(0, 248).Value = ComboP2DWPPhaCAT1.Value
b.Offset(0, 249).Value = ComboP2DWPPhaCAT2.Value
b.Offset(0, 250).Value = ComboP2DWPPhaCAT3.Value
b.Offset(0, 251).Value = ComboP2DWPPhaCAT4.Value

Exit For

```

```

End If
Next b

```

```

End If

```

```

Unload CoolChemScience

```

```

End Sub

```

Code for Nanotechnologies:

Initialize Code to Load Drop-Down Menus:

```

Private Sub UserForm_Initialize()
Dim a, b, c, d, e, f As Variant
For Each a In Sheet4.Range("H4:H22")
If a.Value <> "" Then
Nanotechnologies.ComboP1DImportantSciWhyCAT.AddItem a.Value
End If
Next a

```

```

For Each b In Sheet4.Range("M4:M22")
    If b.Value <> "" Then
        Nanotechnologies.ComboPRParentsWork1.AddItem b.Value
        Nanotechnologies.ComboPRParentsWork2.AddItem b.Value
        Nanotechnologies.ComboPRParentsWork3.AddItem b.Value
        Nanotechnologies.ComboPRParentsWork4.AddItem b.Value

        Nanotechnologies.ComboPR_CareerInt1.AddItem b.Value
        Nanotechnologies.ComboPR_CareerInt2.AddItem b.Value
        Nanotechnologies.ComboPR_CareerInt3.AddItem b.Value
        Nanotechnologies.ComboPR_CareerInt4.AddItem b.Value
    End If
Next b

For Each c In Sheet4.Range("AA4:AA22")
    If c.Value <> "" Then
        Nanotechnologies.ComboPRFSJobCAT1.AddItem c.Value
        Nanotechnologies.ComboP1DWhatIsNTCAT.AddItem c.Value
    End If
Next c

For Each d In Sheet4.Range("AB4:AB22")
    If d.Value <> "" Then
        Nanotechnologies.ComboPRBranchesFSCAT1.AddItem d.Value
        Nanotechnologies.ComboPRBranchesFSCAT2.AddItem d.Value
        Nanotechnologies.ComboPRBranchesFSCAT3.AddItem d.Value
        Nanotechnologies.ComboPRBranchesFSCAT4.AddItem d.Value

        Nanotechnologies.ComboP1DBranchSciCAT1.AddItem d.Value
        Nanotechnologies.ComboP1DBranchSciCAT2.AddItem d.Value
        Nanotechnologies.ComboP1DBranchSciCAT3.AddItem d.Value
        Nanotechnologies.ComboP1DBranchSciCAT4.AddItem d.Value
    End If
Next d

For Each e In Sheet4.Range("L4:L22")
    If e.Value <> "" Then
        Nanotechnologies.ComboP1DBestSubj1.AddItem e.Value
        Nanotechnologies.ComboP1DBestSubj2.AddItem e.Value
        Nanotechnologies.ComboP1DBestSubj3.AddItem e.Value
        Nanotechnologies.ComboP1DBestSubj4.AddItem e.Value
        Nanotechnologies.ComboP1DBestSubj5.AddItem e.Value
        Nanotechnologies.ComboP1DBestSubj6.AddItem e.Value
    End If
Next e

For Each f In Sheet4.Range("AP4:AP22")
    If f.Value <> "" Then
        Nanotechnologies.ComboPRWPhaCAT1.AddItem f.Value
        Nanotechnologies.ComboPRWPhaCAT2.AddItem f.Value
        Nanotechnologies.ComboPRWPhaCAT3.AddItem f.Value
        Nanotechnologies.ComboPRWPhaCAT4.AddItem f.Value
    End If
Next f

For Each g In Sheet4.Range("AK4:AK22")
    If g.Value <> "" Then
        Nanotechnologies.ComboP1DImportantSci.AddItem g.Value
    End If
Next g

For Each h In Sheet4.Range("H4:H22")
    If h.Value <> "" Then

```

```

        Nanotechnologies.ComboP1DImportantSciWhyCAT.AddItem h.Value
    End If
Next h

For Each i In Sheet4.Range("J4:J22")
    If i.Value <> "" Then
        Nanotechnologies.ComboP1DLikedProgram.AddItem i.Value
    End If
Next i

For Each j In Sheet4.Range("J4:J22")
    If j.Value <> "" Then
        Nanotechnologies.ComboP1DNotLikedProgram.AddItem j.Value
    End If
Next j

For Each a1 In Sheet4.Range("AH4:AH22")
    If a1.Value <> "" Then
        Nanotechnologies.ComboP2DGenInterest.AddItem a1.Value
    End If
Next a1
For Each B1 In Sheet4.Range("AI4:AI22")
    If B1.Value <> "" Then
        Nanotechnologies.ComboP2DSeekInfo.AddItem B1.Value
    End If
Next B1
For Each C1 In Sheet4.Range("AJ4:AJ22")
    If C1.Value <> "" Then
        Nanotechnologies.ComboP2DUnderstandInfo.AddItem C1.Value
    End If
Next C1
For Each D1 In Sheet4.Range("N4:N22")
    If D1.Value <> "" Then
        Nanotechnologies.ComboP2DLikeTypeSciCAT1.AddItem D1.Value
        Nanotechnologies.ComboP2DLikeTypeSciCAT2.AddItem D1.Value
        Nanotechnologies.ComboP2DLikeTypeSciCAT3.AddItem D1.Value
        Nanotechnologies.ComboP2DLikeTypeSciCAT4.AddItem D1.Value
    End If
Next D1
For Each E1 In Sheet4.Range("L4:L22")
    If E1.Value <> "" Then
        Nanotechnologies.ComboP2DSchoolSubj1.AddItem E1.Value
        Nanotechnologies.ComboP2DSchoolSubj2.AddItem E1.Value
        Nanotechnologies.ComboP2DSchoolSubj3.AddItem E1.Value
        Nanotechnologies.ComboP2DSchoolSubj4.AddItem E1.Value
    End If
Next E1
For Each F1 In Sheet4.Range("AA4:AA22")
    If F1.Value <> "" Then
        Nanotechnologies.ComboP2DWhatisNTCAT.AddItem F1.Value
    End If
Next F1
For Each G1 In Sheet4.Range("AU4:AU22")
    If G1.Value <> "" Then
        Nanotechnologies.ComboP2DName1ExpCAT.AddItem G1.Value
    End If
Next G1
For Each H1 In Sheet4.Range("AV4:AV22")
    If H1.Value <> "" Then
        Nanotechnologies.ComboP2DStandOutCAT.AddItem H1.Value
    End If
Next H1

```

```

For Each I1 In Sheet4.Range("AP4:AP22")
If I1.Value <> "" Then
    Nanotechnologies.ComboP2DWPPhaCAT1.AddItem I1.Value
    Nanotechnologies.ComboP2DWPPhaCAT2.AddItem I1.Value

    Nanotechnologies.ComboP2DWPPhaCAT3.AddItem I1.Value
    Nanotechnologies.ComboP2DWPPhaCAT4.AddItem I1.Value
End If

Next I1

End Sub

```

Enter/Update Code:

```

Private Sub cmdEnter_Click()
Dim j, studentno As Integer
Dim studentid As String

If optNew.Value = True Then

For Each a In Sheet2.Range("E8:E1000")
    If a.Value = "" Then
        a.Value = Nanotechnologies.SID.Value
        j = a.Offset(-1, -2).Value
        a.Offset(0, -2).Value = j + 1
        studentno = a.Offset(0, -2).Value
        a.Offset(0, -4).Value = Program.Value
        a.Offset(0, -3).Value = College.Value
        a.Value = Nanotechnologies.SID.Value & "-" & studentno
        studentid = a.Value

'Entry Code for the PreTest
        a.Offset(0, 1).Value = DOB.Value
        a.Offset(0, 2).Value = MOB.Value
        a.Offset(0, 3).Value = YOB.Value

'Gender
        If optPRMale.Value = True Then
            a.Offset(0, 5).Value = "Male"
        End If

        If optPRFemale.Value = True Then
            a.Offset(0, 5).Value = "Female"
        End If

'English
        If optPRYesEng.Value = True Then
            a.Offset(0, 6).Value = "Yes"
        End If

