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Live Science Outreach Program: A Feasibility Study
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An Interactive Qualifying Project
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Abstract

The Science Museum in London wishes to create an outreach program that connects researchers with the public both in person and electronically. This IQP determined the feasibility of this Outreach Program among schools, the public, and the Internet. A benchmarking study was conducted to determine best methods for bringing Live Science online. Interviews with past Live Science researchers provided new perspectives on Live Science, including how the Program could be improved. Through interviews with science teachers and the public it was determined that a Live Science Outreach Program is feasible if the Museum follows certain recommendations.

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Without you, this project would not have been possible.

Executive Summary

Would you like to participate in a research study just by surfing on the Internet or going to the mall? The Science Museum wishes to make this a reality by creating an outreach program based on their Live Science event. Live Science is an event within the '*Who Am I?*' gallery of the Museum. In this event, researchers spend time in the Museum collecting data from visitors. At the same time, visitors gain insight into current biomedical topics as the researcher explains the logic behind their scientific study. In this way the goal of Live Science, which is to connect scientists and the public, is accomplished. So far the event has seen two successful research projects completed within the Museum. These projects dealt with relating facial features to DNA and also a memory study involving the use of famous names.

This project determined the feasibility of a Live Science Outreach Program. We performed four tasks in order to complete this goal. First, to determine if Live Science would be welcomed in schools, teachers were interviewed by phone. Next, to find public arenas for Live Science, several venues were evaluated. The past Live Science researchers were interviewed to explore their views and opinions about Live Science and the possibility of a Live Science Outreach Program. Finally, websites were evaluated and analysed to determine the best way to bring Live Science to the web.

From the literature review, it was determined that such an outreach program would be useful to society. Both children and adults retain information better when it is presented using methods that stimulate multiple senses. Also, past outreach programs have been very successful with students. The criteria for acceptable Live Science projects were thoroughly researched, as well as a set of criteria for evaluating web research sites.

The Museum provided us with a list of teachers who were part of a Museum program called the Teacher Advisory Panel (TAP). Science teachers from this TAP list were contacted and interviewed. Also provided by the Museum was the contact information for the two researchers previously engaged in Live Science. These researchers were interviewed. The public places were evaluated in two stages. In Phase I, eight places were observed for their population, pace, and available space. After this initial evaluation, unsuitable venues were eliminated and the remaining locations were contacted to gain permission to perform Phase II evaluations. Phase II involved interviewing the public at the selected locations. Out of the places deemed suitable for Live Science, only two places underwent Phase II evaluations. The other places did not permit Phase II for a variety of reasons.

To determine the best practices used for conducting research via the Internet, a benchmarking study was conducted. On-line research sites were found and evaluated based on the criteria outlined in the literature review. Once these criteria were applied to the websites, the data found was analysed.

The interview results showed that the teachers were very interested in Live Science. They believed that Live Science would help to demystify science and bring children closer to understanding what scientists do. They were worried, however, that the researchers visits might not fit into the National Curriculum and that setting up the visits might be too much work for them to do. They suggested that lesson plans and permission slips be provided by the Museum.

The researchers decided that they had an enjoyable experience with Live Science. They presented ways to improve the event, which included advertisement within the Museum and providing Museum staff to aid the researcher when he/she is at the Museum. When asked for their thoughts on a Live Science Outreach Program, the researchers stated that the success of the

Program would depend on finding a project that required the Museum's Live Science program to access a frame.

The public seemed very interested in Live Science as well. They found the goal behind the event to be interesting and said that they might participate in such an event if they had time. However, a problem that the Museum may have is finding places to take Live Science, since some of the places scheduled for Phase II did not allow public interviews.

The benchmarking study revealed that the best way to bring Live Science to the Internet would be to create a questionnaire for data collection. Also, a message board should be provided on the Live Science website, so that the researcher can answer any questions that a user might have. Consent forms should be formulated to explain the purpose of the study, how and why the data is being used, and stating contact information such an e-mail address or fax number. To reduce fraud, the website should also implement a user registration system.

From the data collected, we were able to recommend several courses of action for the Science Museum. First, we suggest that when Live Science visits a school, lesson plans should be written for the teachers and that the study should fit into the National curriculum. Second, the Museum should provide staff for the researchers and advertise Live Science more effectively. Third, Merton Abbey Mills and Marylebone Station should be contacted if a Live Science Outreach Program is implemented. Both the management and public seemed interested in Live Science at these locations. Lastly, we recommend that a questionnaire be used for data collection along with a message board when establishing Live Science on the Internet. From this study, it was concluded that a Live Science Outreach Program is feasible. The Project Team feels that consideration of the recommendations presented in this document will aid the Museum in developing a successful Live Science Outreach Program.

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its visitors. The most current science and technology can be seen in the Museum's Wellcome Wing. The Museum's website explains the four different floors of the Wellcome Wing.

Part of the ground floor includes a collection of exhibits called, "*Antenna,*" which presents contemporary science. The exhibits are rapidly updated because of the continuous breakthroughs occurring in the world of science. The first floor, called "*Who Am I?*" explains how science and technology lead people to better understandings of themselves. The second floor, "*Digitopolis*," explores how the digital revolution is affecting our lives. This is done through objects and hands-on exhibits including computers and other electronic devices. The top floor of the Wellcome Wing, "*In Future*," presents exhibits regarding the directions that science and technology may be headed.

Our project deals with the "*Who Am I?*" level and more specifically the Live Science event, located on this floor. This program introduces Museum visitors to real science by connecting them with scientists conducting biomedical research studies. Instead of simply viewing an exhibit or having someone lecture about a research study, the visitor becomes part of a study.

The program is beneficial to the visitors and the scientists. First, the visitor experiences the scientist's work, including scientific methods, first hand. Secondly, the researchers collect data from the Museum visitors. The goal of this project is to determine the feasibility of expanding the Live Science event to a larger audience through an outreach program.

The Live Science Outreach Program will have the public and students co-operate with researchers in a travelling version of the Science Museum's Live Science event. Researchers will travel to various public forums including schools, to collect data for their study. While

1.0 INTRODUCTION

The Science Museum is dedicated to presenting science, technology, and medicine to

the researchers are collecting data, the public will be learning about the researcher's project and aspects of the scientific method. The forums considered included schools and public places, such as airports, train stations and markets. Each of these types of places was chosen for the different qualities they possess.

The feasibility of the Outreach Program was determined through many different methods. Journal articles reviewing similar science exhibits provided background knowledge for the Program. Schoolteachers were interviewed to establish demand for outreach programs in schools throughout the London area. Public places were observed and evaluated to provide the Museum with a list of possible venues to take Live Science. In addition, a retrospective study was conducted with the researchers who have participated with the in-house Live Science event. From this study, the researchers' thoughts on the design and improvement of the in-house event were collected. After analysis, their feedback was applied to the Outreach Program. Having completed these tasks, the Science Museum has knowledge of how feasible the Outreach Program is.

The feasibility study of the Outreach Program also includes, presenting Live Science electronically. This would entail researchers collecting data for their study via the Web. A benchmarking study was conducted to analyse the current practices utilised in web-based research. From this study, the Museum was presented with a set of best methods for conducting on-line scientific research. The Science Museum will be able to apply these practices to the design of a Live Science on-line project.

An Interactive Qualifying Project is defined as a project relating science and technology to a social issue. This project's goal was to establish the feasibility of connecting students and the public to scientists so that one will learn from the other. The public will learn about scientists and their work. At the same time, the scientists' research will be augmented from the data collected. This project provided the Science Museum with

information regarding the feasibility of a Live Science Outreach Program for students and the public. This included a benchmarking study that investigated how research is conducted electronically, so as to create a Live Science on-line project.

Chapter 2 will discuss the research performed, which provided the knowledge necessary to effectively carry out the above tasks. In chapter 3, the methods used to perform these tasks are discussed. In chapter 4, the data collected from the interviews and the benchmarking study are presented. Chapter 5 discusses conclusions and provides recommendations for the Museum.

2.0 LITERATURE REVIEW

This portion of the project provided the background that was necessary to complete the Live Science Feasibility Study. Research was conducted to become familiar with the topics pertinent to the generation of a Live Science Outreach Program. To do this, information from journals, books, and websites were researched. The criteria for Live Science projects were investigated to provide a basis for the Outreach Program. Current outreach programs from other institutions were reviewed to determine common themes among successful outreach programs. Research was also conducted on the importance of science education and effective methods of educating students. Web quality standards were researched which provided evaluation criteria for the benchmarking study of web-based research sites.

2.1 LIVE SCIENCE

This section of the literature review discusses the requirements for a Live Science project. Past Live Science projects conducted in the Museum's "*Who am I?*" section of the Wellcome Wing are also discussed. The importance of these topics to the Outreach Program will be introduced.

2.1.1 LIVE SCIENCE REQUIREMENTS

There are specific standards that must be met before the Science Museum will accept and implement a Live Science project proposal. Some of the vital criteria that need to be met are research topic authorisation, ethical approval, as well as independent funding (Science Museum, 2001).

A potential Live Science program must focus on an acceptable research topic. As mentioned by Neil Fazakerley (2001), a Wellcome Wing team member, there are certain

fields of research that are recommended. These include genetic anthropology, psychology, and epidemiology. In addition to these, neuroscience, medical statistics, and linguistics are satisfactory topics for Live Science projects. These six fields of study are preferred by the Museum, however other fields of biomedical research may be considered for a Live Science project.

Once a suitable topic has been chosen, full ethical approval must be obtained from a Museum recognised ethical committee (Science Museum, 2001). Diener and Crandall (1978) state that ethical guidelines for research ensure that the goals of the study are worthwhile and the participants' welfare is guaranteed. Ethical approval by a committee would be granted when researchers meet these guidelines. Often, this approval has already been established since proposed studies are usually affiliated with a university or similar institution. Therefore, meeting this criterion should not present any substantial problems in the project approval process. The Museum has additional requirements pertaining to the welfare of the project participants. These requirements ensure that studies do not employ invasive techniques, such as inflicting pain, diagnosis of disease, or use of hazardous substances (Science Museum, 2001). These guidelines ensure the safety and comfort of participants, allowing them to fully enjoy the program.

Another criterion that must be addressed before a Live Science project will be put into effect is informed consent. Informed consent requires that research participants understand how the data will be collected, applied and who will have access to it (Diener and Crandall, 1978; Edwards, 1998). After this knowledge has been passed to the potential participant, he/she decides to take part in the study by signing a form verifying that they understand the objectives of the study, what they will be asked to do and how the data will be used (Diener and Crandall, 1978; Edwards, 1998). Participants under the age of eighteen must obtain a legal guardian's consent in order to be eligible to take part in the study (Science Museum,

2001). The Museum requires projects to include an information sheet, consisting of the purpose of the experiment, the general procedure to be used, the potential risks, and the overall benefits to the participant (Science Museum, 2001).

2.1.2 Live Science Programs

David Hopkinson performed the first Live Science project. The project involved scanning visitors' faces and relating their facial features to DNA. In this study, Hopkinson preferred to work with families. By using relatives, facial structures could be linked through DNA. Visitors that participated were given a 3-D printout of their face to take home.

The most recent Live Science project was sponsored by Goldsmiths University of London. The researcher, Steven Darling, had the project reviewed and approved by the Ethics Committee of Goldsmiths University. The project entitled "Remembering Names" involved two tasks. First Darling had visitors read a list of four names of famous people. They were asked to recall these names immediately after performing the second task of counting backwards by three, starting from a random three digit number. The object of the research project was to evaluate how the human brain stores information. The resulting data will help scientists develop a greater understanding about long-term memory (Science Museum, 2001).

2.1.3 Relevance to Live Science Outreach Program

A Live Science Outreach Program would follow the same criteria as the in-house Live Science event. The research topic for the Outreach Project should relate to one of the six preferred biomedical fields of study, however the Museum is lenient with this criterion. The research study should be fully funded and have full ethical approval from the sponsoring institution. Also, the Program will not accept any studies that are potentially harmful to the

public in any way. Members of the public who are under the age of eighteen shall be required to have written consent from their legal guardian before participating in a study.

The current Live Science event is effective in that it includes the two elements of a successful event. These elements are interaction with stimuli and the researcher adding personal relevance to the participant. Section 2.2.1, *Museum Exhibits,* gives a more detailed analysis of what makes an exhibit effective.

2.2 EVENTS AND EXHIBITS

This section will examine what makes an effective exhibit. Assessments of museum exhibits were made to determine what criteria make exhibits successful. Also, analysis of current outreach programs was done in order to find out if these programs are successful and if so, why. Common themes found among successful outreach programs were applied to the Live Science Outreach Program.

2.2.1 Museum Exhibits

Museum exhibits stimulate learning in many different ways. In schools, there is often only a teacher and textbook, resulting in lecturing and personal review of the material (Delacôte, 1998). In a museum, visitors can wander through the exhibits, providing a chance to learn informally through exploration (Raloff, 1998). While words can be used to explain a subject, these words are less likely to be remembered if the person has no knowledge of the topic (Lewis, 1976). Museums have the ability to present topics using more than words by catering to different senses, such as hearing, touch, sight, and smell. The key of an effective exhibit is to provide multiple sources of stimuli and present the topic by relating it to something the learner knows (Hanlan and Ljungquist, 2000).

Delacôte (1998) explains that a museum exhibit should first focus on the user. This means that the user should be offered an active experience, rather than a passive one. This

point is applicable to both children and adults. In order to make an exhibit effective for the user, two approaches should be used. The material should first be presented in an informal exhibition atmosphere, and then followed with a structured review. The final point Delacôte (1998) makes is that the exhibit should "create enticing environments that appeal to the senses." This point is understandable. If the physical appearance of the exhibit is dull, the user will not be as visually motivated and could become uninterested in the topic.

2.2.2 Outreach Events

Even if a museum contains effective exhibits, it is often difficult for schools and the public to take full advantage of the many unique opportunities that museum's present. Schools may experience difficulty organising a time to travel to museums with students. Likewise, the public may have busy schedules that do not permit them to visit museums. Many museum directors are aware of these limitations and have created outreach programs, which can provide a similar atmosphere as an in-house exhibit (Blenz-Clucas, 1993). Many museums have outreach programs that are available to schools, other museums, libraries, and other public locations. Since entertainment and inspiring learning is the end goal of both outreach and in-house exhibits, they should both contain the same basic elements. To reiterate, these elements are presenting the topic in a way stimulates more than one of the user's senses, and relating the information back to something they can understand. In order for the Live Science Outreach Program to be successful these same guidelines should be followed. However, further discussion of outreach programs is necessary in order to determine the specific strategies that make these programs successful.

There are many different kinds of outreach programs. Programs exist where guest educators teach students about their respective area of study and try to spark their interest in that area (Archer, 2001). Other programs are more hands-on oriented such as the Salvadori Center's outreach program (Salvadori's on a Roll, 2000). Another type of outreach program

involves the lending of museum property to schools, such as the program explained by Blenz-Clucas (1993). Yet another type of program involves travelling vans that present science topics to high schools such as in Rankin (2000) and López-Garriga et al. (1997). The Science Museum in London has offered a "Science Box" program for the general public.

The Salvadori Center Outreach Program's goal is "to awaken their [students] appreciation of math, science and technology and to improve critical thinking and problem-solving skills" (Salvadori's on a Roll, 2000, p. 59). To accomplish this, an expert from the Center visits the school once a week over the course of the school year. During these visits, the expert works with the students and their teacher on different scientific and mathematical principles that relate to architecture. The program culminates with students constructing a bridge. The building of this bridge combines the different topics that the students learn over the course of the year (Salvadori's on a Roll, 2000). The Center presents material in such a way that the students experience hands-on learning and formal teaching. Through these activities the program fulfils the criteria, which make effective exhibits.

Outreach programs can also include museums lending items in their collections to schools. The Kansas Museum of History runs a program, called "Travelling Resource Trunks," which brings selected items from its collection to elementary schools. The eight different trunks that the Museum offers focus on different themes in the Great Plains society. The students have the opportunity to try on clothes, play children's games, and hold everyday objects from nineteenth century Great Plains life (Blenz-Clucas, 1993). This program also gives the students a chance to learn in a more interactive manner. The students are motivated to learn about the time period, since a comparison can be made between their lives and those of children from the period.

Another outreach program presents more traditional science to students. This program, "Alabama Science in Motion Program" (ASIM) educates students in chemistry,

biology, and physics. The ASIM provides a service to schools that do not have adequate resources to conduct hands-on laboratory work. This program is committed to not only educating the students, but also their teachers. High school teachers are recruited to spend ten days in the summer, training on topics ranging from laboratory safety, to the science topics for the labs. The teachers also have another five days of training during the year to reinforce the material covered over the summer (Rankin, 2000).

The program's mission is to "improve the quality of high school science instruction by providing both teacher training and laboratory equipment directly to the schools" (Rankin, 2000, p. 337). This project has been very successful in Alabama. The program is in such great demand that Juanita College, the program's sponsor, is expanding the current fleet of 22 vans to 33 science vans (Rankin, 2000). This project is similar to the others in that it uses the same hands-on techniques to educate students. The difference with this program is that the students are not the only ones benefiting from the hands-on experience. Teachers are also furthering their knowledge of science through the program. Both students and their teachers learn from the multi-sensory stimuli of hands-on learning.

The University of Puerto Rico at Mayaguez's "Science on Wheels" program presents rural area students with chemistry displays. The demonstrations include: Combustion and the Fire Triangle, Acid-Base Reactions and Indicators, and Phase Changes. The presenting graduate students then break the children up into smaller groups. Within these groups the students and the presenters reinforce the observations and concepts that the students have been exposed to (López-Garriga et al., 1997). The Project brings science into a forum where laboratory experience is nearly impossible. This is due to the lack of financial resources in many of the schools in Puerto Rico (López-Garriga et al., 1997). The program provides an invaluable resource to these rural schools.

The "*Science Box*" program, initially offered within Science Museum, was extended to public venues to stimulate interest in science. The exhibits were set up in different public locations and contained information about contemporary science topics. These exhibits were similar to those of the "*Antenna*" program, which is presently active in the Wellcome Wing of the Museum (Science Museum, 2001).

These programs educate students, teachers, and the public through a mixed and interactive approach to learning. These projects also present the material in terms the subjects can understand, which is one of the points that an exhibit must address according to Delacôte (1998). With the exception of the "*Science Box*," all these successful programs combine hands-on learning with traditional lecture or discussion. These two teaching methods will be analysed in more depth in section 2.3 *Science Education*.

2.2.3 Themes For Live Science Outreach

By analysing different outreach programs, common themes have been discovered. Each program contains interactive demonstrations. At the end of some programs, a discussion of the concepts behind these demonstrations is offered. Also, each program accomplishes Delacôte's (1998) suggested goals for a successful exhibit, which are: providing multiple stimuli for the learners and also relating the material covered to the individual's personal experience. In addition to these goals, the programs provide a valuable resource to the visiting schools. In some cases, such as the "Science on Wheels" program, it is the only way in which students can hope to learn first hand about laboratory science.

In order for the London Science Museum's Live Science program to be adapted into an outreach program, it will need to fulfil Delacôte's (1998) goals. Presenting the material with multiple stimuli will be done by the tests that the researcher will conduct with participants. As with past exhibits there is a high level of interactivity expected from the

students. We can anticipate that a research study performed in the schools will have the same, if not higher, level of interactivity as the in-house Live Science project.

The second item, which must be addressed in order for the Project to be successful, is having the material explained so that the students can relate the research project to their lives. If the material presented by the researcher is too abstract, the students will not understand what is being taught. The types of proposals that are usually used as Live Science projects are ones that can be simplified into terms that students can understand. If these goals are accomplished, the Live Science Outreach Program will be an effective teaching tool.

Museums and schools share a similar objective, which is to inspire learning among their respective audiences. On the other hand, public venues, which are not known as learning environments, may be able to serve as places for education. Bringing an exhibit to schools will possibly lead to the incorporation of learning through the senses, in addition to the use of traditional learning methods. Likewise, hands-on learning could be introduced to public venues through an outreach program. This gives people who would not normally visit a museum the chance to experience science through interactive events set up in every day locations. Inspiring and getting people involved with exhibits is an important aspect for a successful outreach program. In the following section, ways that people process information and ways to maximise their involvement will be discussed.

2.3 SCIENCE EDUCATION

Since most science education occurs in educational institutions, section *2.3 Science Education*, pertains mainly to school outreach applications. However, it is important to recognise that learning is not limited to children nor restricted to the classroom and the general public can benefit from some of the practices discussed.

The current method for teaching science is text-based with emphasis placed on facts, which has students read about experiments and principles rather than perform and experience them (Sumrall, 1997). US Education Secretary William Bennett states that, "seen only as a laundry list of theorems in a workbook, science can be a bore," as well as an ineffective education method (*What is Hands-on Science*, 1987, p. 8). If educators want students to think and perform like scientists, they first must learn like scientists (*What is Hands-on Science*, 1987). Learning like scientists entails using experimentation and testing methods that scientists employ while collecting data for their studies. This concept requires that educators take a more hands-on approach when teaching their students science.

2.3.1 Traditional Science Education

The current text-based approach to science education causes students to experience boredom and frustration, which can lead to a negative view of science (Paris et al., 1998). In the United States, evidence has also been found supporting that as students progress through school, their interest in a science based career decreases (Yager & Penick, 1986). Based on these studies, it is not difficult to deduce that the current method for science education is insufficient.

Although lacking when used alone, text-based learning can be beneficial if used as a supplement to hands-on learning. The hands-on experience serves as starting point from which a child learns. Stevenson (1987) has shown that children can recall a large amount of concrete detail about a hands-on event well over a year after the initial experience. Wellington (1990) also notes that science education can be fortified with an initial hands-on experience. Beisenharz et al. (2001) suggests that a brief introduction to the topic, the hands-on activity, and, finally, a more in-depth explanation of the topic, is the best method for teaching. The Beisenharz combination method provides students with a little information about the subject, but does not allow the students to form any premature conclusions about

the subject. Once the students have experienced what happens, it is easier for them to understand the why and how behind the scientific phenomenon.

2.3.2 Hands-on Learning

There are five major aspects to consider when designing a hands-on learning program. These are: personal meaning, choice, challenge, collaboration, and prior knowledge. These are pertinent to the establishment of a school-based outreach program, however, a public program only utilises the first three. All of these aspects will be discussed in greater detail below. In addition, perceived problems with hands-on learning are presented.

Hands-on Design Considerations

The first of these characteristics, personal meaning, ensures that the learners' experience is interesting since it has personal relevance (Paris et al., 1998). The next characteristic, choice, states that if a person can choose their course of action they are more likely to pursue it with enthusiasm (Paris et al., 1998).

Challenge refers to the difficulty of a task and how that difficulty correlates to the motivation of the participants. Tasks that are moderately difficult, yet still within the scope of the audience's knowledge are motivating to people (Clifford, 1991). According to Csikzentmihalyi (1975), a person cannot become truly engaged in a project unless the challenges are in balance with their skills and abilities. If a challenge is too difficult, frustration will result. Conversely if a challenge is too easy, boredom and detachment will result (Paris et al., 1998). To ensure proper operation of a hands-on project the skill level of the intended audience must be known.

The next characteristic is collaboration, which refers to the relationship between the program co-ordinators and participants. The co-ordinators typically tend to encourage the learners without taking on an authoritative teaching role (Paris et al., 1998). Much of the

literature agrees that if the co-ordinator treats the students as equals, and not someone who must be talked down to, the students will transfer the student-teacher bond to the co-ordinator (Barab and Hay, 2001; Buchler, 1999). This characteristic does not apply to the public outreach because there is no teacher that the co-ordinator must interact with.

The final aspect to consider when designing a hands-on learning program is students' prior knowledge of the principle(s) to be covered. Scientists have differing opinions about providing knowledge of a subject to students before the hands-on learning experience. Without a prior knowledge of the concepts behind the display, the students will view the presentation as meaningless and the principles behind the phenomenon incomprehensible (Baird, 1998). One researcher claims that the concepts would appear too abstract before the students experienced them (Raloff, 1998). However, a study by Rix and McSorley (1999) argues that no incidents of child frustration or confusion occurred, nor did any students state that they did not understand the stations during a hands-on event. Considering these two viewpoints along with that of Beisenharz et al. (2001), mentioned in section 2.3.1, *Traditional Science Education*, the best course of action might be a brief introduction prior to hands-on activities, followed by an in-depth study. Again, this criterion can not be applied to the public because there is no way to gauge their prior knowledge.

In summary, there are five requirements to address concerning the hands-on learning aspect of the Live Science Outreach Programs. While not all of these topics are important to the design of a public outreach program, all of them are required for a successful school outreach program. The public aspects include personal meaning, choice, and challenge, which give individuals the opportunity to participate, and offer something interesting that they can relate to. Collaboration and prior knowledge are important to the establishment of a school outreach program in addition to the three previously mentioned characteristics. These

are significant because of the special relationship between teachers and students, and the fact that students are engaged in learning activates.

Perceived Problems With Hands-on Programs

There are many perceived problems with the proper execution of hands-on programs. Sumrall (1997) has outlined three main reasons why a teacher would consider avoiding hands-on science. The first of these reasons is that teaching hands-on science would take large amounts time and effort. Sumrall (1997) suggests delegation of work to students. Assigning jobs to each student or team of students, such as cleaning up, stocking shelves, and doing preparatory work pertaining to the hands-on program, will be beneficial to teachers. This suggestion lightens the teacher's workload and frees up their schedule, as well as showing students the preparation work that goes into science experiments.

The second perceived problem is that "following the curriculum guide is impossible" (Sumrall, 1997, p. 18). Teachers worry that the standard curriculum is too structured to permit hands-on events. The type of education provided through hands-on learning, although useful, does not fit into standardised curricula easily and proves difficult to test. In regard to current curricula, Sumrall (1997) comments that the common practice of cramming information into students is obsolete and teachers should alert their administrators to this.

The last reason mentioned by Sumrall (1997), is that there is not enough resources to teach science hands-on. He suggests that teachers should give their students a checklist and ask them to bring in materials for hands-on science experiments. Sumrall (1997) makes the argument to reluctant teachers that using hands-on science education is not nearly as hard as it is perceived to be.

The problems addressed by Sumrall (1997) can be broken into two groups, preparatory problems and implementation problems. Increasing student participation easily

solves the preparatory problems. Implementation problems need to be addressed prior to the initiation of a hands-on learning program.

2.3.3 Science Education in the Live Science Outreach Program

As stated in previous sections, the current text-based education method is inadequate (Sumrall, 1997). However, the text-based method does provide an effective way to teach the concepts behind hands-on activities. The combination of techniques utilised in Beisenharz's teaching method should also be applied. The Live Science Outreach Program should provide teachers with background information to be used before and after the researchers have visited the school. This information provided should relate the science behind the research study to the schools' curricula.

Research has suggested that there are five aspects, personal meaning, choice, challenge, collaboration, and prior knowledge, to be considered when designing successful hands-on learning program (Paris et al., 1998). The Science Museum should consider these all of these aspects before a school-based version of the Live Science Outreach Program is implemented. The Museum should also consider, personal meaning, choice, and challenge when implementing a public version of the Live Science Program.

Teachers understand the importance of hands-on learning, however there are perceived problems that must be alleviated before they will participate in the Outreach Program. Conducting interviews with teachers will provide further insight into problems with an Outreach Program and may also aid in determining possible solutions. Section 4.1 *Teachers' Interview Results* will document the problems foreseen with the Outreach Program. In section 5.1 *Teachers' Interview Conclusions* we will propose solutions to these problems.

2.4 WEB QUALITY STANDARDS

In order to conduct the benchmarking study of research websites described in section *3.5 Benchmarking Study*, it is required to establish a set of essential traits that successful websites possess. This set of traits or standards will be used to assess research websites.

An article by Loiacono et al. (2000) contains a survey that provides a method for evaluating the quality of commercial websites. This survey addresses the different attributes of effective commercial websites. Loiacono et al. (2000) separates these aspects into twelve distinct categories. These categories are informational fit-to-task, interaction, trust, response time, design appeal, intuitiveness, visual appeal, innovativeness, flow-emotional appeal, integrated communication, business processes, and viable substitute.

The first of these, informational fit-to-task, pertains to the accuracy of website content. Sites need to provide users with all the information that is needed to use the website effectively. People will avoid visiting websites that do not contain information that is current and pertinent to the site's subject (Loiacono et al., 2000). Regular updates keep visitors informed of current developments.

A certain level of interaction is also necessary in order to create a successful website. Interactive features allow site visitors to receive and submit information that is specific to their needs. Emerick (1995) notes that interactivity includes tools such as questionnaires and email feedback among others.

Trust is the next category used in the assessment of websites. According to Loiacono et al. (2000), visitors' trust applies to both the information contained on a website and the information submitted to the site. Visitors trust that the information on a site is reliable. Though visitors have faith in a site's information, this trust may not be extended to the submission of data (Hoffman et al., 1999). Therefore websites should inform their visitors of the possible uses of their data.

The next consideration is response time, which concerns the amount of time it takes for a site to download (Loiacono et al., 2000). Shand (1999) found that if a site takes more than eight seconds to load, participation and use of that website are hindered.

The next three aspects considered deal with the aesthetics of a website. Loiacono et al. (2000) defines these as design appeal, intuitiveness, and visual appeal. Design appeal refers to properly labelled graphics and legible text. Intuitiveness refers to the ease at which a visitor can browse and access all pages of the website (Loiacono et al., 2000). Website should be navigable so visitors to the site are able to understand the material within the pages and are able to locate desired information (Goodhue & Thompson, 1995). The last of these is visual appeal, which refers to the overall appearance of the site. For a website to be effective, it must appeal visually to its users.

Another significant aspect of website quality is innovativeness. Innovative sites often utilise new technologies in their design. The distinctiveness and creativity these new technologies bring will add to the likeability of a website (Loiacono et al., 2000).

The next aspect considered is the flow-emotional appeal of a website. Flow on the Internet refers to, "the state occurring during network navigation which is: 1) characterised by a seamless sequence of responses facilitated by machine interactivity, 2) intrinsically enjoyable, 3) accompanied by a loss of self-consciousness, and 4) self-reinforcing" (Hoffman, pg. 57, 1996). In order to achieve flow, a website must balance the skills of their visitors with the difficulty of the tasks presented on the site.