        If optPRNoEng.Value = True Then
            a.Offset(0, 6).Value = "No"
        End If

        a.Offset(0, 7).Value = txtPROtherLang.Value

'C Term Questions
        a.Offset(0, 8).Value = txtPRKnowScience.Value
        a.Offset(0, 9).Value = txtPRKnowSubj.Value
        a.Offset(0, 10).Value = txtPRInterestSciTech.Value
        a.Offset(0, 11).Value = txtPRInterestNewTech.Value
    End If
End For

```

```

a.Offset(0, 12).Value = txtPRInterestEvery.Value

'TOSRA Questions
a.Offset(0, 13).Value = txtPRTOSRA_ToldvExp.Value
a.Offset(0, 14).Value = txtPRTOSRA_LivesBetter.Value
a.Offset(0, 15).Value = txtPRTOSRA_JobSci.Value
a.Offset(0, 16).Value = txtPRTOSRA_OutSchool.Value

'Parents Work Field
a.Offset(0, 17).Value = ComboPRParentsWork1.Value
a.Offset(0, 18).Value = ComboPRParentsWork2.Value
a.Offset(0, 19).Value = ComboPRParentsWork3.Value
a.Offset(0, 20).Value = ComboPRParentsWork4.Value

'Career Interests
a.Offset(0, 21).Value = ComboPR_CareerInt1.Value
a.Offset(0, 22).Value = ComboPR_CareerInt2.Value
a.Offset(0, 23).Value = ComboPR_CareerInt3.Value
a.Offset(0, 24).Value = ComboPR_CareerInt4.Value

'Words and Phrases
a.Offset(0, 25).Value = txtPRWPhaRAW1.Value
a.Offset(0, 26).Value = txtPRWPhaRAW2.Value
a.Offset(0, 27).Value = txtPRWPhaRAW3.Value
a.Offset(0, 28).Value = txtPRWPhaRAW4.Value

a.Offset(0, 29).Value = ComboPRWPhaCAT1.Value
a.Offset(0, 30).Value = ComboPRWPhaCAT2.Value
a.Offset(0, 31).Value = ComboPRWPhaCAT3.Value
a.Offset(0, 32).Value = ComboPRWPhaCAT4.Value

'What is Nanotechnology?
a.Offset(0, 58).Value = txtPRFSJobRAW.Value
a.Offset(0, 59).Value = ComboPRFSJobCAT1.Value

'What branches of science does Nanotechnology use?
a.Offset(0, 60).Value = txtPRBranchesFSRAW.Value
a.Offset(0, 61).Value = ComboPRBranchesFSCAT1.Value
a.Offset(0, 62).Value = ComboPRBranchesFSCAT2.Value
a.Offset(0, 63).Value = ComboPRBranchesFSCAT3.Value
a.Offset(0, 64).Value = ComboPRBranchesFSCAT4.Value

'Enter Fields for Post-Test 1
'Importance of science
a.Offset(0, 93).Value = ComboP1DImportantSci.Value
a.Offset(0, 94).Value = txtP1DImportantSciWhyRAW.Value
a.Offset(0, 95).Value = ComboP1DImportantSciWhyCAT.Value

'Best School Subjects
a.Offset(0, 96).Value = ComboP1DBestSubj1.Value
a.Offset(0, 97).Value = ComboP1DBestSubj2.Value
a.Offset(0, 98).Value = ComboP1DBestSubj3.Value
a.Offset(0, 99).Value = ComboP1DBestSubj4.Value
a.Offset(0, 100).Value = ComboP1DBestSubj5.Value
a.Offset(0, 101).Value = ComboP1DBestSubj6.Value

'VCE
If OptP1VCEYes.Value = True Then
    a.Offset(0, 120).Value = "Yes"
End If

```

```

If OptP1VCENo.Value = False Then
    a.Offset(0, 120).Value = "No"
End If

a.Offset(0, 121).Value = txtP1VCECAT1.Value
a.Offset(0, 122).Value = txtP1VCECAT2.Value
a.Offset(0, 123).Value = txtP1VCECAT3.Value

'What is nanotechnology?
a.Offset(0, 199).Value = txtP1DWhatIsNTRAW.Value
a.Offset(0, 200).Value = ComboP1DWhatIsNTCAT.Value

'What topics of science does nanotechnology use?
a.Offset(0, 201).Value = txtP1DBranchSciRAW.Value
a.Offset(0, 202).Value = ComboP1DBranchSciCAT1.Value
a.Offset(0, 203).Value = ComboP1DBranchSciCAT2.Value
a.Offset(0, 204).Value = ComboP1DBranchSciCAT3.Value
a.Offset(0, 205).Value = ComboP1DBranchSciCAT4.Value

'I learned about the following topics today:
If chkP1LearnedAboutTopics1.Value = True Then
    a.Offset(0, 206).Value = "Yes"
End If

If chkP1LearnedAboutTopics2.Value = True Then
    a.Offset(0, 207).Value = "Yes"
End If

If chkP1LearnedAboutTopics3.Value = True Then
    a.Offset(0, 208).Value = "Yes"
End If

If chkP1LearnedAboutTopics4.Value = True Then
    a.Offset(0, 209).Value = "Yes"
End If

If chkP1LearnedAboutTopics5.Value = True Then
    a.Offset(0, 210).Value = "Yes"
End If

If chkP1LearnedAboutTopics6.Value = True Then
    a.Offset(0, 211).Value = "Yes"
End If

'TOSRA Questions
a.Offset(0, 102).Value = txtP1DHandsOnAct.Value
a.Offset(0, 103).Value = txtP1DObsThink.Value
a.Offset(0, 104).Value = txtP1DExpHelp.Value
a.Offset(0, 105).Value = txtP1DPresent.Value
a.Offset(0, 106).Value = txtP1DOverallProgram.Value
a.Offset(0, 107).Value = txtP1DIntTVSci.Value
a.Offset(0, 108).Value = txtP1DIntPrintSci.Value
a.Offset(0, 109).Value = txtP1DIntOnlineSci.Value
a.Offset(0, 110).Value = txtP1DIntLiveSci.Value
a.Offset(0, 111).Value = txtP1DTOSRA_LearnOnOwn.Value
a.Offset(0, 112).Value = txtP1DTOSRA_IntSci.Value
a.Offset(0, 113).Value = txtP1DTOSRA_SciClass.Value
a.Offset(0, 114).Value = txtP1DTOSRA_NotEnjoyCareer.Value
a.Offset(0, 115).Value = txtP1DTOSRA_NewTech.Value
a.Offset(0, 116).Value = txtP1DTOSRA_SciKnow.Value
a.Offset(0, 117).Value = txtP1DTOSRA_SciPositive.Value

```

```
a.Offset(0, 118).Value = txtP1DTOSRA_SubjectKnow.Value
a.Offset(0, 119).Value = txtP1DTOSRA_Function.Value
```

```
'CSIRO Programs
```

```
a.Offset(0, 124).Value = txtP1DLikedProgram.Value
a.Offset(0, 310).Value = ComboP1DLikedProgram.Value
a.Offset(0, 125).Value = txtP1DNotLikedProgram.Value
a.Offset(0, 311).Value = ComboP1DNotLikedProgram.Value
```

```
'Entry Fields for Post-Test 2
```

```
'Interest in Science Category
```

```
a.Offset(0, 221).Value = ComboP2DGenInterest.Value
a.Offset(0, 222).Value = ComboP2DSeekInfo.Value
a.Offset(0, 223).Value = ComboP2DUnderstandInfo.Value
```

```
'Logic Block for Determining D Term Category
```

```
If ComboP2DGenInterest.Value = "Interested" Then
  If ComboP2DSeekInfo.Value = "Seek Info" Then
    If ComboP2DUnderstandInfo.Value = "Do Understand" Then
      a.Offset(0, 224).Value = "Interested, Seek info, understand"
    End If
```

understand"

```
    If ComboP2DUnderstandInfo.Value = "Do Not Understand" Then
      a.Offset(0, 224).Value = "Interested, seek info, do not
```

```
    End If
```

```
  End If
```

```
  If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
    a.Offset(0, 224).Value = "Interested, Do Not Seek Info"
```

```
  End If
```

```
End If
```

```
If ComboP2DGenInterest.Value = "Neutral" Then
```

```
  If ComboP2DSeekInfo.Value = "Seek Info" Then
    a.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
  End If
```

```
  If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
    a.Offset(0, 224).Value = "Neutral, do not seek info"
```