The last three aspects considered by Loiacono et al. (2000) all relate to the business procedures of websites. The first of these is integrated communication. This aspect refers to how a website fits into the company's overall communication strategy, including both off-line and on-line sources. The next aspect, business processes, simply refers to how the company will use the web to support their business functions. For a website to be useful, it

must satisfy the last aspect of being a viable substitute. This means that the website must provide a similar, if not better, experience using off-line methods.

These twelve aspects are used to evaluate e-commerce websites. In section 3.5 *Benchmarking Study*, these aspects will be related to research websites.

2.5 CONCLUSIONS

Review of the literature has shown that outreach programs would be useful teaching devices. This is apparent from the fact that text-based methods of teaching are less effective than hands-on methods. Hands-on learning should not be limited to students since the all members of the public can benefit from these methods as well. While universities have been major providers of outreach programs, museums also have a wide variety of resources at their disposal with which to create successful outreach programs. The knowledge of what makes an exhibit popular can provide insight for the creation of a successful and educational outreach program.

Analysis of what makes exhibits effective has shown that two key points should be addressed. First of these is that material presented in the exhibit should be done in an interactive and stimulating manner. This will aid in holding the audience's attention. A Live Science Outreach Program should contain interactivity so that students and the members of public do not become disinterested. The in-house Live Science event always necessitates interaction with visitors; a Live Science Outreach Program should contain this same interactivity with its participants. The Live Science Outreach Program has the potential to be successful if a similar format to the in-house event, as described in Section 2.1.2 *Live Science Programs*, is used.

The second item contained within effective exhibits is presenting the topic in such a way that the audience can relate it to their own personal experience. The Live Science

Outreach Program should contain an explanation of the research study and indicate how it relates to participants. During the operation of the Outreach Program, the researchers can provide more in-depth information about the topic that they are investigating.

As discussed in section 2.3.1 *Traditional Science Education*, the Beisenharz teaching method best utilises hands-on experiences. The students should be provided with an introduction to the material before the hands-on event. Once the event has taken place, the students should then be given detailed information regarding the concepts presented in the hands-on experience. Following the interaction of students and researchers, a question and answer period should be provided in order to clarify the information that has been presented.

Website quality involves twelve major components: informational fit-to-task, interaction, trust, response time, design appeal, intuitiveness, visual appeal, innovativeness, flow-emotional appeal, integrated communication, business processes and viable substitute. Throughout the benchmarking study, most of these criteria will be used for analysis of on-line research studies. Through the benchmarking process, a list of the best practices used in on-line research will be compiled. If an electronic version of Live Science is to be constructed, it should integrate the best practices determined through the benchmarking study.

Chapter 3, *Methodology,* will discuss the tasks required to determine the feasibility of the Live Science Outreach Program. To gauge interest in the school version of the Outreach Program, teachers will be interviewed and asked about their feelings regarding the Program. For the public Outreach Program, venues will be observed and evaluated to determine interest among members of the public. To gain feedback on the Live Science event, the researchers who have participated in the event will be interviewed. A benchmarking study of research-based websites will be conducted to generate a list of best practices for establishing an

electronic version of Live Science Outreach. This study will use the criteria mentioned in section 2.4 *Web Quality Standards* to analyse and evaluate the sites.

3.0 METHODOLOGY

This project needed to address four tasks in order to ascertain the feasibility of a Live Science Outreach Program. These tasks were:

- To conduct a retrospective study with the two in-house Live Science researchers
- To collect data from science teachers in the London area regarding the potential Program
- To evaluate public venues
- To perform a benchmarking study of on-line research projects

This section of the proposal will present the methods that were used in completing this multifaceted feasibility study.

3.1 MEANS OF DATA COLLECTION

An instrument refers to the questions or protocols that will be used for data collection. Many methods can be used to gather information on how different groups, such as teachers, researchers, and the public, feel regarding a proposed Outreach Program. These instruments include surveys, interviews, and focus groups.

Interviews were the most desirable data collection method for this feasibility study. Interviews are conversations with a purpose (Bailey, 1987). They can be strictly structured with a set of predetermined questions, called standardised interviews, or they can lack structure as in un-standardised interviews. A combination of these is called a semi-standardised interview.

The standardised interview is very formal. The interviewer asks a set of goal-oriented questions. This type of interview does not allow the interviewer a chance to deviate from the predetermined questions. This is done to offer each subject the same stimuli so that the responses to the questions can be compared (Babbie, 1995). The standardised interview operates from the perspective that one's thoughts are intricately related to one's actions

(Berg, 2001). The standardised interview is good for eliciting a person's thoughts, opinions, and attitudes about a subject. The interviewer, however, is not allowed to probe the interviewee in-depth. This feasibility study desired the feelings and opinions of teachers, researchers, and the public. To obtain these feelings each teacher, researcher, or member of the public, will need to be probed differently, which standardised interviews do not permit.

Conversely, the un-standardised interview lacks a set of predetermined questions. This method is used when the interviewer does not know the types of questions he/she will need to ask in order to obtain the desired information. During the un-standardised interview, Berg (2001, p. 70) states that the "interviewer must develop, adapt, and generate questions and follow up probes appropriate to the given situation and the central purpose of the investigation." This method is inappropriate for novices because a novice may not know what questions to ask in order to obtain the response sought after. Although this method could have gathered the data desired for this project, our inexperience in conducting interviews required the use of an alternative method.

The type of interview that was used to elicit information from the different groups was a semi-standardised interview. A semi-standardised interview involves implementing a number of predetermined questions asked in a systematic order. However, unlike the standardised interview, this method allows the interviewer to deviate from protocol and follow up on specific ideas and topics that may arise during the interview (Berg, 2001). This type of interview will access the specific reasons why schoolteachers, researchers, and the public view the Outreach Program as either favourable or unfavourable.

When creating interview protocols, several factors were taken into consideration. These factors were the types of questions asked, their structure, the order in which they were asked and the type of information that the interviewer wanted to collect. There are four possible types of questions that can be used in interviews. These are essential questions,

extra questions, throwaway questions, and probing questions (Bailey, 1987; Berg, 2001). The use of only essential and probing questions was used in our interview protocols in order to keep the interviews short. Throwaway and extra questions were not used because they are mainly used to gain rapport and verify responses to complicated questions.

Essential questions are questions that directly assess the feelings of the interviewee toward a subject. Probing questions permit the interviewer to draw more complete answers from the respondent. The use of probes allows the interviewer to focus on a specific topic the interviewee mentioned, leading to an in-depth discussion of that particular point (Kvale, 1996). Probing questions were utilised to concentrate on specific themes talked about by the interviewee.

In order to collect exact feelings from the interviewee, he/she must understand what the interviewer is asking. To accomplish this, the structure of the questions must be considered prior to the interview. If questions are worded affectively, in a way that would elicit an emotional response, they could arouse negative emotions in some people. Negative emotions may cause the interviewee to loose trust in the interviewer and withhold information. Neuman (1994) suggests that neutralising the questions will avoid these negative emotions, which may hinder the results of the interview.

The interviewer must also stay away from the use of 'double-barrelled questions' (Neuman, 1994). A double-barrelled question is when the interviewee is asked to respond to two issues in the same question. It is critical to separate each issue into its own question, because the results gained from double-barrelled questions are virtually impossible to analyse (Berg, 2001).

The sequence of questions may significantly effect the results as well (Bailey 1987; Berg, 2001). The most effective order is to first ask the interviewee interesting questions, followed by more complex questions, and finally, the questions that may be the most

sensitive. Using this sequence allows the interviewer time to create rapport and trust with the interviewee and yield results that will be helpful to the study.

A rating question was used within the public and teacher interview protocols as a way of comparing results between responses. This type of question can be used to quantify the responses of the question. While the use of this type of question does not quantify the overall results, it can be used to confidently compare results among the responses collected. Ben Gammon, the Museum's Head of Visitor Research, suggested this use of a rating question to establish a numerical value of the interviewee's interest in a Live Science Outreach Program.

The three parameters, type, structure, and sequence of questions were used in designing the protocol for the interviews. Also, both double-barrelled questions and affective wording were avoided. This proved effective in eliciting thoughts regarding the Outreach Program. Pre-tests were used in order to identify double-barrelled and affectively worded questions within the interview protocols.

All the interview protocols that were used needed to be pre-tested before they could be implemented. This helped account for cross-cultural contamination and was used to identify double-barrelled and affectively worded questions. Participants of the pre-test included Sabiha Foster and the Museums' Evaluation Team. An un-standardised interview was used to determine if any negative conditions existed within the protocol. The information gathered through the pre-test allowed for the correction of the semi-standardised interview protocols.

When using any instrument to collect data, it is essential to keep in mind that there will be both costs and benefits for the interviewee. The interviewer must always try to maximise the benefits for the interviewee while minimising the costs (Tetlock, 1991). This maximising of the benefits while minimising the costs is also known as the Social Exchange Theory.

An obvious cost for all groups is time. Teachers can be busy preparing and teaching classes. The Live Science researchers also have their own busy schedules. The public may be limited on time because they may be en-route to a destination or may be preoccupied. This time cost can be minimised if the interviewer makes the protocol as short as possible while still gathering the desired information. For the public and the teachers, interviews were restricted to only a few minutes. For the researchers, time was restricted to no more than an hour when the interview was conducted.

Another potential cost that the interviewer must reduce while questioning teachers is the perceived risk that their opinions may be unpopular with their peers. By establishing good rapport and expressing confidentiality, the interviewer can reduce the likelihood that information and opinions will be withheld. A benefit for teachers that are willing to be interviewed is the establishment of the Outreach Program, which is a potentially useful tool for teaching science to their students.

While interviewing the public, the costs are more apparent than the benefits. The interviewers must present themselves in a professional and credible manner. This will increase the likelihood that the interviewees will feel more comfortable speaking with the interviewers.

In conclusion, the best method for gathering information regarding the potential Live Science Outreach Program was to use a semi-standardised interview. This method was determined to be the most effective since it allows for one-on-one discussions about the Program.

3.2 ASSESSING TEACHERS FEELINGS

It was necessary to collect the opinions of science teachers regarding the potential Outreach Program. These opinions are important since part of the Live Science Outreach

Program involves researchers collecting data within teachers' classrooms. For the program to succeed, teachers must be willing to open their classrooms to these researchers. In addition to this, their questions and concerns should be addressed.

Our liaison, Sabiha Foster, provided a list of primary and secondary science teachers that have good relationships with the Museum. The list contained twenty-two science teachers. The list was divided into two categories, primary and secondary schoolteachers. Primary schools contain students ranging from ages five through eleven whereas secondary school students' ages range from eleven to eighteen. It was important to select teachers from both groups because of the large student age difference.

Once the list of teachers was divided into two groups, all the members were contacted. No sampling was used on these groups. All teachers on the list were contacted for interviews. This was because we expected that some teachers would be unavailable or unable to arrange a time for an interview. Therefore contacting all the teachers increased the likelihood of collecting meaningful data. After the contacting process had been completed eleven interviews were scheduled, including seven among primary and four among secondary schoolteachers.

Phone interviews were used to reduce the costs for the teachers, since they only needed to set aside fifteen minutes of their day to participate. If face-to-face interviews were used, the time commitment for both the teachers and the Team would have been greater. Another point that needed consideration was the length of the interview. With the interview being conducted over the phone, a concise protocol was needed. This was accomplished by the creation of a three-question interview, excluding probe questions, as seen in Appendix B-1.

3.3 RETROSPECTIVE STUDY

A retrospective study was conducted to examine the researchers past experiences with the Live Science event and to see what benefits and/or problems they encountered during their time at the Museum. Based on their past experiences, the researchers were asked their opinions on the possible implementation of a Live Science Outreach Program. They were also asked for suggestions on how to improve the Outreach Program's chances for success. This information gave insight into a researcher's point of view when considering the Live Science Outreach Program's feasibility. This was a retrospective study because the data collected was of the researchers past experiences and opinions (Burgoyne, 1994).

Sabiha Foster, our liaison, contacted the two researchers to be interviewed. Each researcher was then interviewed separately with a semi-standardised protocol, contained in Appendix B-2, conducted face-to-face. In addition to the two interviews, Steve Darling, the most recent Live Science researcher, allowed us to participate in the study he was conducting. Giving us a better understanding of the Live Science event.

3.4 EVALUATING PUBLIC PLACES

In order to determine if a Live Science Outreach Program would be feasible in a public area, the public's feelings toward such a program were evaluated. There are certain qualities that a public venue must contain in order to take Live Science to a public place. For instance, the venue must have space for the scientist to set up any instruments needed for the study. It must also be a place where people frequent and a place where they have time to stop and participate in the Program.

To determine which public places to evaluate, greater knowledge into different London public areas was needed. This knowledge was acquired in an un-standardised

interview with Jennie Hawks, a London native. Her suggestions and others from Science Museum staff were arranged into categories.

3.4.1 Phase I: Public Observation

Since the Outreach Team had limited time and personnel resources, observations of each public place were done to narrow the list to only four sites. Phase I observations were conducted at times where there would be large numbers of people at the site. The airports and train stations were observed from 11.00 till 14.00, while the shopping areas were observed between 12.00 and 15.00. Phase I included an estimation of the population, a rough estimation of the population's demographics, the captivity of the population, and availability of space for Live Science Outreach Program.

During the first step of population estimation, people were counted for one-minute every ten minutes for three hours. During this minute, each individual who walked past a project team member was counted. After the minute was finished, the number was recorded. During the second step, a count of the number of people who were sitting or standing was taken for one minute. These two measurements were taken to compare how many people were moving to how many were not.

Using the two measurements above, an estimation of the total population at each venue was determined. This was accomplished by calculating the mean number of people walking by per minute. This mean represents the approximate number of people moving through the venue at any given minute during the three hours. This mean can then be multiplied by the length of the observation time. In our case the mean was multiplied by 180 minutes. This calculation gave the estimation of the people moving through a venue. An example may illustrate the method further; if the mean came to 20 people, it can be said that every minute, 20 people passed by the specific location. Since there are 180 minutes in the observation period, 3600 people walked through that area.

In addition to the people moving through an area, the people sitting or standing were estimated. The method was similar to the previous estimation. Every ten minutes the people sitting or standing were counted for one-minute. The mean was then calculated to give the approximate number of people standing or sitting at any given time. The turnover time for those loitering was not the same as those who were walking. The people walking turned over every minute, where the people loitering did not. The observer estimated the turnover rate of new people sitting or standing. This was accomplished by estimating how long it took before the majority of the people were new to the area. With this rate, the number people who loitered through the area were calculated. An example can show this. 50 people are observed loitering in an area and the turnover rate is every 30 minutes. There are six 30-minute intervals in the 180-minute observation period. This would result in 300 people loitering in the area during observation. After calculating these two sub-populations, a grand total can be computed. In the examples used above there would be an estimated 3900 people in the location observed.

As with any measurement there is always some error introduced. The only error involved with this method of population estimation is not counting the correct number of people. This could happen in several ways. Certain people might not have been visible when the counting was occurring. Another situation could have occurred when the people were moving which made them more difficult to count. Yet another error could have occurred by counting the same person twice. All of these would also skew the results. While these circumstances could have changed the results, effort was made to keep them at a minimum. This was done by limiting the counting time to one-minute intervals reduced the chance of error in our readings.

3.4.2 Phase II: Public Evaluation

The method described allowed us to estimate the population of an area. Once the population information was collected from each site, one venue from each of the four public area types was chosen for phase II evaluation. The venues to be evaluated were chosen by weighing the population size, the attitude of the population, and the space available for the Program. The attitude of the population was the largest factor in determining which locations to evaluate. If the location had a very hurried ambience, it would not lend itself to a Live Science Outreach Program.

Another aspect, which determined where phase II would happen, took place concurrently with the observation process. This aspect it somewhat unrelated to the population and their attitude. Permission from the venue's management was needed before the interviews could take place. The final word on if the Team would evaluate a public place was by the venue's management.

The evaluation of each public place was done through the use of a short semi-standardised interview consisting of three questions, as seen in Appendix B-3. This type of interview was chosen because it allows some freedom with the questions, but also allowed the interviewer to compare the responses. To reduce the time cost for the public, only three questions were used in the interview. The sampling method for these short interviews is described in the following section.

3.4.3 Sampling Method for Public Interviews

Once the locations for evaluation were finalised, interviews with the public were conducted by Systematic Sampling (SS). This method of data collection is performed by selecting the n^{th} person passing by. While this method seems straightforward, there are many nuances that could make implementing this method difficult.

A major problem with this is estimating the population. While a rough estimation of the population was made, it is extremely difficult to have an exact number. This arises from the potentially large number of people in public places and the limited resources of the Team. This was the biggest problem when using SS as the sampling method.

While SS works best if the population is definitively known, it can however, be used even if the exact number of the population is not known (Berg, 2001). This versatility is one of the strengths of this method. Before implementing this method there was another problem, which was addressed. This was the fluid nature of a public place.

While the population of a certain place can be estimated, it is nearly impossible to count each individual of that population because the individuals which comprise the population are always coming and going. This project was interested in the people who happen to be in the selected public venue at one particular time, not every individual who has entered it.

Keeping this fluid nature of the public in mind, it can be seen that picking every n^{th} person who has entered the public venue would be extremely difficult, if not impossible. Even if tracking people were possible, it would be difficult to reach each of them for an interview. This is due to the limited resources of our Team. With only two to four interviewers at each site, a people overflow might occur. This overflow would occur if each interviewer were engaged in interviews at the same time. For example, because each interviewer is engaged, the next n^{th} person, who should be questioned, is not questioned and passes by without being interviewed.

A more feasible method counting that would allow SS to be used was having each interviewer work at their own pace, independent of the rest of the Team. Each interviewer started with a predetermined n value. With this number n, the interviewer began their count at a random person. While this incorporates some self-selection bias, counting to the next n^{th}

person helped remove it. Once this next n^{th} person was selected, they were approached for an interview. At the conclusion of this interview the interviewer then selected a new person at random to start their count to the next n^{th} person.

In order to lessen the chance of a person being interviewed again by different interviewers, interviewers stood in their own section of the public place. For instance, if the team were in a market, the interviewers should be spaced evenly along the length of the marketplace, rather than in a small area.

The value for n must then also be defined. Choosing n values that are too high would be difficult to implement just because of the large numbers of people who would need to be counted. Another consideration is that the length of time between interviews would be large. Conversely, if a value of n were too small the results might be skewed because certain types of people might be congregating in a group. Resulting in a batch of interviews that does not describe the public accurately. A reasonable value for n needed to be chosen in order to balance out these two problems. This value was concluded to be twelve. This value lessened the chance of many members of one demographic being selected for the interviews. This number was also sufficiently small so that it was easily counted and the interviewer did not loose track of their place while counting.

3.5 BENCHMARKING STUDY

The final aspect of this project was to determine the best way to conduct scientific research. To accomplish this, a benchmarking study of on-line scientific research sites was conducted. From this study, a list of requirements and suggestions was compiled to guide the Museum in establishing a project on the web.

Grayson (1995) defines benchmarking as the process by which industry leaders are analysed to find ways to improve the practices of others within the industry. The results from

this analysis are a set of best practices employed within the industry studied (Handfield, 1995). Benchmarking studies can have many forms, ranging from face-to-face interviews to literature analysis, however the formula for the studies remains the same. The three-step formula consists of planning the study, collecting data, and then the analysis of data to determine the set of best practices (Grayson, 1995; Handfield, 1995).

The first step of the formula is planning the study. Information concerning the area to be studied, or the focus, is required for this step. By determining the focus, the best methods for benchmarking can be evaluated. If the focus is specific enough, a particular company maybe identified and that company would be contacted for interviewing, surveying, or constructing focus groups. However, if the area to be studied is a broad topic, literature regarding the topic could be analysed to determine the best practices. After planning the study, the data collection is accomplished through the pre-determined means. The last step is analysis of the data. The best practices can then be generated from the analysis of the collected data.

For the Live Science project, a benchmarking study was employed to evaluate current research via the Internet. To accomplish this study, online research websites had to be found. These sites were found by doing keyword searches on many search engine sites. These websites were then evaluated according to a modified version of the criteria explained in section 2.4 *Web Quality Standards*. This modified WebQual assessment tool is included in Table 3-1.

Criterion	Application to Website	Reason For Use
Informational Fit-to-task	-Site information is up-to-date -Site provides all needed information	Information on the site needs to meet a certain quality in order for the site to be useful.
Interactivity	-Site provides contact information -Site contains some type of data collection	Contact information provides visitors with a way to talk to the researchers. In order to collect data, each site must have some form of interactivity.
Trust	-Site provides explanation of what data will be used for -Site expresses level of confidentiality	For visitors to submit personal data, they first must feel comfortable.
Response Time	-Site should load in less than 8 seconds	People will not visit a site with a slow loading time.
Design Appeal	-All graphics labelled -All text is legible	Sites must provide visitors with knowledge of what they are viewing.
Intuitiveness	-Site is easy to navigate -All pages on the site can be accessed easy	Visitors must be able to access the information contained within a website.
Visual Appeal	-Site is aesthetically pleasing	People will not visit a site that does not looking good.
Innovativeness	-Site uses new web technologies	New web technology can help a site separate itself from similar sites.

Table 3-0-1: Modified WebQual Assessment Tool.

As stated earlier, the original criteria are informational fit-to-task, interaction, trust, response time, design appeal, intuitiveness, visual appeal, innovativeness, flow-emotional appeal, integrated communication, business processes, and viable substitute. Since these were designed for e-commerce sites, some of the characteristics were determined to be inapplicable for the evaluation of research-based sites.

A major change that was made to the original set of criteria was the elimination of the last four aspects. Integrated communication and business processes were both omitted since they are only applicable to business sites. The other two criteria omitted were viable substitute and flow-emotional appeal. The first of these could not be used since there was no basis for comparison between the online and offline research studies. Flow-emotional appeal could not be evaluated because it too subjective. For example, we could not assess if a site was challenging for those it was designed for, since most sites were designed for young

children. The eight relevant aspects that need to be assessed for scientific research web sites are informational fit-to-task, interaction, trust, response time, design appeal, intuitiveness, visual appeal, and innovaitiveness.

A minor change was made to the application of trust. In the application of this standard, trust was expanded to include expressed confidentiality, which alerts website visitors of the level of confidentiality their data will receive. The remaining criteria were used exactly as specified in section 2.4 *Web Quality Standards*.

After the criteria that would be applied to the websites were defined, a search for websites to benchmark was conducted. Many Internet search engines were used for this investigation. Through this search, a list of possible websites was compiled. After visiting each site, it was determined which websites were applicable to the benchmarking study. These sites then had the eight criteria mentioned above, applied to them. From the information gathered by applying these standards, the Science Museum was provided with suggestions and comments for conducting and designing web-based scientific research.

4.0 RESULTS

There were four tasks performed in order to determine the feasibility of a Live Science Outreach Program. The first task was to interview teachers so as to assess their opinions on bringing Live Science into the classroom. The second task was to interview the past researchers of Live Science and determine any problems they had performing Live Science and what suggestions and potential problems they see for an Outreach Program. The third task was to evaluate public venues in order to find places to take a Live Science Outreach Program to. Also a benchmarking study was done to determine the best practices for bringing Live Science to the World Wide Web. When these tasks were completed, the data collected were analysed for common themes and concerns. This chapter will discuss the results attained from interviewing teachers, researchers, evaluating public places, and assessing research websites.

4.1 TEACHERS' INTERVIEW RESULTS

The Live Science Outreach Team received a list of sixty-seven teachers, who are all participants in the Museum's Teacher Advisory Panel (TAP). This panel meets at the Museum a few times a year to discuss Museum programs, evaluate new ideas, and brainstorm possible exhibits. After eliminating non-science teachers, this list was reduced to twenty teachers. From these twenty science teachers, we were able to contact thirteen for possible telephone interviews. The seven teachers who we were not able to contact either no longer worked at the contacted school or had no work number provided on the list. Of the thirteen teachers contacted, eleven interviews were scheduled. Every teacher who we spoke to directly agreed to interview with us. From the eleven interviews, teachers' opinions regarding the Live Science event and a possible outreach program were gathered. The protocol followed for these interviews can be found in Appendix B-1.

4.1.1 Museum Experience

The first question asked of the teachers was what their past experiences with the Museum have been. This question was also used to establish rapport with each interviewee before asking for their opinions. Six of the teachers said they are active participants in the TAP program, and have taken classes to visit the Museum. Four teachers said that they have taken part in the TAP program, but have not taken classes to visit the Museum. One teacher said that they had taken part in the TAP program but not for a few years.

4.1.2 Perceptions of the In-house Live Science Event

The overall response to the second question, which asked teachers to comment on the Live Science event after having it described to them, was positive; with one teacher saying she would like to see the event before commenting fully on it. Teachers felt that this program was a good idea as well as educational, with two mentioning that it, "brings the curriculum to life." They also liked the idea of connecting the public with the scientific community. Eight of the eleven teachers stated that this program would remove many of the misconceptions people associate with science. One teacher felt that, "quite often scientists are thought of as people in white coats in labs. This program would dispel that." Although all the teachers felt that the program would be beneficial to the students, a few of them said that they would not make a special trip to the Museum to see Live Science, because of the difficulty and cost involved in planning school trips.

When asked what they would like to get out of the program, many of the teachers had similar responses. Six respondents commented that, "the program makes science real," as well as, "relating science to the children's lives." These teachers meant that science would no longer appear as an obscure topic to the students. Four teachers mentioned an idea that would help relate the study to the children, this was obtaining the some type of results from

the study. Teachers said they would like to have the results as quickly as possible, citing children's short attention spans as the reason. With the results, children could realise that they were a part of something important, which would build a personal relevance to science. As mentioned in section 2.2.1 *Museum Exhibits*, personal relevance is one of the criteria for an effective museum exhibit this is verified by the teachers comments. One of the teachers mentioned that the students, "need to then see the big picture of where that research has gone, otherwise it's a limited response." These teachers also mentioned that they would like the students to have something that they could take away with them, such as a printout of their personal results.

Three teachers mentioned that they would like to have either an information session before taking students through the program, or an informational packet so they could get their students excited about participating. A couple of teachers addressed the idea of the Museum providing permission slips for the visit as well as lesson plans to use before or after the Live Science event. However, one teacher thought the program did not need to have any other benefits aside from connecting the students with the scientists.

Question	Responses
What they thought about Live Science?	- Ten had positive responses - One wanted to see it first
What they thought about the goal?	- Eight thought it would remove misconceptions about science - Two thought it, "brings the curriculum to life"
What they would want to get out of participating?	- Six wanted the program to, "relate science to the children's lives" - Four wanted some form of results. - Three wanted some type of information prior to participating - Two wanted the Museum to provide permission slips and lesson plans - One did not need anything except the experience

Table 4-1: Teachers' Feelings Towards the In-house Live Science Event

4.1.3 Feelings Regarding the Proposed Outreach Program

The third question of the interview dealt with how the teachers felt about a proposed Live Science Outreach Program. This question elicited positive responses from all eleven of the teachers. The responses were similar to what was said for the in-house event. Most commenting that it would be a great educational tool. Many teachers felt that the outreach program was a better idea because it reduced the costs for the schools since they would not have to plan a trip to the Museums. One teacher commented,

> "I personally prefer the outreach, because you avoid all this fuss about getting children on transport, [and] worrying about packed lunches. You wouldn't need parental help, and of course [you don't have to worry about] safety, and the children are at school [so] you wouldn't need parental permission to take them on a journey."

However, when asked about suggestions for how the program should operate, many teachers began to mention stipulations that would have to be dealt with. Six of the eleven teachers mentioned that the program would have to somehow fit into the National Curriculum (NC). The reason for this adherence to the Curriculum is because students are required to pass exams at different stages of their academic careers. Spending time on non-National Curriculum activities is very difficult for the teachers to do, because they need to teach information which is covered in the exams. One teacher felt that if, "you'd be able to link it to this possible Curriculum, I don't see why the teachers wouldn't want to participate." An alternative suggestion, which would by-pass this adherence, was that the program could take place during, "science weeks or at the end of the year when the Curriculum is no longer focused on." The reason for this easing off of the Curriculum is because students have finished the exams that they have to take. A similar suggestion was that the outreach program could meet with 'science clubs' or other enrichment activities that meet outside of school time.

Others discussed that the Museum would have to provide the required permission slips and lesson plans for teachers to use as follow up for the event. One of the teachers felt

that the, "reasons why teachers don't do these sorts of activities is that it takes a lot of work." If the Museum were willing to alleviate lot of the work needed for the Outreach Program to visit schools, teachers would be much more willing to participate. Relevance to each grade level was also brought up. Three teachers thought that a pre-visit would be something very useful. This visit could be used to explain the study to the children as well as increase their excitement about getting to meet the scientist. One teacher thought that it might be useful to have someone come do this pre-visit, then come with the researcher to keep the children busy while the researcher is collecting data.

Some teachers were still concerned with receiving the results of the study. They felt that the class would need to see the results. One teacher even suggested that the students could become more involved in the study if they had results. Instead of just providing data, the students could collect data from each other and then discuss the themes and trends found within the data.

When asked what benefits the teachers would like to get from the program, the teachers responded very similarly to the same part of question one. Again, the teachers focused on the program as being a way in which science could be taken from the textbook and brought into real life. This comment is similar to a topic that was discussed in section 2.3 *Science Education*. The program could disprove some of the misconceptions surrounding science. Some teachers also mentioned that the program would help to excite children about science, by giving it of personal relevance.

The final question posed to the teachers asked them to rate their interest in the proposed outreach program on a scale of one to five. The mean we received for this question was a 4.36, which is a strong positive response. Although this question was supposed to provide us with a way to quantify the results, most teachers provided an answer with stipulations attached. Many of these stipulations were regarding some of the suggestions that

had been made earlier. Some examples of these stipulations are, "if it fits within the National Curriculum," or, "if the Museum provides the permission slips and lesson plans." These would be important to address when designing the program.

Question	Responses
What their feelings were regarding proposed outreach version?	- All eleven had positive responses
What were their suggestions for how the program should operate?	- Six felt it needed to fit into the National Curriculum - Alternatively, four thought the program should visit during non-Curriculum time, such as science weeks, post-exam time, or enrichment activities - Four teachers wanted access to some form of the results - Three teachers wanted a pre-visit information session - Two teachers wanted permission slips and lesson plans provided
What benefits the teachers would like to get from the program?	- Six wanted the program to bring science from the textbook into real life - Five wanted students to feel some type of personal relevance
Level of interest, rated on a scale of one to five.	- Mean value was 4.36, indicating strong interest in participating

Table 4-2: Teachers' Feelings Regarding the Live Science Outreach Event

Overall, the responses toward Live Science were positive. All of the teachers provided constructive suggestions and showed what the program will need to address in order to be successful. From the teachers' answers to our questions, conclusions and suggestions regarding both the in-house and outreach version of the Live Science event can be made. These conclusions and suggestions will be address in section 5.1 *Teachers' Interviews Conclusions*.