```
  End If
```

```
End If
```

```
If ComboP2DGenInterest.Value = "Not Interested" Then
```

```
  If ComboP2DSeekInfo.Value = "Seek Info" Then
    a.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
  End If
```

```
  If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
    a.Offset(0, 224).Value = "Not Interested, do not seek info"
```

```
  End If
```

```
End If
```

```
'Logic Block for Determining C Term Category
```

```
If ComboP2DGenInterest.Value = "Interested" Then
  If ComboP2DSeekInfo.Value = "Seek Info" Then
    a.Offset(0, 225).Value = "Interested, seek info"
  End If
```

```
  If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
    a.Offset(0, 225).Value = "Interested, Do Not Seek Info"
```

```
  End If
```



```

End If

If ComboP2DGenInterest.Value = "Neutral" Then
    a.Offset(0, 225).Value = "Neutral and do not seek info"
End If

If ComboP2DGenInterest.Value = "Not Interested" Then
    a.Offset(0, 225).Value = "Not interested"
End If

'TOSRA and Other Questions
a.Offset(0, 226).Value = txtP2DKnowSci.Value
a.Offset(0, 227).Value = txtP2DKnowSubj.Value
a.Offset(0, 228).Value = txtP2DInterestSciTech.Value
a.Offset(0, 229).Value = txtP2DInterestNewTech.Value
a.Offset(0, 230).Value = txtP2DInterestEvery.Value

a.Offset(0, 240).Value = txtP2DTOSRA_ToldvExp.Value
a.Offset(0, 241).Value = txtP2DTOSRA_LivesBetter.Value
a.Offset(0, 242).Value = txtP2DTOSRA_JobSci.Value
a.Offset(0, 243).Value = txtP2DTOSRA_OutSchool.Value

'Favourite Topic in science?
a.Offset(0, 231).Value = txtP2DLikeTypeSciRAW.Value
a.Offset(0, 232).Value = ComboP2DLikeTypeSciCAT1.Value
a.Offset(0, 233).Value = ComboP2DLikeTypeSciCAT2.Value
a.Offset(0, 234).Value = ComboP2DLikeTypeSciCAT3.Value
a.Offset(0, 235).Value = ComboP2DLikeTypeSciCAT4.Value

'School Subject You are best at?
a.Offset(0, 236).Value = ComboP2DSchoolSubj1.Value
a.Offset(0, 237).Value = ComboP2DSchoolSubj2.Value
a.Offset(0, 238).Value = ComboP2DSchoolSubj3.Value
a.Offset(0, 239).Value = ComboP2DSchoolSubj4.Value

'Check Offset Values here
'Name 1 Experiment
a.Offset(0, 351).Value = txtP2DName1ExpRAW.Value
a.Offset(0, 352).Value = ComboP2DName1ExpCAT.Value

'What stands out most?
a.Offset(0, 353).Value = txtP2DStandOutRAW.Value
a.Offset(0, 354).Value = ComboP2DStandOutCAT.Value

'Words and Phrases
a.Offset(0, 244).Value = txtP2DWPPhaRAW1.Value
a.Offset(0, 245).Value = txtP2DWPPhaRAW2.Value
a.Offset(0, 246).Value = txtP2DWPPhaRAW3.Value
a.Offset(0, 247).Value = txtP2DWPPhaRAW4.Value

a.Offset(0, 248).Value = ComboP2DWPPhaCAT1.Value
a.Offset(0, 249).Value = ComboP2DWPPhaCAT2.Value
a.Offset(0, 250).Value = ComboP2DWPPhaCAT3.Value
a.Offset(0, 251).Value = ComboP2DWPPhaCAT4.Value

'What is Nanotechnology?
a.Offset(0, 355).Value = txtP2DWhatisNTRAW.Value
a.Offset(0, 356).Value = ComboP2DWhatisNTCAT.Value

Exit For
End If
Next a

```

'Write in entry code for all of the fields

```
MsgBox "Record for student " & studentid & " has been entered.", vbInformation  
End If
```

```
If optUpdate.Value = True Then
```

```
studentid = SID.Value
```

```
For Each b In Sheet2.Range("E8:E1000")
```

```
    If b.Value = studentid Then
```

```
        'Entry Code for the PreTest
```

```
            b.Offset(0, 1).Value = DOB.Value
```

```
            b.Offset(0, 2).Value = MOB.Value
```

```
            b.Offset(0, 3).Value = YOB.Value
```

```
        'Gender
```

```
        If optPRMale.Value = True Then
```

```
            b.Offset(0, 5).Value = "Male"
```

```
        End If
```

```
        If optPRFemale.Value = True Then
```

```
            b.Offset(0, 5).Value = "Female"
```

```
        End If
```

```
        'English
```

```
        If optPRYesEng.Value = True Then
```

```
            b.Offset(0, 6).Value = "Yes"
```

```
        End If
```

```
        If optPRNoEng.Value = True Then
```

```
            b.Offset(0, 6).Value = "No"
```

```
        End If
```

```
        b.Offset(0, 7).Value = txtPROtherLang.Value
```

```
        'C Term Questions
```

```
            b.Offset(0, 8).Value = txtPRKnowScience.Value
```

```
            b.Offset(0, 9).Value = txtPRKnowSubj.Value
```

```
            b.Offset(0, 10).Value = txtPRInterestSciTech.Value
```

```
            b.Offset(0, 11).Value = txtPRInterestNewTech.Value
```

```
            b.Offset(0, 12).Value = txtPRInterestEvery.Value
```

```
        'TOSRA Questions
```

```
            b.Offset(0, 13).Value = txtPRTOSRA_ToldvExp.Value
```

```
            b.Offset(0, 14).Value = txtPRTOSRA_LivesBetter.Value
```

```
            b.Offset(0, 15).Value = txtPRTOSRA_JobSci.Value
```

```
            b.Offset(0, 16).Value = txtPRTOSRA_OutSchool.Value
```

```
        'Parents Work Field
```

```
            b.Offset(0, 17).Value = ComboPRParentsWork1.Value
```

```
            b.Offset(0, 18).Value = ComboPRParentsWork2.Value
```

```
            b.Offset(0, 19).Value = ComboPRParentsWork3.Value
```

```
            b.Offset(0, 20).Value = ComboPRParentsWork4.Value
```

```
        'Career Interests
```

```
            b.Offset(0, 21).Value = ComboPR_CareerInt1.Value
```

```
            b.Offset(0, 22).Value = ComboPR_CareerInt2.Value
```

```
            b.Offset(0, 23).Value = ComboPR_CareerInt3.Value
```

```

b.Offset(0, 24).Value = ComboPR_CareerInt4.Value

'Words and Phrases
b.Offset(0, 25).Value = txtPRWPhaRAW1.Value
b.Offset(0, 26).Value = txtPRWPhaRAW2.Value
b.Offset(0, 27).Value = txtPRWPhaRAW3.Value
b.Offset(0, 28).Value = txtPRWPhaRAW4.Value

b.Offset(0, 29).Value = ComboPRWPhaCAT1.Value
b.Offset(0, 30).Value = ComboPRWPhaCAT2.Value
b.Offset(0, 31).Value = ComboPRWPhaCAT3.Value
b.Offset(0, 32).Value = ComboPRWPhaCAT4.Value

'What is Nanotechnology?
b.Offset(0, 58).Value = txtPRFSJobRAW.Value
b.Offset(0, 59).Value = ComboPRFSJobCAT1.Value

'What branches of science does Nanotechnology use?
b.Offset(0, 60).Value = txtPRBranchesFSRAW.Value
b.Offset(0, 61).Value = ComboPRBranchesFSCAT1.Value
b.Offset(0, 62).Value = ComboPRBranchesFSCAT2.Value
b.Offset(0, 63).Value = ComboPRBranchesFSCAT3.Value
b.Offset(0, 64).Value = ComboPRBranchesFSCAT4.Value

'Enter Fields for Post-Test 1
'Importance of science
b.Offset(0, 93).Value = ComboP1DImportantSci.Value
b.Offset(0, 94).Value = txtP1DImportantSciWhyRAW.Value
b.Offset(0, 95).Value = ComboP1DImportantSciWhyCAT.Value

'Best School Subjects
b.Offset(0, 96).Value = ComboP1DBestSubj1.Value
b.Offset(0, 97).Value = ComboP1DBestSubj2.Value
b.Offset(0, 98).Value = ComboP1DBestSubj3.Value
b.Offset(0, 99).Value = ComboP1DBestSubj4.Value
b.Offset(0, 100).Value = ComboP1DBestSubj5.Value
b.Offset(0, 101).Value = ComboP1DBestSubj6.Value