4.2 RESULTS OF THE RETROSPECTIVE STUDY

Interviews conducted with the past researchers gave insight into their perspective of Live Science. The researchers discussed how Live Science could be improved and the problems that they had when conducting their study. The researchers were also helpful in giving ideas on what may be potential problems for an Outreach Program and how to get other researchers interested in Live Science.

Focusing on the problems that the researchers encountered, we found that both researchers had trouble getting people to participate in Live Science. The researchers explained that they thought "it [the Museum] would be a lot busier than it was." In fact, both researchers had to change the times they came to the Museum to a time when the Museum would be busier. The reason that a lack of participants can be a problem is because the researchers need a large amount of data to make their trips to the Museum worthwhile. One researcher stated that, "the fundamental benefit that the researcher needs is bodies through the door. That's it, if you can get enough bodies through the door, of the population that you're interested in then your gonna be happy." Unfortunately, both researchers felt that the, "numbers [of people] that we got [to participate] were really too small."

Another problem mentioned by both dealt with the Live Science Arena. One researcher felt that the Arena was "treated like a phone booth" by the Museum staff. Staff, he explained, would enter the Arena while he was conducting his research and use the phone. Also, he found that in his absence things were moved around and he would have to rearrange things before beginning his day. He felt that the "Museum hasn't made enough effort to make sure people know this [the Live Science Arena] is not a public area."

Also, due to the area's location on the gallery, the Arena can be quite noisy, and this too was found to sometimes be distracting. This however, was not a major problem for either researcher, but it was pointed out that, "there is an awful lot of stuff you can't do [here in the

Arena] because it's noisy." An example that was given was the usage of voice-activated equipment. These pieces of equipment are used to measure response time by measuring people's vocal responses. The noise of the Arena would affect the use of these pieces of equipment.

Discussed above are the two main problems that the researchers encountered while conducting their Live Science study. Next, the discussion will turn to possible improvements and solutions that the researchers suggested for Live Science. The main theme was that the Live Science event needs more advertisement within the Museum.

Suggestions for advertising the program were to put up signs and hand out fliers to Museum visitors. For example, when people buy their ticket to enter the Museum, the staff can, "give them a little slip of paper, which says 'Live Science going through [and] they're looking for [participants]." Another suggestion was to have a Museum staff member make announcements over the broadcasting system. This way, the researcher could make people aware that Live Science is taking place without wasting the manpower needed to conduct the experiment quickly and efficiently. Also, the researchers thought it would be helpful to have control over what the sign outside the Arena says. One researcher had said that the "frustrating thing was that we couldn't change it [the sign]...and say [that] we [had] gone off for a cup of coffee or you know, we're running a bit behind today can you come back."

Another suggestion was that it would be "useful to have a semi-permanent monitor or assistant designated to [a Live Science] project when it's running." This assistant, it was explained, should be a member of the Museum staff. During the hours the researcher is at the museum, this assistant would stand in the '*Who Am I?*' gallery and recruit visitors to take part in the research study. The assistant would also help the researcher conduct his or her study and help to collect data. A reason for this suggestion is that "clearly, if you can move people through by having more assistants there, then people don't get tired of waiting. Especially, if

you're trying to get families with children [to participate] who don't like to sit and wait around."

When asked their thoughts on a potential Live Science Outreach Program, the researchers' answers were very similar. The points that they both expressed were that, "most research programs are very specialised," and that what will work for one experiment might not work for other experiments. For example, the first researcher interviewed would need a very controlled space where he could perform his experiment on one person at a time. When travelling to different locations he would have, "to make sure that those locations are comparable," and that the people within those locations are comparable. He thought that, "it's pretty likely that they won't be comparable and the people who come in won't be comparable." He thought that doing a project similar to the one he did in-house for an Outreach Program would prove very difficult for him.

On the other hand, the second researcher had already taken his research to a public place, the Whiteley's Centre. His research was quite different than that of the first researcher interviewed, because he did not require responses, just their faces and DNA. He did not have to worry about comparability of the populations at the locations he would visit. Based on his experience however, he did mention a problem that he had. Due to his visually appealing set up, people would crowd around the area but they were "just watching, not wanting to participate, [but] just watching."

From the researchers general knowledge about science, two points were brought up in relation to a Live Science Outreach Program. The first point is that every researcher will have a different set of needs depending on the topic of their study. Some researchers might want to travel to several locations, while others might want to frequent just one.

The second point is that it might be hard to find researchers to participate in the program. As one of the researchers said:

> "The mark from the researchers point of view [is], 'Why bother?' Why go out to different places, at different times and take a lot of time travelling places and working things out. You'd have to get quite a lot back for that to be worthwhile."

Interviewees suggested that a way to get researchers interested is to provide them access to places or people they usually would be unable to access. Researchers might not want the Museum to act as a middleman to a place or population they could access on their own.

Lastly, suggestions were made as to how and where the Museum might look to find researchers to participate in Live Science and the Live Science Outreach Program. The first suggestion was to look to secondary students for possible projects and try to find students who "have a research project that they feel they would like to involve the general public." Another suggestion is to work through the sponsor of the Wellcome Wing, the Wellcome Trust Foundation, a medical research charity founded by Sir Henry Wellcome in 1936, and place advertisements in the Wellcome Trust Newsletter. The last suggestion the researchers had was for the Museum "to have a meeting where they invite scientists along to the Science Museum."

In summary, the researchers had several problems with participating in Live Science. First, the researchers felt that there were not enough people at the Museum for them to conduct their studies. Secondly, the researchers complained that there were too many interruptions caused by Museum staff to use the telephone. The researchers suggested that the Museum make more of an effort to advertise the Live Science event within the museum by putting up signs and handing out leaflets to visitors. They also hoped that the Museum would make its staff more aware that the event going on in the Live Science Arena.

In terms of the Outreach Program, the prevalent mood of the researchers was that such a program is a possibility. They believed that it might be hard to find researchers to participate in Live Science and in the Outreach Program. Also, the researchers thought that a

major incentive the Museum could offer would be to allow the scientist access to populations they normally could not.

Topic	Responses
Problems with the in-house Live Science	- Population was less than expected - Arena was both noisy and often had people walking in and out of it
Suggestions for the in-house Live Science	- Increase awareness within the Museum, with both staff and visitors - Allocate researchers an assistant from the Museum staff
Feelings regarding proposed outreach version	- Requirements for each study must be kept in mind when determining possible venues to take the event to - Museum will need to provide researchers with access to a frame they can not access themselves
Suggestions for finding researchers for in-house/outreach event	- Increase advertisement in journals, and even newsletters, like the Wellcome Trust's - Hold some kind of meeting for researchers at the Museum to discuss Live Science

Table 4-3: Researchers' Feelings on Live Science

Discussed above are the main thoughts and suggestions that the researchers had concerning Live Science and the potential Live Science Outreach Program. In section 5.2 *Retrospective Study Conclusions*, these thoughts and suggestions will be discussed further and recommendations to the Museum will be made.

4.3 PUBLIC VENUE EVALUATION RESULTS

Four steps were completed in order to evaluate the public venues. These steps were: the collection and selection of the venues, the Phase I evaluation, getting permission to interview people at the venue, and the Phase II evaluation. Phase I was an evaluation that consisted of observing the venue and taking a population estimate. Phase II was an evaluation that consisted of interviewing the public. This section will report the results of each step listed above.

Due to the Project Team's unfamiliarity with London, suggestions where to take Live Science were collected from Museum staff and Jennie Hawks, and then categorised into four

subject headings. These headings were shopping centres, open markets, train stations and airports. The Project Team did not have the time or resources to observe and evaluate each place. Therefore, two venues from each category were selected for observation based on preconceived ideas on whether the site would be good for Live Science. The venues chosen for each category, respectively, were:

Shopping Centres	Open Markets	Train Stations	Airports
O2 Centre	Spitalfields	Marylebone	Stansted
Merton Abbey Mills	Camden Town	Waterloo	Heathrow

Table 4-4: Locations Observed by Project Team

Using the method described in section 3.4.2 *Phase II: Public Evaluations,* all eight places listed above in Table 4-4 were observed for three hours and a population estimate was taken. Table 4-5 shows the results of the population estimations. Using this population estimate and other site characteristics, we made a decision as to whether the physical aspects of the venue would be good for a Live Science Outreach Program. The characteristics that we took into consideration included the pace of the people moving through the area and how spacious the area observed was.

Venue	Moving Population	Standing Population	Total Population
0_2 Centre	4820	65	4885
Merton Abbey Mills	3590	171	3761
Spitalfields	N/A	N/A	N/A
Camden Town	8230	111	8341
Marylebone Station	4220	846	5066
Waterloo Station	36450	3192	39642
Heathrow Airport	7300	139	7439
Stansted Airport	18400	727	19127

Table 4-5: Population Estimates for Venues

In the next section, the observations of each venue will be discussed in detail. Also, the decisions of whether or not to evaluate each venue will be presented. This data, summarised in Table 4-6, can be found at the end of the section.

4.3.1 Phase I: Observations Results

Based on our observations, the O_2 Centre at Finchley Road seemed receptive to Live Science. The customers at the Centre seemed to shop leisurely, rather than to going in and out of stores quickly. The population at the Centre was moderate, and even though there were not many people standing around, the pace of the people walking through the area was slow. The overall attitude of the venue made it seem like the Centre would be a good place for a Live Science Outreach Program. Therefore, the O_2 Centre was chosen as a candidate for Phase II of our evaluation.

Merton Abbey Mills was very similar to the O_2 Centre, in that people would come to the venue to spend time and browse in the stores. People did not seem to be in a hurry when we were observing there. The venue has a lot of open space for Live Science to set up. While the location was not overly crowed there was a steady flow of people who, in general, seem to be relaxed and easy going. With this in mind, Merton Abbey Mills was chosen as a candidate for Phase II.

As noted in Table 4-5, Spitalfields does not have an estimate of the population. The main reason for this was the limited amounts of space available for Live Science at the site. The set up of the market had a very compact feel. There were no open areas where estimating people could be done effectively. The only areas where people could walk around were the many small aisles between the stalls. If estimation were done on any one aisle, it would not yield an accurate estimate of the number of people at Spitalfields. Due to this lack

of space and population problem, Spitalfields was dismissed for Phase II, even though it seemed to have a large population.

Camden Town Market was very similar to Spitalfields. The passageways through the market were narrow and crowded, making it hard to estimate properly. The atmosphere of the area seemed chaotic and busy. The population seemed more interesting in buying clothing than stopping to look at what other attractions there might be. For example, there was a man already there, looking for people to fill-out surveys and no one would stop to participate. Due to the lack of space and the fast, busy pace of the population, Camden Town Market was not chosen for Phase II.

Marylebone Station gave the impression of being a slow paced station. Although there were some people in a hurry, there seemed to be more people waiting around to catch the trains. Also, there was space for Live Science to set up in several places within the station. Due to the fact that there were many people there who have to wait for trains and there is ample space for Live Science to set up, Marylebone was chosen as one of the venues for Phase II.

The opposite, however, was true of Waterloo Statino. While the population was large, much larger than that of Marylebone, and there was space to set up, the pace of the station seemed to be much different. We observed that people had a need-to-get-somewhere demeanour, which made the venue seem rushed and chaotic. Overall, the people within the station seemed intent on getting to where they had to go; they did not seem like they would be responsive to a Live Science Outreach Program. This is probably due to the fact that the station is very big, therefore, Waterloo Station was not chosen for Phase II of our evaluation.

In the departure lounge at terminal three of Heathrow Airport, there were many spaces available for Live Science to set up. There was a constant flow of people walking by, yet at the same time, the airport was not so crowded that Live Science would be impossible to

perform. Airports usually have the atmosphere of being in a rush to get somewhere, however people in the departure lounge looked bored. There were many people waiting on benches with nothing to do. While waiting for their flights, people would stroll along the corridor and look in the shops. It is thought that since people had time to do this, they might have time for Live Science and therefore, Heathrow was made a candidate for Phase II.

Stansted Airport was also a good candidate for Phase II of our evaluation. The pace of the venue was very relaxed and slow. Those sitting or standing around outnumbered the people walking at any given time. The reason for this is probably because many people are either waiting for their flight to leave or they are waiting for someone to arrive. Therefore, there were many people not moving for a long period of time. Within the airport, there were a number of places where Live Science could be set up. Due to the fact that there were many people who were waiting for their flight, or a passenger, Stansted was thought to be a good candidate for Live Science and Phase II.

Site	Population size	Pace of Venue	Considered for Phase II evaluation
O2 Centre	4885	Slow	Yes
Merton Abbey Mills	3761	Slow	Yes
Spitalfields	N/A	Fast	No
Camden Town Market	8230	Fast	No
Marylebone Station	4220	Slow	Yes
Waterloo Station	36450	Fast	No
Heathrow Airport	7300	Slow	Yes
Stansted Airport	18400	Slow	Yes

Table 4-6: Phase I Evaluation Summary

As noted above, both airports and shopping centres were nominated for Phase II. Since both open markets were decided unsuitable for Live Science, both shopping centres were to be evaluated. The airports had remained undecided, with the decision pending on which would allow us to conduct Phase II there.

Now that the Team had decided upon the places to evaluate further, we needed permission from the venues to perform Phase II. This is because Phase II involved interviews with the public. The next section will discuss the issues of obtaining permission.

4.3.2 Gaining Permission for Evaluation

Public relations managers at the venues were sent a fax from our Project Team, which outlined Live Science and why interviews were being requested. This information provided the venues with background so that they could make informed decisions on whether our Team could conduct evaluations. The venues' responses received were mixed.

The O_2 Centre did not want our Project Team to interview its shoppers because the Centre had recently performed marketing research and tenant questionnaires as well as housed two large public promotions. The Centre expressed that they did not want to subject its visitors to another type of soliciting. Meanwhile, Merton Abbey Mills was more than happy to grant us access to their venue in order to perform public interviews.

Another venue that was comfortable with us interviewing the public was Marylebone Station. It should also be noted that both open markets were willing to allow our Project Team to do Phase II at their venues, but it was already decided that, unfortunately, the markets were unsuitable for Live Science.

The airports however, were hesitant about allowing us to interview the people in their venues. In the end, both airports decided against our team to interview the public and did not give us access to their venue. Stansted, for example, said that due to construction they were unable to allow people to survey the public. Heathrow's negative response was attributed to security issues. In attempts to gauge some public opinion in an airport venue, Gatwick was contacted. The response to our interviewing people at Gatwick was negative, again for security related reasons.

Out of the five candidates contacted after Phase I, two venues had interviews conducted with the public. This was because three venues would not permit interviewing of people. The next section will discuss the results found at the two venues where Phase II took place: Merton Abbey Mills and Marylebone Station.

4.3.3 Phase II: Evaluation of Public Venues

Public venue evaluations consisted of interviewing the public using systematic sampling discussed in section 3.4.3 *Sampling Method for Public Interviews*. However, instead of having each interviewer work individually, we worked in pairs. Both Merton Abbey Mills and Marylebone Station were scheduled to have two hours of interview time. Unfortunately, the second hour at Merton Abbey Mills was not carried out. This was due to stagnation in population. We began to count the same people over again and would approach people who said they were already interviewed by the other team. Therefore, the sampling method broke down, and it was difficult to continue interviewing to the end of the second hour. At Marylebone Station, the population was constantly changing and so we did not run into this problem and therefore we interviewed the public for two hours as planned.

At each location, the public was asked three questions as stated on the protocol located in Appendix B-3. This discussion will now move to present the data recorded from these interviews.

Merton Abbey Mills

At Merton Abbey Mills there was a positive feeling toward Live Science and the Live Science Outreach Program. Forty-two people were approached at the station and twenty-five agreed to participate for a response rate of 59.5%.

When asked what they thought of the idea of Live Science, 72% of the people interviewed had positive feelings. The general responses were that Live Science was a "good idea" and sounds "very interesting." There were a few responses that said that Live Science was a "brilliant" or "wonderful" idea. Eight percent of the public were indifferent to the idea, saying that the idea "sounds fine" and that it is "fair." Four percent of the public interviewed said Live Science was a bad idea and 12% of the people did not understand the question asked.

When asked what type of experience they would like to have from participating in Live Science, eleven people said they wanted to gain information. The majority of these responses were that they wanted to "learn" something from their experience with Live Science. Three people said they would like to know the results of the study they participated in. One person said it would be nice if the study held some personal relevance to her, meaning that when she walked away from the experiment, she had learned something about herself. Three people were unsure of what they would want to get out of the experience of Live Science. Seven people gave independent responses such as to "know that my information is helpful to the researcher" and to participate in the program "for money."

When asked to rate their interest in participating in an Outreach program, the responses were also very positive. The mean rating was 3.92, with 24% of the public interviewed saying they were strongly interested, 52% saying they were slightly interested and 20% being indifferent. Even though there were many positive thoughts on Live Science 4% said they were strongly disinterested in a Live Science Outreach Program. The main concern that people had was what would happen to the data after it was collected.

Thoughts People Had	Positive	Negative	Indifferent	Misunderstood Question	
#(%)	19(72%)	1(4%)	2(8%)	3(12%)	
Experiences Wanted	**Gain Info**	**See Results**	**Personal Relevance**	**Not Sure**	**Misc.**
#	11	3	1	3	7
Rating of Interest in Participating	**Strongly Interested**	**Slightly Interested**	**Indifferent**	**Slightly Disinterested**	**Strongly Disinterested**
#(%)	6(24%)	13(52%)	5(20%)	0(0%)	1(4%)

Table 4-7: Assessment of Merton Abbey Mills

Marylebone Station

At Marylebone Station there was also a positive feeling toward Live Science and the Live Science Outreach Program. Ninety-nine people were approached at the station and sixty-three agreed to participate for a response rate of 63.6%.

When asked what they thought of the idea of Live Science 84.1% of the people interviewed had positive feelings. The general responses were similar to that of Merton Abbey Mills, saying that Live Science was a "good idea" and sounds "very interesting." Fourteen percent were indifferent to the idea saying that the idea "sounds fine" and that it "makes sense." Even though the public did not say it was a bad idea, 1.59% of the people interviewed did not understand the question asked.

When asked what type of experience they would like to have from participating in Live Science, thirty-two people said they wanted to gain information. The majority of these responses were that they wanted to "learn" something from their experience with Live Science. Ten people said they would like to know the results of the study they participated in. Another response was that the public wanted the study to be relevant to them in some way. Six people gave this response. Also, six people were unsure of what they would want to get out of Live Science. Fourteen people gave independent responses such as to "know

that my information is helpful to the researcher" and to participate in the program "just to experience it." One interviewee said that he wanted to gain nothing from the experience.

When asked to rate their interest in participating in an Outreach program, the responses were very positive. The mean rating was 3.69, with 15.87% of the public interviewed saying they were strongly interested, 44.44% saying that they were slightly interested and 31.75% being indifferent. Despite positive thoughts of Live Science, 3.17% said they were slightly disinterested, and 4.76% said they were strongly disinterested in a Live Science Outreach Program. The main concern people had was that they might not have time to participate in the program. Two people even suggested that such a program should remain inside the Museum saying that, "it [the program] makes sense in a museum but not in a public place."

Thoughts People Had	**Positive**	**Negative**	**Indifferent**	**Misunderstood Question**	
#(%)	53(84.1%)	0	9(14.3%)	1(1.59%)	
Experiences Wanted	**Gain Info**	**See Results**	**Personal Relevance**	**Not Sure**	**Misc.**
#	32	10	6	6	14
Rating of Interest in Participating	**Strongly Interested**	**Slightly Interested**	**Indifferent**	**Slightly Disinterested**	**Strongly Disinterested**
#(%)	10(15.87%)	28(44.44%)	20(31.75%)	2(3.17%)	3(4.76%)

Table 4-8: Assessment of Marylebone Station

The public in both venues evaluated held very positive feelings toward Live Science and the Live Science Outreach Program. The majority of people interviewed was had some degree of interest in the Live Science Outreach Program and hoped that they would learn something new while participating in the program. In *5.3 Public Venue Conclusions*, these results will be discussed and recommendations to the Museum will be made.

4.4 BENCHMARKING RESULTS

In order to advise the Science Museum on the best design for their Live Science website, we conducted a benchmarking study of online research websites. Our benchmarking study yielded seven websites pertaining to online web research. We have concluded that this low number is due to two reasons. The first reason is the possibility that a limited number of online research programs exist. Second, we may have missed pertinent sites because they did not register under the keywords used on the search engines. Also, newsgroups and message boards, which were not searched extensively because of time constraints, might provide more sources for analysis. Due to the time constraints of this project, messages could not be posted to either newsgroups or message boards because of the proper web etiquette associated with these. The proper etiquette is to observe message boards and newsgroups for a period of time before posting to them.

Through the application of the modified WebQual assessment tool, described in section 3.5 *Benchmarking Study*, many similarities were found between the evaluated websites. Table F-1 showing the results from this evaluation can be found in Appendix F.

Informational Fit-to-Task

This criterion is applied to the information contained within a website. The information contained within a website must meet a certain level of quality to be of any use to users of the site. The two parts of this criterion regard whether the information is up-to-date and all the information needed is provided. All of the evaluated websites contain information that is up-to-date, excluding the *Astronomy Online* and *Scientists in the City* sites. However, neither site is currently in use. All of the sites, except *Scientists in the City*, provided all of the information needed to complete the projects.

Interactivity

This criterion is one of the more important ones to consider when evaluating online research websites. In order to conduct research online, sites must have some level of interactivity to collect data from visitors. Most of the sites utilised various forms of questionnaires to collect data. Some of the sites, specifically the *Astronomy Online* and *Project Atmosphere Australia Online* sites, used e-mail for data submission. The *Scientists in the City* site has a unique way of collecting data. Participants in this project constructed web pages detailing their methods and results, and then these pages were submitted or linked to the project site. The second part of the interactivity criterion requires that contact information for the people in charge of each site be provided. All the sites contain an e-mail address or some other means for contacting the site's Webmaster.

Trust

Trust is very important because in order for people to submit personal data, they first must feel comfortable. This can be accomplished by websites in two ways. First, sites should fully explain what the data will be used for and why the data is needed. Second, sites should express the exact level of confidentiality that participants will receive. All of the evaluated websites provided a statement of purpose explaining what the data was going to be used for and why the data was needed. Only one website, the *American Psychological Society* site, provided expressed confidentiality statements to participants.

Response Time

The response time criterion is very important when considering websites. Shand (1999) found that if a website takes longer than eight-seconds to load, visitors would be

discouraged from using the site. All of the evaluated websites took less than eight-seconds to load using the Museum's Internet connection.

Design Appeal

This criterion refers to the clarity of text and graphics. For visitors to understand what a project asks of them, they first must be able to read all the text and recognise what each graphic represents. All of the evaluated websites accomplished this. First, all of the text within the sites is legible. Second, all of the graphics are clearly labelled, with the exception of a few diagrams on the *KanCRN* site.

Intuitiveness

Intuitiveness refers to the navigability of a website, which allows visitors to access all of the information contained within a site easily. Each site, except the *Astronomy Online* and *Scientists in the City* sites, provides a central directory. This central directory allows the visitors to easily access each page within the site.

Visual Appeal

This criterion refers to the overall aesthetics of a website. All of the websites evaluated contained a lot of text. This leads to a somewhat bland look to each site. Some of the sites, mainly the *Project Atmosphere Australia Online* and *Journey North* sites, try to offset this by including a lot of graphics. The inclusion of graphics helps to make a website look a little more exciting to visitors.

Innovativeness

In order for websites to stand out, many use new forms of web technologies. These technologies can provide sites with a way to take on a unique look. Aside from the G2 videos on the *KanCRN* site, none of the evaluated websites utilise any form of new web technology.

Even though many similarities were found between the sites, evaluated sites had varying purposes and some unique qualities. These different functions and qualities will be discussed in each section below.

Astronomy Online (Figure F-1 in Appendix F)

(http://http.hq.eso.org/outreach/spec-prog/aol/market/collaboration/erathostenes/)

This website asks visitors to apply a formula, which determines the circumference of the Earth by using measurements of shadows, and then report their results via e-mail. It was designed for primary and secondary classes and independent learners. The site contains no confidentiality statement and provides no security for the information submitted. This is not necessary due to the type of data submitted, which are merely measurements and calculated results. The site is no longer being used to collect data, however it does provide a good example of the most basic design for collecting data through the Internet.

Project Atmosphere Australia Online (Figure F-2 in Appendix F)

(http://www.schools.ash.org.au/paa/)

Project Atmosphere Australia Online is designed for primary and secondary classes from all over the world to take part in the study of weather. Although, it uses e-mail submission for data collection, the site's main purpose is relatively concurrent with that of a science fair. This means that the site is used to display the work of students, not use their individual data for a greater purpose. Once again, there is no confidentiality statement. The

site provides two features that are very useful to teachers. The first is an e-mail list, which visitors must register with before being allowed to submit data. The e-mail list is also used to discuss the projects and address any questions that teachers might have. The site directors also ask experts to answer some of the weather questions brought up within the e-mail list. These experts' responses are then posted on the website. The second useful feature is a page of downloadable material. These downloads include software to help in data analysis as well as booklets and lesson plans to help students with their studies.

CIESE (Figure F-3 in Appendix F)

(http://k12science.ati.stevens-tech.edu/collabprojs.html)

This website is a directory of projects designed for primary and secondary classes to participate in. This is the first website that uses a questionnaire for data submission. It also contains a message board allowing teachers to discuss their project experiences with one another. No confidentiality statement or any security measures for accessing or submitting data are in place. This site provides links to contact experts, allowing teachers to get their questions answered directly (shown in Figure F-4 in Appendix F). Like *KanCRN*, discussed below, this site requires teachers to purchase kits in order to complete some of the experiments. Links to articles relevant to each science project are also provided.

KanCRN (Figure F-5 in Appendix F)

(http://KanCRN.org/)

This website is another project directory site intended for primary and secondary classes, which utilises questionnaires to collect data (example shown in Figure F-6 in Appendix F) and message boards for discussions. There is no apparent confidentiality statement, but a password is required to access and submit data. This site utilises web

technology in that it contains a few G2 videos, which require special software to view. This is the only evaluated site that uses web technologies such as this. Similar to CIESE, mentioned above, the main page of this site contains links to recent science headlines relevant to some of the projects. As mentioned previously, some projects on this site require teachers to purchase testing kits to collect data.

Scientists in the City (Figure F-7 in Appendix F)

(http://sln.fi.edu/city/city.html)

This website is another 'science fair'-type program designed for primary and secondary classes, which is no longer in use. Classes were asked to study a part of the ecosystem and present the data they collected. These classes submitted information in a unique manner, by designing web pages that document their data and the processes that they used to collect it (example shown in Figure F-8 in Appendix F). Project links can be submitted to the website for display. Confidentiality is not pertinent since the results are meant to be publicly displayed along with contact information for each project group. The site is more of a venue for schools to display their results, rather that making use of the schools' results.

Journey North (Figure F-9 in Appendix F)

(http://www.learner.org/jnorth/)

Journey North is a site designed for primary and secondary classes to submit data about the spring and autumn migrations of different animals and growth patterns of different plants. Questionnaires are used for data submission. Before data can be submitted, a registration form must be completed (shown in Figure F-10 in Appendix F). The site also contains a discussion board for teachers to share project experiences. The results held some level of confidentiality, since the data from each school is represented only as a dot on a map

(example shown in Figure F-11 in Appendix F). Similar to the *Project Atmosphere Australia Online* site, *Journey North* provides teachers with lesson plans and questions for their classes. Archival data is provided from previous years starting in 1994. This site is the only one that we have encountered that includes this type of information (shown in Figure F-12 in Appendix F).

American Psychological Society (Figure F-13 in Appendix F)

(http://psych.hanover.edu/aps/exponnet.html)

The *American Psychological Society* website is the only site found in our analysis that was designed for individual adults, though, age and demographic requirements change for each study. Various types of questionnaires are used by this website to collect data (example shown in Figure F-14 in Appendix F). This was the only site that provided expressed confidentiality as well as the researcher's contact information (example shown in Figure F-15 in Appendix F). This site was the only one found which actually connects the researchers to the public.

Two common problems were found within all of the evaluated websites. The first problem is that there is no definitive way to find out if the participants actually meet the age requirements of a project. The other problem is that there is no way to control just how many times a visitor can submit data, leading to possible data errors. The possible solutions to these problems and other suggestions for an online Live Science project will be addressed in the section 5.4 *Benchmarking Discussion and Conclusions*.

4.5 CONCLUSIONS

The data collected from teachers, public, researchers, and websites gave us a good perspective into how feasible different aspects of a Live Science Outreach Program might be. Responses from most teachers were very positive towards the Outreach Program attending their school. However, nearly all had stipulations that needed to be met before they would have Live Science in their classroom. Some of these included administrative duties carried out for them, lesson plans or result printouts.

The retrospective study with the researchers also gave us valuable knowledge into how the previous Live Science researchers feel towards an Outreach Program. The responses from the two researchers were not quite as positive as the teachers' responses. The main concern from both researches was there needed to be a reason why the Live Science would help them gain their data. If the Museum did not provide access to a frame previously unavailable to the researcher, he/she has no real incentive to do it. Despite these comments the researchers both said that they enjoyed their experiences with the Museum.

Responses from the public regarding a Live Science Outreach in public places yielded interesting results. After interviewing at Marylebone and Merton Abbey Mills, the public seemed to respond well to the idea of a Live Science Outreach Program. Some people had concerns that they wanted the Program to be very accessible and take only a few minutes of their time. Others mentioned that they would like to have something, which they could easily understand and possibly have a printout of results for them to take home.

From the benchmarking study of online data collection sites, requirements and suggestions for an online Live Science event were found. First of these was the prevalent use of questionnaires for data collection. Also, message boards for visitors to interact on would be useful to Live Science. Two problems with on-line data collection were also identified; these both involved identity and data fraud.