'VCE
If OptP1VCEYes.Value = True Then
    b.Offset(0, 120).Value = "Yes"
End If

If OptP1VCENo.Value = False Then
    b.Offset(0, 120).Value = "No"
End If

b.Offset(0, 121).Value = txtP1VCECAT1.Value
b.Offset(0, 122).Value = txtP1VCECAT2.Value
b.Offset(0, 123).Value = txtP1VCECAT3.Value

'What is nanotechnology?
b.Offset(0, 199).Value = txtP1DWhatisNTRAW.Value
b.Offset(0, 200).Value = ComboP1DWhatisNTCAT.Value

'What topics of science does nanotechnology use?
b.Offset(0, 201).Value = txtP1DBranchSciRAW.Value
b.Offset(0, 202).Value = ComboP1DBranchSciCAT1.Value
b.Offset(0, 203).Value = ComboP1DBranchSciCAT2.Value
b.Offset(0, 204).Value = ComboP1DBranchSciCAT3.Value

```

```

b.Offset(0, 205).Value = ComboP1DBranchSciCAT4.Value

'I learned about the following topics today:
If chkP1LearnedAboutTopics1.Value = True Then
    b.Offset(0, 206).Value = "Yes"
End If

If chkP1LearnedAboutTopics2.Value = True Then
    b.Offset(0, 207).Value = "Yes"
End If

If chkP1LearnedAboutTopics3.Value = True Then
    b.Offset(0, 208).Value = "Yes"
End If

If chkP1LearnedAboutTopics4.Value = True Then
    b.Offset(0, 209).Value = "Yes"
End If

If chkP1LearnedAboutTopics5.Value = True Then
    b.Offset(0, 210).Value = "Yes"
End If

If chkP1LearnedAboutTopics6.Value = True Then
    b.Offset(0, 211).Value = "Yes"
End If

'TOSRA Questions
b.Offset(0, 102).Value = txtP1DHandsOnAct.Value
b.Offset(0, 103).Value = txtP1DObsThink.Value
b.Offset(0, 104).Value = txtP1DExpHelp.Value
b.Offset(0, 105).Value = txtP1DPresent.Value
b.Offset(0, 106).Value = txtP1DOverallProgram.Value
b.Offset(0, 107).Value = txtP1DIntTVSci.Value
b.Offset(0, 108).Value = txtP1DIntPrintSci.Value
b.Offset(0, 109).Value = txtP1DIntOnlineSci.Value
b.Offset(0, 110).Value = txtP1DIntLiveSci.Value
b.Offset(0, 111).Value = txtP1DTOSRA_LearnOnOwn.Value
b.Offset(0, 112).Value = txtP1DTOSRA_IntSci.Value
b.Offset(0, 113).Value = txtP1DTOSRA_SciClass.Value
b.Offset(0, 114).Value = txtP1DTOSRA_NotEnjoyCareer.Value
b.Offset(0, 115).Value = txtP1DTOSRA_NewTech.Value
b.Offset(0, 116).Value = txtP1DTOSRA_SciKnow.Value
b.Offset(0, 117).Value = txtP1DTOSRA_SciPositive.Value
b.Offset(0, 118).Value = txtP1DTOSRA_SubjectKnow.Value
b.Offset(0, 119).Value = txtP1DTOSRA_Function.Value

'CSIRO Programs
b.Offset(0, 124).Value = txtP1DLikedProgram.Value
b.Offset(0, 310).Value = ComboP1DLikedProgram.Value
b.Offset(0, 125).Value = txtP1DNotLikedProgram.Value
b.Offset(0, 311).Value = ComboP1DNotLikedProgram.Value

'Entry Fields for Post-Test 2
'Interest in Science Category
b.Offset(0, 221).Value = ComboP2DGenInterest.Value
b.Offset(0, 222).Value = ComboP2DSeekInfo.Value
b.Offset(0, 223).Value = ComboP2DUnderstandInfo.Value

'Logic Block for Determining D Term Category
If ComboP2DGenInterest.Value = "Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then

```

```

        If ComboP2DUnderstandInfo.Value = "Do Understand" Then
            b.Offset(0, 224).Value = "Interested, Seek info, understand"
        End If

        If ComboP2DUnderstandInfo.Value = "Do Not Understand" Then
            b.Offset(0, 224).Value = "Interested, seek info, do not
understand"
        End If
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        b.Offset(0, 224).Value = "Interested, Do Not Seek Info"
    End If
End If

If ComboP2DGenInterest.Value = "Neutral" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        b.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        b.Offset(0, 224).Value = "Neutral, do not seek info"
    End If
End If

If ComboP2DGenInterest.Value = "Not Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        b.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        b.Offset(0, 224).Value = "Not Interested, do not seek info"
    End If
End If

'Logic Block for Determining C Term Category
If ComboP2DGenInterest.Value = "Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        b.Offset(0, 225).Value = "Interested, seek info"
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        b.Offset(0, 225).Value = "Interested, Do Not Seek Info"
    End If
End If

If ComboP2DGenInterest.Value = "Neutral" Then
    b.Offset(0, 225).Value = "Neutral and do not seek info"
End If

If ComboP2DGenInterest.Value = "Not Interested" Then
    b.Offset(0, 225).Value = "Not interested"
End If

'TOSRA and Other Questions
b.Offset(0, 226).Value = txtP2DKnowSci.Value
b.Offset(0, 227).Value = txtP2DKnowSubj.Value
b.Offset(0, 228).Value = txtP2DInterestSciTech.Value
b.Offset(0, 229).Value = txtP2DInterestNewTech.Value
b.Offset(0, 230).Value = txtP2DInterestEvery.Value

```

```

b.Offset(0, 240).Value = txtP2DTOSRA_ToldvExp.Value
b.Offset(0, 241).Value = txtP2DTOSRA_LivesBetter.Value
b.Offset(0, 242).Value = txtP2DTOSRA_JobSci.Value
b.Offset(0, 243).Value = txtP2DTOSRA_OutSchool.Value

'Favourite Topic in science?
b.Offset(0, 231).Value = txtP2DLikeTypeSciRAW.Value
b.Offset(0, 232).Value = ComboP2DLikeTypeSciCAT1.Value
b.Offset(0, 233).Value = ComboP2DLikeTypeSciCAT2.Value
b.Offset(0, 234).Value = ComboP2DLikeTypeSciCAT3.Value
b.Offset(0, 235).Value = ComboP2DLikeTypeSciCAT4.Value

'School Subject You are best at?
b.Offset(0, 236).Value = ComboP2DSchoolSubj1.Value
b.Offset(0, 237).Value = ComboP2DSchoolSubj2.Value
b.Offset(0, 238).Value = ComboP2DSchoolSubj3.Value
b.Offset(0, 239).Value = ComboP2DSchoolSubj4.Value

'Check Offset Values here
'Name 1 Experiment
b.Offset(0, 351).Value = txtP2DName1ExpRAW.Value
b.Offset(0, 352).Value = ComboP2DName1ExpCAT.Value

'What stands out most?
b.Offset(0, 353).Value = txtP2DStandOutRAW.Value
b.Offset(0, 354).Value = ComboP2DStandOutCAT.Value

'Words and Phrases
b.Offset(0, 244).Value = txtP2DWPPhaRAW1.Value
b.Offset(0, 245).Value = txtP2DWPPhaRAW2.Value
b.Offset(0, 246).Value = txtP2DWPPhaRAW3.Value
b.Offset(0, 247).Value = txtP2DWPPhaRAW4.Value

b.Offset(0, 248).Value = ComboP2DWPPhaCAT1.Value
b.Offset(0, 249).Value = ComboP2DWPPhaCAT2.Value
b.Offset(0, 250).Value = ComboP2DWPPhaCAT3.Value
b.Offset(0, 251).Value = ComboP2DWPPhaCAT4.Value

'What is Nanotechnology?
b.Offset(0, 355).Value = txtP2DWhatisNTRAW.Value
b.Offset(0, 356).Value = ComboP2DWhatisNTCAT.Value

Exit For

End If
Next b

End If

Unload Nanotechnologies

End Sub

```

Code for Materials and Structures:

Initialize Code to Load Drop-Down Menus:

```

Private Sub UserForm_Initialize()
Dim a, b, c, d, e, f As Variant

```

```

For Each b In Sheet4.Range("M4:M22")
    If b.Value <> "" Then
        MaterialsandStructures.ComboPRParentsWork1.AddItem b.Value
        MaterialsandStructures.ComboPRParentsWork2.AddItem b.Value
        MaterialsandStructures.ComboPRParentsWork3.AddItem b.Value
        MaterialsandStructures.ComboPRParentsWork4.AddItem b.Value

        MaterialsandStructures.ComboPR_CareerInt1.AddItem b.Value
        MaterialsandStructures.ComboPR_CareerInt2.AddItem b.Value
        MaterialsandStructures.ComboPR_CareerInt3.AddItem b.Value
        MaterialsandStructures.ComboPR_CareerInt4.AddItem b.Value
    End If
Next b

For Each e In Sheet4.Range("A04:A022")
    If e.Value <> "" Then
        MaterialsandStructures.ComboPRWPhaCAT1.AddItem e.Value
        MaterialsandStructures.ComboPRWPhaCAT2.AddItem e.Value
        MaterialsandStructures.ComboPRWPhaCAT3.AddItem e.Value
        MaterialsandStructures.ComboPRWPhaCAT4.AddItem e.Value

        MaterialsandStructures.ComboP2DWPhaCAT1.AddItem e.Value
        MaterialsandStructures.ComboP2DWPhaCAT2.AddItem e.Value
        MaterialsandStructures.ComboP2DWPhaCAT3.AddItem e.Value
        MaterialsandStructures.ComboP2DWPhaCAT4.AddItem e.Value
    End If
Next e

For Each f In Sheet4.Range("AK4:AK22")
    If f.Value <> "" Then
        MaterialsandStructures.ComboP1DImportantSci.AddItem f.Value
    End If
Next f

For Each g In Sheet4.Range("H4:H22")
    If g.Value <> "" Then
        MaterialsandStructures.ComboP1DImportantSciWhyCAT.AddItem g.Value
    End If
Next g

For Each h In Sheet4.Range("L4:L22")
    If h.Value <> "" Then
        MaterialsandStructures.ComboP1DBestSubj1.AddItem h.Value
        MaterialsandStructures.ComboP1DBestSubj2.AddItem h.Value
        MaterialsandStructures.ComboP1DBestSubj3.AddItem h.Value
        MaterialsandStructures.ComboP1DBestSubj4.AddItem h.Value
        MaterialsandStructures.ComboP1DBestSubj5.AddItem h.Value
        MaterialsandStructures.ComboP1DBestSubj6.AddItem h.Value

        MaterialsandStructures.ComboP2DBestSubj1.AddItem h.Value
        MaterialsandStructures.ComboP2DBestSubj2.AddItem h.Value
        MaterialsandStructures.ComboP2DBestSubj3.AddItem h.Value
        MaterialsandStructures.ComboP2DBestSubj4.AddItem h.Value
    End If
Next h

For Each k In Sheet4.Range("AH4:AH22")
    If k.Value <> "" Then
        MaterialsandStructures.ComboP2DGenInterest.AddItem k.Value
    End If

```

```

Next k

For Each l In Sheet4.Range("AI4:AI22")
    If l.Value <> "" Then
        MaterialsandStructures.ComboP2DSeekInfo.AddItem l.Value
    End If
Next l

For Each m In Sheet4.Range("AJ4:AJ22")
    If m.Value <> "" Then
        MaterialsandStructures.ComboP2DUnderstandInfo.AddItem m.Value
    End If
Next m

For Each n In Sheet4.Range("AQ4:AQ22")
    If n.Value <> "" Then
        MaterialsandStructures.ComboP2DName1ExpCAT.AddItem n.Value
    End If
Next n

For Each o In Sheet4.Range("AR4:AR22")
    If o.Value <> "" Then
        MaterialsandStructures.ComboP2DStandOutCAT.AddItem o.Value
    End If
Next o

For Each p In Sheet4.Range("J4:J22")
    If p.Value <> "" Then
        MaterialsandStructures.ComboP1DLikedProgram.AddItem p.Value
    End If
Next p

For Each q In Sheet4.Range("K4:K22")
    If q.Value <> "" Then
        MaterialsandStructures.ComboP1DNotLikedProgram.AddItem q.Value
    End If
Next q

For Each i In Sheet4.Range("AS4:AS22")
    If i.Value <> "" Then
        MaterialsandStructures.ComboP2DLikeTypeSciCAT1.AddItem i.Value
        MaterialsandStructures.ComboP2DLikeTypeSciCAT2.AddItem i.Value
        MaterialsandStructures.ComboP2DLikeTypeSciCAT3.AddItem i.Value
        MaterialsandStructures.ComboP2DLikeTypeSciCAT4.AddItem i.Value
    End If
Next i

End Sub

```

Enter/Update Code:

```

Private Sub cmdEnter_Click()
    Dim j, studentno As Integer
    Dim studentid As String

    If optNew.Value = True Then

For Each a In Sheet2.Range("E8:E1000")
    If a.Value = "" Then
        a.Value = MaterialsandStructures.SID.Value
    End If
Next a
    End If

```



```

j = a.Offset(-1, -2).Value
a.Offset(0, -2).Value = j + 1
studentno = a.Offset(0, -2).Value
a.Offset(0, -4).Value = Program.Value
a.Offset(0, -3).Value = College.Value
a.Value = MaterialsandStructures.SID.Value & "-" & studentno
studentid = a.Value

'Entry Code for the PreTest
a.Offset(0, 1).Value = DOB.Value
a.Offset(0, 2).Value = MOB.Value
a.Offset(0, 3).Value = YOB.Value

'Gender
If optPRMale.Value = True Then
    a.Offset(0, 5).Value = "Male"
End If

If optPRFemale.Value = True Then
    a.Offset(0, 5).Value = "Female"
End If

'English
If optPRYesEng.Value = True Then
    a.Offset(0, 6).Value = "Yes"
End If

If optPRNoEng.Value = True Then
    a.Offset(0, 6).Value = "No"
End If

a.Offset(0, 7).Value = txtPROtherLang.Value

'C Term Questions
a.Offset(0, 8).Value = txtPRKnowScience.Value
a.Offset(0, 9).Value = txtPRKnowSubj.Value
a.Offset(0, 10).Value = txtPRInterestSciTech.Value
a.Offset(0, 11).Value = txtPRInterestNewTech.Value
a.Offset(0, 12).Value = txtPRInterestEvery.Value

'TOSRA Questions
a.Offset(0, 13).Value = txtPRTOSRA_ToldvExp.Value
a.Offset(0, 14).Value = txtPRTOSRA_LivesBetter.Value
a.Offset(0, 15).Value = txtPRTOSRA_JobSci.Value
a.Offset(0, 16).Value = txtPRTOSRA_OutSchool.Value

'Parents Work Field
a.Offset(0, 17).Value = ComboPRParentsWork1.Value
a.Offset(0, 18).Value = ComboPRParentsWork2.Value
a.Offset(0, 19).Value = ComboPRParentsWork3.Value
a.Offset(0, 20).Value = ComboPRParentsWork4.Value

'Career Interests
a.Offset(0, 21).Value = ComboPR_CareerInt1.Value
a.Offset(0, 22).Value = ComboPR_CareerInt2.Value
a.Offset(0, 23).Value = ComboPR_CareerInt3.Value
a.Offset(0, 24).Value = ComboPR_CareerInt4.Value

'Words and Phrases
a.Offset(0, 25).Value = txtPRWPhaRAW1.Value
a.Offset(0, 26).Value = txtPRWPhaRAW2.Value
a.Offset(0, 27).Value = txtPRWPhaRAW3.Value

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```

a.Offset(0, 28).Value = txtPRWPhaRAW4.Value

a.Offset(0, 29).Value = ComboPRWPhaCAT1.Value
a.Offset(0, 30).Value = ComboPRWPhaCAT2.Value
a.Offset(0, 31).Value = ComboPRWPhaCAT3.Value
a.Offset(0, 32).Value = ComboPRWPhaCAT4.Value

'Additional Questions for the Pre-Test
'Why Are you taking this course?
If chkPRTakeCourse1.Value = True Then
    a.Offset(0, 66).Value = "Interested in Subject Matter"
End If

If chkPRTakeCourse2.Value = True Then
    a.Offset(0, 67).Value = "Getting into University"
End If