After collecting data for each aspect of a possible Live Science Outreach, we are able to make conclusions and recommendations on its feasibility. Chapter 5 will explain why we think that the three different aspects of a Live Science Outreach would be feasible.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The previous chapter discussed the data we found after interviewing teachers, researchers, the public, and also benchmarking Internet data collection sites. Different themes were found among the teachers, such as many were interested in an Outreach but would like to have some added benefits for them. The public interviews also gave us similar information, they were interested but would like their results or other form of printout for their participation in the Program. The researchers gave many insights into the in-house version of Live Science and how it can be improved. In addition to this they gave us suggestions into how an Outreach version of Live Science could be run. The benchmarking study provided suggestions for the electronic version of the Outreach Program. This chapter will discuss our interpretations and give suggestions based on these data. Finally, our opinion on how feasible the different aspects of a Live Science Outreach Program will be presented.

5.1 TEACHERS' INTERVIEW CONCLUSIONS

In the previous section 4.1 *Teachers' Interview Results*, many common themes were found among the teachers' responses regarding both the in-house and outreach versions of Live Science. From these themes, suggestions and conclusions regarding Live Science school outreach can be made. In the section below, analysis of these themes and the conclusions drawn from them will be presented.

When asked to comment on the Live Science event, teachers' responses were positive. Teachers felt that this program was a good way to stimulate student interest in science. The teachers thought that connecting the students with the scientific community was a unique way to inspire learning. Even though the teachers liked the idea of Live Science, many had not heard of the event before. Since the Museum now knows that there is a demand for the program among teachers, they should increase awareness. This could be accomplished by a

promotional campaign to teachers. This could involve advertising, brochures, or placing articles about the program in relevant publications or other news sources.

While the teachers thought it was a good idea, they did have some reservations about coming to the Museum just for the Live Science event. Some of their anxieties related to the logistics of bringing a class to the Museum, such as cost and consent forms. This type of response is understandable since teachers would like to minimise the costs for them while increasing their benefits. The Museum has already addressed consent forms, which need to be filled out by the students' parents prior to visiting the Museum and participating in the study. The Museum's continued use of these consent forms for both the outreach and in-house events is necessary to entice teachers' participation and lighten their workload.

Another problem that the teachers mentioned is that of monetary cost. This will reduce the cost of a trip to the Museum for schools. Even though the Museum is free to schools, there are other costs associated with a trip. Some of these costs include transportation to the Museum and feeding the children while they are there. The Museum is already addressing this problem. The proposed outreach version of Live Science would eliminate the transportation costs and also the cost of feeding students since they will not have to leave the school. The outreach program will also save the teachers the time it takes to plan a Museum visit.

Another major theme focused more on the educational aspects of the Program. At least three teachers were apprehensive about the complexity level of the research study. They were concerned that the study might be too advanced for their students to understand, thereby eliminating any educational benefits. This problem could easily occur with primary school students since they are young. To remedy this problem, the Museum should take precautions when determining how to advertise particular studies to schools. If the Live Science project is too advanced for primary schools, then the event should not be advertised to them. This

problem might not be as black and white as that, though. If the study is too advanced in its raw form for primary students, perhaps a simplified version of the event might be a solution. This would result in two versions of the event, one that would be targeted at secondary and beyond students, and one that would be easier to understand for primary schools.

Another item mentioned by the teachers was including a pre-made lesson plan for students. This is related to the previous problem of costs, which for teachers in this case is taking time to prepare a lesson plan. Providing these ready-made teaching tools reduces the amount of work that the teacher needs to do in order for their class to experience either the outreach or the in-house Live Science event. Creating lesson plans and information sheets is not new to the Museum; many other galleries and exhibits have these types of sheets. It would be beneficial for the Museum to formulate similar pamphlets for the Live Science event, possibly in a primary and secondary form, to help students better understand the concepts behind the research study.

A few teachers made a suggestion that was similar to a comment made by the researchers, this was that the Museum provide an assistant for the researcher. It was suggested that this assistant could help the researcher present the material to the students. This helper could also occupy the students while the researcher was collecting the data. If the Museum could supply an assistant, the program would operate more efficiently, possibly appealing to teachers by further reducing their workload. If this was not possible, the Museum might strongly recommend incoming Live Science researchers that they have an assistant to help with the Live Science event. This is a way of minimising the costs for the teachers and maximising the benefits for them by reducing their work. Both the in-house and outreach versions of Live Science could benefit from this.

Besides the monetary costs of attending the Museum, there are also time and curriculum costs. These two problems are closely linked. Nearly every teacher mentioned

that the outreach and in-house events should follow the National Curriculum (NC). For some, this was a determining factor in whether or not they would participate in the Live Science event. Since much of the United Kingdom's school system is based on the NC, it is extremely difficult for teachers to make time for things such as Museum visits or outreach programs. To address this, the Museum should attempt to find Live Science studies that can be related to the NC. This would ensure that teachers' time at the Museum or participating in the outreach is well spent. Meaning that they can escape from the normal classroom-teaching arena in addition to meeting a requirement of the NC.

One option, relating to the NC, offered by at least two teachers is that the timing of the event should be considered. Near the end of the school year students are preparing for the exams they must take for the NC. Once these exams have been taken there is a short amount of time before the students are dismissed for the summer months. If the outreach version of Live Science were presented during this 'off-Curriculum' time it might be better received. The reason being that the teachers are more inclined to pursue non-National Curriculum topics at this time. The in-house event might also benefit from this since the students and teachers have more time available to visit the Science Museum. If the Museum keeps this time of year in mind when presenting both Live Science Programs to schools, the participation rate might be higher.

One teacher mentioned that rather than simply targeting students for the outreach and in-house events during school time, the Museum could also look into enrichment groups, such as science clubs or other extracurricular activities. This would eliminate all of the problems associated with the NC. These groups may also have larger amounts of time that they can dedicate to the project. Which leads to the next concern the teachers had.

Some teachers were worried about how much time an outreach of Live Science would take. They suggested that it be designed so it fit into the normal schedule for classes.

According to one of the teachers, most time slots for classes range from 50-70 minutes. If the Outreach could operate within that range, teachers may be more inclined to participate in such a program. The idea of time slots can also be related to the in-house program. If teachers had a specific time to participate in Live Science, they might be more interested in attending. They could then plan their visit to the Museum and have enough time to explore the galleries they are interested in, in addition to visiting the Live Science event. Therefore, if the Museum can structure the outreach and in-house Live Science events along a timetable, participation may increase.

The final item that teachers would like to see before participating in a Live Science event is that their students felt truly involved in the project. Some teachers suggested that the students could take home a copy of the results. For primary schools, this was suggested to make the students feel more involved, where as for secondary schools, this suggestion had more of an educational reason behind it. Primary students might take more away from the event if they feel personally involved in the study by seeing their name attached to something. However, the secondary students could analyse the printouts of the results and make their own conclusions, which would make them feel more involved in the program.

Closely linked with the results of the study is making the students feel that the topic discussed is personally relevant to them. Many of the teachers mentioned that both the outreach and the in-house events should try and make the studies relevant to the students. This is one of the topics covered in section 2.2.1 *Museum Exhibits*. When the learner can relate personal data or experiences to an exhibit they learn more and are more interested in it. The same personal relevance would help students learn the science behind the Outreach or in-house research study. Printing out results for the students to look at or take home might help increase their personal relevance to the data collected, thus making them more interested in learning about the science involved.

In reality giving results to students might not be an option for the Museum. The most likely reason, which would stop this, is the problem of confidentiality. In the past studies, the data collected was confidential and the researcher expressed that the results would be used only for the goals of the research study, nothing beyond that. The Museum might be able to provide printouts of the results, but only after careful consideration regarding confidentiality. In the end, if the Museum could provide this, some of the teachers spoken to would be more inclined to participate in Live Science outreach and in-house.

In conclusion, the teachers provided many suggestions, which might help both the in-house and the proposed Outreach Program. Nearly all of these suggestions are related to increasing the benefits for teachers while decreasing the costs. The suggestions made are:

Program	Suggestions
In-house and Outreach	- Should continue with the program - Provide consent forms prior to participating in Live Science - Target appropriate ages for Live Science studies - Prepare lesson plans for teachers - Provide an aid with the researcher - Provide a printout of results for students to bring home - Choose studies which students can identify with
Outreach	- Choose Live Science topics relating to the National Curriculum - Schedule Live Science at times of non-National Curriculum work - Work around teachers schedules

Table 5-1: Teacher Suggestions for In-house and Outreach Live Science Events

The information collected points to the idea that a Live Science Outreach with schools would be well received. Most teachers interviewed were very interested in participating in a Live Science event. Some discussion into where the data came from should be recognised, however. The teachers interview are associated with the Museum, therefore they might be more open to participating in Museum events. We do not have data indicating what teachers unaffiliated with the Museum would think of Live Science. However, the suggestions made by the interviewed teachers would probably hold true for many others.

Another action that the Science Museum might take is bringing the Live Science Outreach topic to one of the TAP meetings. Through a focus group, the teachers might be able to provide other data, which could help the Museum in establishing an Outreach. The responses collected from the interviews provided valuable data which helped in determining the feasibility of the school Live Science Outreach Program. If the suggestions presented are implemented into both the in-house and possible outreach program, the programs should be a successful way to connect students and scientists.

5.2 RETROSPECTIVE STUDY CONCLUSIONS

To determine the feasibility of a Live Science Outreach Program, it was important to learn how the scientists that have performed the in-house version felt about the event. Their views and suggestions can help improve Live Science overall. Also, the researchers proved helpful in generating new ideas for ways to get other scientists interested in participating.

These researchers voiced some concerns, most of which were based on the lack of a steady flow of visitors to the event. This was partially due to a lack of proper advertisement within the Museum. To try and improve this, the Museum can do several things. One thing that the Museum can do is hand out fliers to the visitors when they arrive at the Museum on days when Live Science is taking place. When Live Science is in session, announcements drawing attention to the event would be beneficial.

The Museum should make an effort to help the researchers choose times that will prove fruitful for them. The researchers made it clear that they did not like the amount of 'down-time' that they had. If the Museum could tell the researchers when their busiest times are, the researchers would have a better chance of collecting the amount of data they need. This can lead to a better chance that the researchers would want to participate in the event again.

Another option that the Museum should consider is offering help in the form of staff members to assist the researcher. The staff members would be more knowledgeable about ways to get people interested in attractions, and could escort people into the Live Science Arena. Depending on the project, the more people the scientist has helping them, the quicker they could get people through the Live Science study. The researcher would be able to collect more data and at the same time a greater number of visitors could experience the event.

Researcher Needs	Solution
Constant supply of visitors	- Alert researchers of times of visitor maximum attendance - Pass out Live Science fliers to visitors - Public announcements over Museum PA system - Staff assistance

Table 5-2: Suggestions to Improve Live Science

The researchers were also helpful in suggesting where and how the Museum could find other researchers to participate in Live Science. One suggestion was to hold a social event for researchers within the Museum. This would be valuable because the Museum would have the opportunity to meet researchers and learn about studies that are being performed. During the event, the researchers would become more familiar with the Science Museum, its goals, and specifically Live Science. The Museum would find out what researchers would want and need in order to be interested in Live Science. New contacts could lead to a list of potential scientists.

The other suggestion was to advertise for Live Science in more journals and other forms of print-type media. The Museum has already does this, but it was specifically mentioned that the event should be advertised in the Wellcome Trust Foundation's newsletter.

When speaking about scientific research in general, a concern that both researchers mentioned was that every scientific study is different. While one experiment might work well in a mall, it might not be feasible in airport. Particular venues would have to be chosen for the specific population of people the researcher wishes to collect data from. This might make it hard for the Museum to find researchers to participate in the outreach version of Live Science.

Another idea voiced by the researchers is that a list of the benefits offered through working with the Museum would aid in recruiting scientists. This would clearly layout the goal of Live Science and explain how it could be useful to them, as they believed that in some cases the Museum might present obstacles rather than aid. For example, when trying to access a frame the more parties involved the more problems that might occur.

Researcher interviews have provided a new perspective on Live Science. The problems that were mentioned can help the Museum make Live Science better for researchers in the future. The main asset for the Outreach Program is the suggested means of recruiting other professionals to perform studies. In summary, potential means of gaining researcher participation in Live Science include:

- Providing a list of benefits that Live Science offers
- Advertising in the Wellcome Trust Foundation newsletter
- Offering social events for researchers

The Museum should thoroughly consider these recommendations because they directly reflect the comments and concerns of researchers with Live Science experience. Their ideas and solutions for what they saw as problems with the event will help the Museum better understand researchers' perspectives. It is important to recognise, however, that research studies and data collection processes are different. Due to this subjectivity between the works of different scientists, a variety of perspectives regarding Live Science will result.

Therefore these suggestions may not be completely representative of all researchers that are interested in the program.

5.3 PUBLIC VENUE CONCLUSIONS

The Science Museum is looking to expand the Live Science event into a larger arena, such as a public place. This will allow members of the public who do not frequent the Museum to benefit from the Live Science experience. As discussed in the previous chapter, several venues were observed and evaluated by the Project Team to see how feasible it would be to create such an Outreach Program.

5.3.1 Limitations Placed on Data Collection

Unfortunately, there were many limitations placed on our data collection from the public venue evaluations. The first limitation began with the way the public venues were chosen. There are many different types of venues and many locations that could have been explored. Since we are not native to the London area and had limited time, only venues that were suggested and familiar to us were considered. This constraint left many possible venues not considered.

From the Phase I observation, it was concluded that places the Museum might want to take Live Science to could include the airports, train stations, and shopping centres we observed. The open markets observed, Spitalfields and Camden Town Markets, were decided to be unsatisfactory places to take Live Science to because these places were over-crowded and did not have adequate space for a researcher to set up Live Science.

However, the Phase I, the observational period, was not the only factor considered when deciding where researchers could conduct their studies. A major influence over this decision was the assessment of how interested the public was. There would be no reason for

the researcher to set up at a location, if the public would not stop to participate in the event. This interest would be determined during Phase II evaluations of each location. In order for Phase II to take place, permission was needed from the venues to address the public.

The issue of gaining permission from the venues proved to be a second difficulty that we had to overcome. As mentioned in section 4.3.2 *Gaining Permission for Evaluation*, several venues did not permit our evaluation of the public. Therefore, we could not assess how the people at these venues would react to an Outreach Program. Being unable to perform these interviews, we are not in a position to make any conclusions of feasibility concerning the implementation of Live Science in these places.

At Merton Abbey Mills and Marylebone Station, the places that permitted our public interviews, different types of problems arose. One of these included miscommunication with the public. The analysis of responses from public interviews suggests that some of the questions were either unclear or misheard by the interviewee. In some cases, responses were made which did not relate to the question posed and therefore held no relevance to our study. These responses represented only a small percentage of people at Marylebone Station; however, at Merton Abbey Mills 12% of the people fell into this category when asked what they thought about the idea of Live Science. This may be due to our lack of experience in our first few interviews.

The pre-testing of our protocols included analysis and approval by the Museum's evaluation team. Because of the apparent misunderstanding of questions, we conclude that pre-testing on people in the public would have proven beneficial. If the protocol were pre-tested on people of the general public, perhaps the amount of people who misunderstood the question would have been lower.

Another issue is the shortened interview time at Merton Abbey Mills. Because of the sampling problems discussed in section 4.3.3 *Phase II Evaluation of Public Places*, the

amount of interviews received was low and there was a poor response rate of 59.5%. If the sampling had gone as planned and the full two hours had been utilised, a different response rate may have resulted.