If chkPRTakeCourse3.Value = True Then
    a.Offset(0, 68).Value = "I wanted a challenge"
End If

If chkPRTakeCourse4.Value = True Then
    a.Offset(0, 69).Value = "Needed an extra course"
End If

If chkPRTakeCourse5.Value = True Then
    a.Offset(0, 70).Value = "Pursue Career in Field"
End If

If chkPRTakeCourse6.Value = True Then
    a.Offset(0, 71).Value = "For Fun"
End If

If chkPRTakeCourse7.Value = True Then
    a.Offset(0, 72).Value = "Parents"
End If

a.Offset(0, 73).Value = txtPRTakeCourseOther.Value

'I have studied the following topics in class:
If chkPRLearnStress.Value = True Then
    a.Offset(0, 74).Value = "Stress"
End If

If chkPRLearnStrain.Value = True Then
    a.Offset(0, 75).Value = "Strain"
End If

If chkPRLearnCreep.Value = True Then
    a.Offset(0, 76).Value = "Creep"
End If

If chkPRLearnElasticity.Value = True Then
    a.Offset(0, 77).Value = "Elasticity"
End If

If chkPRLearnToughness.Value = True Then
    a.Offset(0, 78).Value = "Toughness"
End If

'What quantities are used to calculate Young's Modulus
If chkPRCalcStrain.Value = True Then
    a.Offset(0, 80).Value = "Strain"

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```

End If

If chkPRCalcYieldStrength.Value = True Then
    a.Offset(0, 81).Value = "Yield Strength"
End If

If chkPRCalcElasticity.Value = True Then
    a.Offset(0, 82).Value = "Elasticity"
End If

If chkPRCalcStress.Value = True Then
    a.Offset(0, 83).Value = "Stress"
End If

If chkPRCalcTemperature.Value = True Then
    a.Offset(0, 84).Value = "Temperature"
End If

'What material is more brittle?
If OptPRGlass.Value = True Then
    a.Offset(0, 85).Value = "Glass"
End If

If OptPRAluminum.Value = True Then
    a.Offset(0, 85).Value = "Aluminum"
End If

'What is the elemental shape of a truss?
a.Offset(0, 86).Value = txtPRElemShape.Value

'Enter Fields for Post-Test 1
'Importance of science
a.Offset(0, 93).Value = ComboP1DImportantSci.Value
a.Offset(0, 94).Value = txtP1DImportantSciWhyRAW.Value
a.Offset(0, 95).Value = ComboP1DImportantSciWhyCAT.Value

'Best School Subjects
a.Offset(0, 96).Value = ComboP1DBestSubj1.Value
a.Offset(0, 97).Value = ComboP1DBestSubj2.Value
a.Offset(0, 98).Value = ComboP1DBestSubj3.Value
a.Offset(0, 99).Value = ComboP1DBestSubj4.Value
a.Offset(0, 100).Value = ComboP1DBestSubj5.Value
a.Offset(0, 101).Value = ComboP1DBestSubj6.Value

'TOSRA Questions
a.Offset(0, 102).Value = txtP1DHandsOnAct.Value
a.Offset(0, 103).Value = txtP1DObsThink.Value
a.Offset(0, 104).Value = txtP1DExpHelp.Value
a.Offset(0, 105).Value = txtP1DPresent.Value
a.Offset(0, 106).Value = txtP1DOverallProgram.Value
a.Offset(0, 107).Value = txtP1DIntTVSci.Value
a.Offset(0, 108).Value = txtP1DIntPrintSci.Value
a.Offset(0, 109).Value = txtP1DIntOnlineSci.Value
a.Offset(0, 110).Value = txtP1DIntLiveSci.Value
a.Offset(0, 111).Value = txtP1DTOSRA_LearnOnOwn.Value
a.Offset(0, 112).Value = txtP1DTOSRA_IntSci.Value
a.Offset(0, 113).Value = txtP1DTOSRA_SciClass.Value
a.Offset(0, 114).Value = txtP1DTOSRA_NotEnjoyCareer.Value
a.Offset(0, 115).Value = txtP1DTOSRA_NewTech.Value
a.Offset(0, 116).Value = txtP1DTOSRA_SciKnow.Value

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a.Offset(0, 117).Value = txtP1DTOSRA_SciPositive.Value
a.Offset(0, 118).Value = txtP1DTOSRA_SubjectKnow.Value
a.Offset(0, 119).Value = txtP1DTOSRA_Function.Value

'CSIRO Programs
a.Offset(0, 124).Value = txtP1DLikedProgram.Value
a.Offset(0, 310).Value = ComboP1DLikedProgram.Value
a.Offset(0, 125).Value = txtP1DNotLikedProgram.Value
a.Offset(0, 311).Value = ComboP1DNotLikedProgram.Value

'Glass vs. Aluminum = True or False?
If OptP1GlassTrue.Value = True Then
    a.Offset(0, 183).Value = "True"
End If

If OptP1GlassFalse.Value = True Then
    a.Offset(0, 183).Value = "False"
End If

'Stress and Strain are used to calculate what quantity?
If chkP1DToughness.Value = True Then
    a.Offset(0, 186).Value = "Toughness"
End If

If chkP1DYStrength.Value = True Then
    a.Offset(0, 336).Value = "Yield Strength"
End If

If chkP1DYMod.Value = True Then
    a.Offset(0, 337).Value = "Youngs Modulus"
End If

If chkP1DElasticity.Value = True Then
    a.Offset(0, 338).Value = "Elasticity"
End If

'Entry Fields for Post-Test 2
'Interest in Science Category
a.Offset(0, 221).Value = ComboP2DGenInterest.Value
a.Offset(0, 222).Value = ComboP2DSeekInfo.Value
a.Offset(0, 223).Value = ComboP2DUnderstandInfo.Value

'Logic Block for Determining D Term Category
If ComboP2DGenInterest.Value = "Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        If ComboP2DUnderstandInfo.Value = "Do Understand" Then
            a.Offset(0, 224).Value = "Interested, Seek info, understand"
        End If

        If ComboP2DUnderstandInfo.Value = "Do Not Understand" Then
            a.Offset(0, 224).Value = "Interested, seek info, do not
understand"
        End If
    End If
End If

If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
    a.Offset(0, 224).Value = "Interested, Do Not Seek Info"
End If
End If

If ComboP2DGenInterest.Value = "Neutral" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then

```

```

        a.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        a.Offset(0, 224).Value = "Neutral, do not seek info"
    End If
End If

If ComboP2DGenInterest.Value = "Not Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        a.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        a.Offset(0, 224).Value = "Not Interested, do not seek info"
    End If
End If

'Logic Block for Determining C Term Category
If ComboP2DGenInterest.Value = "Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        a.Offset(0, 225).Value = "Interested, seek info"
    End If

    If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
        a.Offset(0, 225).Value = "Interested, Do Not Seek Info"
    End If
End If

If ComboP2DGenInterest.Value = "Neutral" Then
    a.Offset(0, 225).Value = "Neutral and do not seek info"
End If

If ComboP2DGenInterest.Value = "Not Interested" Then
    a.Offset(0, 225).Value = "Not interested"
End If

'TOSRA and Other Questions
a.Offset(0, 226).Value = txtP2DKnowSci.Value
a.Offset(0, 227).Value = txtP2DKnowSubj.Value
a.Offset(0, 228).Value = txtP2DInterestSciTech.Value
a.Offset(0, 229).Value = txtP2DInterestNewTech.Value
a.Offset(0, 230).Value = txtP2DInterestEvery.Value

a.Offset(0, 240).Value = txtP2DTOSRA_ToldvExp.Value
a.Offset(0, 241).Value = txtP2DTOSRA_LivesBetter.Value
a.Offset(0, 242).Value = txtP2DTOSRA_JobSci.Value
a.Offset(0, 243).Value = txtP2DTOSRA_OutSchool.Value

'I have studied the following topics in class:
If chkP2StudyStress.Value = True Then
    a.Offset(0, 290).Value = "Stress"
End If

If chkP2StudyStrain.Value = True Then
    a.Offset(0, 291).Value = "Strain"
End If

If chkP2StudyCreep.Value = True Then
    a.Offset(0, 292).Value = "Creep"
End If

```

```

If chkP2StudyElasticity.Value = True Then
    a.Offset(0, 293).Value = "Elasticity"
End If

If chkP2StudyToughness.Value = True Then
    a.Offset(0, 294).Value = "Toughness"
End If

'What quantities are used to calculate Young's Modulus
If chkP2CalcStrain.Value = True Then
    a.Offset(0, 296).Value = "Strain"
End If

If chkP2CalcYieldStrength.Value = True Then
    a.Offset(0, 297).Value = "Yield Strength"
End If

If chkP2CalcElasticity.Value = True Then
    a.Offset(0, 298).Value = "Elasticity"
End If

If chkP2CalcStress.Value = True Then
    a.Offset(0, 299).Value = "Stress"
End If

If chkP2CalcTemperature.Value = True Then
    a.Offset(0, 300).Value = "Temperature"
End If

'School Subject You are best at?
a.Offset(0, 236).Value = ComboP2DBestSubj1.Value
a.Offset(0, 237).Value = ComboP2DBestSubj2.Value
a.Offset(0, 238).Value = ComboP2DBestSubj3.Value
a.Offset(0, 239).Value = ComboP2DBestSubj4.Value

'Check Offsets on these values
'Name 1 Experiment
a.Offset(0, 286).Value = txtP2DName1ExpRAW.Value
a.Offset(0, 287).Value = ComboP2DName1ExpCAT.Value

'What stands out most?
a.Offset(0, 288).Value = txtP2DStandOutRAW.Value
a.Offset(0, 289).Value = ComboP2DStandOutCAT.Value

'Words and Phrases
a.Offset(0, 244).Value = txtP2DWPPhaRAW1.Value
a.Offset(0, 245).Value = txtP2DWPPhaRAW2.Value
a.Offset(0, 246).Value = txtP2DWPPhaRAW3.Value
a.Offset(0, 247).Value = txtP2DWPPhaRAW4.Value

a.Offset(0, 248).Value = ComboP2DWPPhaCAT1.Value
a.Offset(0, 249).Value = ComboP2DWPPhaCAT2.Value
a.Offset(0, 250).Value = ComboP2DWPPhaCAT3.Value
a.Offset(0, 251).Value = ComboP2DWPPhaCAT4.Value

```

```

        Exit For
    End If
Next a

'Write in entry code for all of the fields

MsgBox "Record for student " & studentid & " has been entered.", vbInformation
End If

If optUpdate.Value = True Then

studentid = SID.Value
For Each b In Sheet2.Range("E8:E1000")
    If b.Value = studentid Then

        'Entry Code for the PreTest
        b.Offset(0, 1).Value = DOB.Value
        b.Offset(0, 2).Value = MOB.Value
        b.Offset(0, 3).Value = YOY.Value

        'Gender
        If optPRMale.Value = True Then
            b.Offset(0, 5).Value = "Male"
        End If

        If optPRFemale.Value = True Then
            b.Offset(0, 5).Value = "Female"
        End If

        'English
        If optPRYesEng.Value = True Then
            b.Offset(0, 6).Value = "Yes"
        End If

        If optPRNoEng.Value = True Then
            b.Offset(0, 6).Value = "No"
        End If

        b.Offset(0, 7).Value = txtPROtherLang.Value

        'C Term Questions
        b.Offset(0, 8).Value = txtPRKnowScience.Value
        b.Offset(0, 9).Value = txtPRKnowSubj.Value
        b.Offset(0, 10).Value = txtPRInterestSciTech.Value
        b.Offset(0, 11).Value = txtPRInterestNewTech.Value
        b.Offset(0, 12).Value = txtPRInterestEvery.Value

        'TOSRA Questions
        b.Offset(0, 13).Value = txtPRTOSRA_ToldvExp.Value
        b.Offset(0, 14).Value = txtPRTOSRA_LivesBetter.Value
        b.Offset(0, 15).Value = txtPRTOSRA_JobSci.Value
        b.Offset(0, 16).Value = txtPRTOSRA_OutSchool.Value

        'Parents Work Field
        b.Offset(0, 17).Value = ComboPRParentsWork1.Value
        b.Offset(0, 18).Value = ComboPRParentsWork2.Value
        b.Offset(0, 19).Value = ComboPRParentsWork3.Value
        b.Offset(0, 20).Value = ComboPRParentsWork4.Value

        'Career Interests

```

```
b.Offset(0, 21).Value = ComboPR_CareerInt1.Value
b.Offset(0, 22).Value = ComboPR_CareerInt2.Value
b.Offset(0, 23).Value = ComboPR_CareerInt3.Value
b.Offset(0, 24).Value = ComboPR_CareerInt4.Value
```

```
'Words and Phrases
```

```
b.Offset(0, 25).Value = txtPRWPhaRAW1.Value
b.Offset(0, 26).Value = txtPRWPhaRAW2.Value
b.Offset(0, 27).Value = txtPRWPhaRAW3.Value
b.Offset(0, 28).Value = txtPRWPhaRAW4.Value
```

```
b.Offset(0, 29).Value = ComboPRWPhaCAT1.Value
b.Offset(0, 30).Value = ComboPRWPhaCAT2.Value
b.Offset(0, 31).Value = ComboPRWPhaCAT3.Value
b.Offset(0, 32).Value = ComboPRWPhaCAT4.Value
```

```
'Additional Questions for the Pre-Test
```

```
'Why Are you taking this course?
```

```
If chkPRTakeCourse1.Value = True Then
```

```
    b.Offset(0, 66).Value = "Interested in Subject Matter"
```

```
End If
```

```
If chkPRTakeCourse2.Value = True Then
```

```
    b.Offset(0, 67).Value = "Getting into University"
```

```
End If
```

```
If chkPRTakeCourse3.Value = True Then
```

```
    b.Offset(0, 68).Value = "I wanted a challenge"
```

```
End If
```

```
If chkPRTakeCourse4.Value = True Then
```

```
    b.Offset(0, 69).Value = "Needed an extra course"
```

```
End If
```

```
If chkPRTakeCourse5.Value = True Then
```

```
    b.Offset(0, 70).Value = "Pursue Career in Field"
```

```
End If
```

```
If chkPRTakeCourse6.Value = True Then
```

```
    b.Offset(0, 71).Value = "For Fun"
```

```
End If
```

```
If chkPRTakeCourse7.Value = True Then
```

```
    b.Offset(0, 72).Value = "Parents"
```

```
End If
```

```
b.Offset(0, 73).Value = txtPRTakeCourseOther.Value
```

```
'I have studied the following topics in class:
```

```
If chkPRLearnStress.Value = True Then
```

```
    b.Offset(0, 74).Value = "Stress"
```

```
End If
```

```
If chkPRLearnStrain.Value = True Then
```

```
    b.Offset(0, 75).Value = "Strain"
```

```
End If
```

```
If chkPRLearnCreep.Value = True Then
```

```
    b.Offset(0, 76).Value = "Creep"
```

```
End If
```

```
If chkPRLearnElasticity.Value = True Then
```

```
    b.Offset(0, 77).Value = "Elasticity"
```



```

End If

If chkPRLearnToughness.Value = True Then
    b.Offset(0, 78).Value = "Toughness"
End If

'What quantities are used to calculate Young's Modulus
If chkPRCalcStrain.Value = True Then
    b.Offset(0, 80).Value = "Strain"
End If

If chkPRCalcYieldStrength.Value = True Then
    b.Offset(0, 81).Value = "Yield Strength"
End If

If chkPRCalcElasticity.Value = True Then
    b.Offset(0, 82).Value = "Elasticity"
End If

If chkPRCalcStress.Value = True Then
    b.Offset(0, 83).Value = "Stress"
End If

If chkPRCalcTemperature.Value = True Then
    b.Offset(0, 84).Value = "Temperature"
End If

'What material is more brittle?
If OptPRGlass.Value = True Then
    b.Offset(0, 85).Value = "Glass"
End If

If OptPRAluminum.Value = True Then
    b.Offset(0, 85).Value = "Aluminum"
End If

'What is the elemental shape of a truss?
b.Offset(0, 86).Value = txtPRElemShape.Value

'Enter Fields for Post-Test 1
'Importance of science
b.Offset(0, 93).Value = ComboP1DImportantSci.Value
b.Offset(0, 94).Value = txtP1DImportantSciWhyRAW.Value
b.Offset(0, 95).Value = ComboP1DImportantSciWhyCAT.Value

'Best School Subjects
b.Offset(0, 96).Value = ComboP1DBestSubj1.Value
b.Offset(0, 97).Value = ComboP1DBestSubj2.Value
b.Offset(0, 98).Value = ComboP1DBestSubj3.Value
b.Offset(0, 99).Value = ComboP1DBestSubj4.Value
b.Offset(0, 100).Value = ComboP1DBestSubj5.Value
b.Offset(0, 101).Value = ComboP1DBestSubj6.Value

'TOSRA Questions
b.Offset(0, 102).Value = txtP1DHandsOnAct.Value
b.Offset(0, 103).Value = txtP1DObsThink.Value
b.Offset(0, 104).Value = txtP1DExpHelp.Value
b.Offset(0, 105).Value = txtP1DPresent.Value
b.Offset(0, 106).Value = txtP1DOverallProgram.Value
b.Offset(0, 107).Value = txtP1DIntTVSci.Value
b.Offset(0, 108).Value = txtP1DIntPrintSci.Value

```

```

b.Offset(0, 109).Value = txtP1DIntOnlineSci.Value
b.Offset(0, 110).Value = txtP1DIntLiveSci.Value
b.Offset(0, 111).Value = txtP1DTOSRA_LearnOnOwn.Value
b.Offset(0, 112).Value = txtP1DTOSRA_IntSci.Value
b.Offset(0, 113).Value = txtP1DTOSRA_SciClass.Value
b.Offset(0, 114).Value = txtP1DTOSRA_NotEnjoyCareer.Value
b.Offset(0, 115).Value = txtP1DTOSRA_NewTech.Value
b.Offset(0, 116).Value = txtP1DTOSRA_SciKnow.Value
b.Offset(0, 117).Value = txtP1DTOSRA_SciPositive.Value
b.Offset(0, 118).Value = txtP1DTOSRA_SubjectKnow.Value
b.Offset(0, 119).Value = txtP1DTOSRA_Function.Value

'CSIRO Programs
b.Offset(0, 124).Value = txtP1DLikedProgram.Value
b.Offset(0, 310).Value = ComboP1DLikedProgram.Value
b.Offset(0, 125).Value = txtP1DNotLikedProgram.Value
b.Offset(0, 311).Value = ComboP1DNotLikedProgram.Value

'Glass vs. Aluminum = True or False?
If OptP1GlassTrue.Value = True Then
    b.Offset(0, 183).Value = "True"
End If

If OptP1GlassFalse.Value = True Then
    b.Offset(0, 183).Value = "False"
End If

'Stress and Strain are used to calculate what quantity?
If chkP1DToughness.Value = True Then
    b.Offset(0, 186).Value = "Toughness"
End If

If chkP1DYStrength.Value = True Then
    b.Offset(0, 336).Value = "Yield Strength"
End If

If chkP1DYMod.Value = True Then
    b.Offset(0, 337).Value = "Youngs Modulus"
End If

If chkP1DElasticity.Value = True Then
    b.Offset(0, 338).Value = "Elasticity"
End If

'Entry Fields for Post-Test 2
'Interest in Science Category
b.Offset(0, 221).Value = ComboP2DGenInterest.Value
b.Offset(0, 222).Value = ComboP2DSeekInfo.Value
b.Offset(0, 223).Value = ComboP2DUnderstandInfo.Value

'Logic Block for Determining D Term Category
If ComboP2DGenInterest.Value = "Interested" Then
    If ComboP2DSeekInfo.Value = "Seek Info" Then
        If ComboP2DUnderstandInfo.Value = "Do Understand" Then
            b.Offset(0, 224).Value = "Interested, Seek info, understand"
        End If

        If ComboP2DUnderstandInfo.Value = "Do Not Understand" Then
            b.Offset(0, 224).Value = "Interested, seek info, do not
understand"
        End If
    End If
End If

```

```

        If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
            b.Offset(0, 224).Value = "Interested, Do Not Seek Info"
        End If
    End If

    If ComboP2DGenInterest.Value = "Neutral" Then
        If ComboP2DSeekInfo.Value = "Seek Info" Then
            b.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
        End If

        If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
            b.Offset(0, 224).Value = "Neutral, do not seek info"
        End If
    End If

    If ComboP2DGenInterest.Value = "Not Interested" Then
        If ComboP2DSeekInfo.Value = "Seek Info" Then
            b.Offset(0, 224).Value = "Neutral/Not Interested, Seek info"
        End If

        If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
            b.Offset(0, 224).Value = "Not Interested, do not seek info"
        End If
    End If

    'Logic Block for Determining C Term Category
    If ComboP2DGenInterest.Value = "Interested" Then
        If ComboP2DSeekInfo.Value = "Seek Info" Then
            b.Offset(0, 225).Value = "Interested, seek info"
        End If

        If ComboP2DSeekInfo.Value = "Do Not Seek Info" Then
            b.Offset(0, 225).Value = "Interested, Do Not Seek Info"
        End If
    End If

    If ComboP2DGenInterest.Value = "Neutral" Then
        b.Offset(0, 225).Value = "Neutral and do not seek info"
    End If

    If ComboP2DGenInterest.Value = "Not Interested" Then
        b.Offset(0, 225).Value = "Not interested"
    End If

    'TOSRA and Other Questions
    b.Offset(0, 226).Value = txtP2DKnowSci.Value
    b.Offset(0, 227).Value = txtP2DKnowSubj.Value
    b.Offset(0, 228).Value = txtP2DInterestSciTech.Value
    b.Offset(0, 229).Value = txtP2DInterestNewTech.Value
    b.Offset(0, 230).Value = txtP2DInterestEvery.Value

    b.Offset(0, 240).Value = txtP2DTOSRA_ToldvExp.Value
    b.Offset(0, 241).Value = txtP2DTOSRA_LivesBetter.Value
    b.Offset(0, 242).Value = txtP2DTOSRA_JobSci.Value
    b.Offset(0, 243).Value = txtP2DTOSRA_OutSchool.Value

    'I have studied the following topics in class:
    If chkP2StudyStress.Value = True Then
        b.Offset(0, 290).Value = "Stress"
    End If

```

```

If chkP2StudyStrain.Value = True Then
    b.Offset(0, 291).Value = "Strain"
End If

If chkP2StudyCreep.Value = True Then
    b.Offset(0, 292).Value = "Creep"
End If

If chkP2StudyElasticity.Value = True Then
    b.Offset(0, 293).Value = "Elasticity"
End If

If chkP2StudyToughness.Value = True Then
    b.Offset(0, 294).Value = "Toughness"
End If

'What quantities are used to calculate Young's Modulus
If chkP2CalcStrain.Value = True Then
    b.Offset(0, 296).Value = "Strain"
End If

If chkP2CalcYieldStrength.Value = True Then
    b.Offset(0, 297).Value = "Yield Strength"
End If

If chkP2CalcElasticity.Value = True Then
    b.Offset(0, 298).Value = "Elasticity"
End If

If chkP2CalcStress.Value = True Then
    b.Offset(0, 299).Value = "Stress"
End If

If chkP2CalcTemperature.Value = True Then
    b.Offset(0, 300).Value = "Temperature"
End If

'School Subject You are best at?
b.Offset(0, 236).Value = ComboP2DBestSubj1.Value
b.Offset(0, 237).Value = ComboP2DBestSubj2.Value
b.Offset(0, 238).Value = ComboP2DBestSubj3.Value
b.Offset(0, 239).Value = ComboP2DBestSubj4.Value

'Check Offsets on these values
'Name 1 Experiment
b.Offset(0, 286).Value = txtP2DName1ExpRAW.Value
b.Offset(0, 287).Value = ComboP2DName1ExpCAT.Value

'What stands out most?
b.Offset(0, 288).Value = txtP2DStandOutRAW.Value
b.Offset(0, 289).Value = ComboP2DStandOutCAT.Value

'Words and Phrases
b.Offset(0, 244).Value = txtP2DWPPhaRAW1.Value
b.Offset(0, 245).Value = txtP2DWPPhaRAW2.Value
b.Offset(0, 246).Value = txtP2DWPPhaRAW3.Value
b.Offset(0, 247).Value = txtP2DWPPhaRAW4.Value

b.Offset(0, 248).Value = ComboP2DWPPhaCAT1.Value
b.Offset(0, 249).Value = ComboP2DWPPhaCAT2.Value
b.Offset(0, 250).Value = ComboP2DWPPhaCAT2.Value
b.Offset(0, 251).Value = ComboP2DWPPhaCAT3.Value

```

```
        Exit For
    End If
Next b
```

```
End If
```

```
Unload MaterialsandStructures
```

```
End Sub
```