5.3.2 Conclusions from Phase II Evaluations

Despite these unexpected difficulties, Merton Abbey Mills and Marylebone Station seem to be good prospects for Live Science. Section 4.3.3 *Phase II Evaluation of Public Places*, states that 72% of the people at Merton Abbey Mills and 84% of the people at Marylebone Station had positive feelings about the idea of Live Science. These numbers suggest that people are quite interested and not opposed to the concept of Live Science. However, the responses may not be completely accurate. It is possible that some of the respondents were unsure what we were describing but gave positive replies because they did not want to criticise the Science Museum. Also, positive responses may have been given simply due to the fact that the Museum is a reputable organisation. Although the data displays an overall interest in Live Science, it must be recognised that the public replies may not be as precise as we had hoped due to communication problems.

In regards to the question of pubic participation in a Live Science Outreach Program, many people at the evaluated venues had some level of interest in actually interacting with the researcher. At Merton Abbey Mills 76% of the people sampled had some level of interest for taking part in the event; 24% of the total number of people interviewed claiming to be strongly interested. Just over 60% of the people sampled at Marylebone Station said that they would be willing to participate. The higher percentage of interested people at Merton Abbey Mills might be related to the type of venue. At the Mills there was a very slow moving number of people, therefore the public there would have more time to participate in an event.

This is completely opposite of Marylebone. Since it is a train station, people have plans to travel. The available time at a train station is probably much less than that at a shopping area.

Although Phase II could not be carried out at an airport, the results from Marylebone can be extended to include airports. Travellers arrive early at airports, because of security and check-in times. However, at rail stations travellers can purchase tickets five-minutes before their train departs. This leads to the conclusion that people at airports might have more time and may be more interested in a Live Science event. This conclusion is supported by the data collected during Phase I of both Heathrow and Stansted, which indicates that a large amount of the population was waiting for departure.

Although the question used to generate the information regarding interest in participating involved a rating scale, a few other comments that were made should be noted. Many of the interviewees stated that time and ease of access are big factors in their decision to participate. It was also mentioned that privacy is an issue because some people might be too self-conscious to do Live Science in public. It would therefore be in the Museum's best interest to use research studies that take very little time to perform and have some way of ensuring privacy in order to increase participation.

There were a wide variety of replies indicating what participants would like to receive from a Live Science outreach. A majority of the interviewed people specified that they would want to gain more knowledge about many different topics. The Museum will not have a problem satisfying this desire since informing the public is inherently part of the Program. Also, a significant number of replies incorporated the idea of finding out the results of the research study. We recommend that the Museum establish a means of informing participants about the developments of the study. It would be beneficial to post the results somewhere besides scientific journals, which may require subscriptions. This information should be

offered via means that permit easy retrieval, possibly through email, posting on the web, or a mailing list participants can sign-up on.

Personal relevance, or having a topic that relates to the participants' life, was also a desired trait in a Live Science event. This demand is not easy to meet, as personal relevance can be very subjective. It may be useful, to offer Live Science events in locations that not only contain the researchers desired population, but which would include a majority of people that are typically interested in the particular research topic. An example might be a study involving alcoholic effects on people, which would take place where alcoholic beverages are consumed.

After Phase II evaluations, it was determined that the feasibility of a Live Science Outreach Program at the two evaluated places is high. Obviously more locations might have sufficient interest in the Live Science Outreach, but we are only able to draw conclusions from the two places evaluated. To make the Public Outreach Program better, the Museum should:

- Use studies that minimise the time required from participants
- Ensure privacy for participants
- Provide study results for participants
- Attempt to relate studies to specific venues

Consideration of the points mentioned above will aid in establishing a successful Live Science Outreach Program.

5.4 BENCHMARKING DISCUSSION AND CONCLUSIONS

As mentioned before, the Science Museum expressed an interest in creating an online version of the Live Science event, which would consist of establishing a website to collect data for a research study. This website would attempt to achieve the same goal as the in-house event, which is to connect scientists with the public. The scope of the online project would be much broader, simply because more people can access the Internet than can visit the Museum. In order to accomplish this goal, websites designed for data collection were benchmarked. The benchmarking study provided a basis for us to make informed suggestions to the Museum on how to create a successful online research website. The evaluated websites provided solutions for how the Museum could accomplish the tasks of collecting data and connecting the participants with the researchers.

First, the solution for the best way to collect data online was identified. Some of the evaluated websites use e-mail, however, a majority of the sites prefer questionnaires as a means of data collection. Questionnaires are more useful than e-mail submissions since they have a set layout. Some examples of the questionnaires found on the evaluated sites include pull-down menus, checklists, and fill-in fields. The latter example allows participants to document results in their own words, as does e-mail. Pull-down menus and checklists merely permit the participant to pick the choice that best matches the results they attained. Although this stifles open interpretation of results, it provides a structured template for data submission, which subsequently makes the analysis of the data significantly easier. Of course, it must be recognised that each research program would have different data to collect. Therefore, the information gathering technique used is subjective to each program's needs.

A means of connecting researchers to the public was determined through website evaluations as well. Three of the evaluated websites utilise message boards, which facilitate discussion about the project and related topics. *Project Atmosphere Australia Online* uses an

e-mail list to facilitate this type of discussion. The co-ordinators of the *Project Atmosphere Australia Online* site submit specialists' responses to some of the questions posed within this e-mail list. The Science Museum could use something similar to these examples to facilitate researcher interaction with the public. A message board should be used instead of an e-mail list, since a message board does not require visitor registration to be accessed. Also, instead of the Museum asking the researcher questions posted on a message board, the researcher could simply check the board periodically. Use of a message board would allow the visitors to discuss all aspects of the research study and post any questions that they may have. The researcher would then be able to answer these questions directly and join in the discussions. The site visitors would then be connected to the science community, accomplishing the second goal of the Museum's site.

Our evaluation indicates that Internet fraud is an inherent problem with conducting research online. Misrepresentation of identity and falsification of data are two types of fraud that occur in online research. The first of these, misrepresentation of identity refers to the difficulty associated with determining if people are who they claim to be. In online research, this pertains to both the researcher and the participants. A researcher could claim to have credentials, which are actually invalid. Likewise, participants could take part in studies that are not designed for them. Falsification of data, the other type of fraud, refers to participants resubmitting data multiple times for the same project. Results of the research study could be skewed by these repeat submissions.

A possible solution to fraud associated with participant identity and frequency of data submission is the use of a registration system, similar to those found on the *KanCRN* and *Journey North* websites. This would require users to register with the website in order to submit data. Theoretically, each participant could only offer data once since the site would be able to track those who have previously submitted information. This registration system

could also be used to attain additional information about the participant that may be useful to a study, such as age and gender. This may be somewhat discouraging to public interested in the study because of the time commitment involved as well as the transmission of personal information. Keeping the Social Exchange Theory, mentioned in section 3.1 *Means of Data Collection*, in mind, this could be offset by providing benefits such as an e-mail service, which could keep people updated on the study and any new events within the site. One type of web technology that could help alleviate concern over the transmission of personal data is secure data transfer. This type of transfer encrypts data so that the intended recipient is the only party who is able to decipher it.

The Museum does not have to worry about fraud involving the validity of the researchers' credentials. This has already been addressed in the Museum's Live Science criteria. These criteria state that a research study must have independent funding, which requires some sort of affiliation with a university or similar institution. Specifically, the criterion pertaining to ethical approval from a committee also demands that the researcher and the project's aims are legitimate.

As with all research studies, participants must know what their data will be used for and be informed of the confidentiality that they will receive. Participants should also be provided with researcher contact information in case they have any questions or concerns regarding the project. Only one evaluated website, the *American Psychological Society*'s site, contains a method for providing informed consent and the researcher's contact information. The site accomplishes this by creating an introductory page for each study that contains all of the information described above. Participants are required to read over this page and click an 'accept' button at the bottom indicating that they understand all aspects of the study and are willing to participate.

The other suggestions generated from the evaluation of the sites are strictly aesthetic in nature. One of these recommendations is the use of a central navigation menu throughout the site to facilitate easy navigation and allow a visitor to access all pages contained within the site. The second suggestion is the use of graphics and videos on the site to make it more interesting to the visitors. The only stipulation to this is that response time should not be compromised by the use of new web technologies. The last suggestion is simply that all graphics on the site should be clearly labelled and the text should be easy to read.

In summary, there are many issues that must be addressed in order to accomplish the Museum's goal of replicating the Live Science event on the web. The two goals of Live Science, allowing the researcher to collect data and simultaneously connecting the researcher with the public, must be kept in mind. The first goal should be accomplished by using a type of questionnaire for data submission on the Live Science website. Ease of data analysis for the researcher and less of a time commitment for data submission by participants are some benefits of this technique. In order to accomplish the second goal, the use of a message board that is regularly monitored by the researcher is suggested. This would help facilitate discussion about the research project and allow the researcher to answer questions posted to the board. In addition to these suggestions, a registration system is recommended in order to help solve the problems of participant misrepresentation and resubmission of data. The Museum should also include a page stating the research goals, level of confidentiality, and researcher contact information. By following these recommendations, an on-line version of the Live Science event should run smoothly and have similar success to that of the in-house version.

5.5 FURTHER RESEARCH

Through the methods described in chapter 3, we gained data that supports that a Live Science Outreach Program would be feasible. However, more research should be conducted before implementing the Program. This research would help Live Science Outreach become a successful event for both researchers and participants. A future IQP could perform this research.

Each of the three aspects of Live Science Outreach could be investigated in further detail. Unfortunately because of time restrictions a completely through implementation of each of the outreach programs was impossible for our group. For instance, another project team could help the Museum gauge interest among teachers not associated with the Science Museum. A search for researchers willing to participate in a school Live Science program could also be done. A similar project could be made with the public side of a Live Science Outreach Program. Finding researchers willing to participate in the event could be located. Contacting some of the venues we contacted might help to get solid permission from their management. Another suggestion would be to have an IQP designing the electronic version of Live Science. A team could locate a research study and implement the suggestions we have provided.

5.6 CONCLUSIONS

Through this study, it was determined that the Live Science Outreach Program is feasible. The schoolteachers interviewed were very interested in Live Science. They believed that if the Museum created lesson plans, provided consent forms, and related the research topic to the National Curriculum, Live Science would be welcome in their classrooms. The researchers advised that every scientific study is different and that the level of researcher interest in Live Science will vary depending on their study. The best means to

increase researcher participation is to maximise benefits for them by providing unique or larger populations than they would be able to access without working with the Museum. Members of the public were also interested in Live Science. The majority of the people interviewed believe that Live Science is a good idea and that they would participate in a Live Science event if they had the time.

The interaction with venue managers indicated that gaining permission to perform Live Science at certain places might be a problem. Three locations, the O_2 Centre, Heathrow Airport, and Stansted Airport, did not allow us to perform Phase II evaluations. Although venues may lend themselves to Live Science Outreach, it must be recognised that certain venues may not permit Museum events.

To establish an electronic version of Live Science, it is recommended that a well-structured questionnaire be used, which permits easy data submission and analysis. We also recommend the use of a message board to allow interaction between participants and researchers. Use of a registration system, which allows people to submit data only once, will minimise data fraud. In addition to these, consent forms should be provided, which explain what the participant will have to do, as well as the project's objectives and how the data will be used. Consideration of the recommendations made in this chapter will aid in the establishment of a successful Live Science Outreach Program.

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APPENDICES

APPENDIX A: THE WORK PLAN

Task	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Teacher Interviews							
Contact Museum's Bookings Office							
Pre-test							
Set up Interviews with Teachers							
Collect Data from Interviews							
Analyse Data Gathered							
Draw Conclusions							
Retrospective Study							
Pre-test							
Contact Pervious Researchers							
Collect Data from Interviews							
Analyse Data Gathered							
Draw Conclusions							
Public Venues							
Phase I Evaluation							
Management Contact							
Phase II Evaluation							
Analysis of Data							
Draw Conclusions							
Benchmarking Study							
Research							
Drawing Conclusions							
Write Up Paper							
Work on Final Presentation							

APPENDIX B: INTERVIEW PROTOCOLS

B-1 London Science Teachers with Museum Experience Protocol

Objectives:

1. To determine teachers feelings about the Live Science Outreach Program
2. To determine interest in a Live Science Outreach Program

Structure:

1. Interview directed as a conversation with a purpose.
2. Method: Semi-standardised format with in-depth probes
3. Facilitator role: Sophisticated Sympathetic

Schedule:

1. Give statement of purpose, appreciation, confidentiality statement
2. Brief background questioning
3. Opening Statement:

1) The Museum's Learning Department provided us with a list containing your name. The teachers on the list have all participated in the TAP program. This list contained teachers who have varying levels of involvement with the Science Museum. Could you please describe your past experiences with the Museum?

Questioning:

Since you aren't familiar with the Museum's Live Science event I'll describe it for you.

The event involves a researcher coming to the Museum to perform a research study. These studies are usually biomedical in nature. Past projects have included name and face recognition tests and also facial features relating to DNA. All of the Live Science research studies must meet certain criteria like the use of non-invasive data collection methods, for example.

When the event is running the researcher takes volunteers from the Museum visitors. These visitors then participate in the research study. The underlying goal of the Live Science event is to connect scientists to the public. The Live Science event does this. Both the researchers and the public benefit from this program. First, the researchers gain data for their study. They are able to then formulate conclusions from these data. Secondly, and most importantly, the visitors can see how the scientific method works by experiencing it first hand. The researchers are always willing to talk to the visitors and explain the theory behind the research study.

Do you have any questions on Live Science?

2) Could you please share your thoughts on this event?

Probe:

- What do you think of the event's goal?

- What does this program need in order for you to be interested in participating in it?

3) The Museum has expressed an interest in creating an outreach program based on this event. In this program, researchers would travel to schools, and collect data for their research. What do you think about this proposed program?

Probe:

- What are your suggestions on how the program should operate?
- What benefits would you like to get from this program?
- On a scale of 1 to 5, with 1 being strongly uninterested and 5 being strongly interested, could you please rate your interest in participating in this proposed program?

B-2 Previous Researchers Protocol

Objectives:

1. To gather opinions on the researchers' experiences with the in-house Live Science Event
2. To determine researchers' opinions on the possibility of an Outreach Program

Structure:

1. Interview directed as a conversation with a purpose.
2. Method: Semi-standardised format using in-depth probes
3. Facilitator role: Unsophisticated Sympathetic

Schedule:

1. Give statement of purpose, appreciation, confidentiality statement
2. Brief background questioning
3. Opening statement:

"In an interview conducted with Sabiha Foster at the London Science Museum, my research group was informed that you have participated in the Museum's Live Science event. Using as much detail as possible, could you please describe your event for me?"

Probe:

- What were your expectations of the Live Science Program?
- Were these expectations met?
- What aspects of this event could be improved upon?

Questioning:

"Could you please describe for me any limitations placed on your research by participating in this event?"

Probe:

- Where there any unexpected problems/benefits encountered?
- How did working at the Museum effect your research?
- What could be done to improve the relationship between the Museum and the researcher?

"The Museum is interested in starting a Live Science Outreach Program based on the in-house event. However, instead of conducting the research at the museum, researchers would travel to public places and collect data there. Could you please describe your feelings regarding the creation of such a program?"

Probe:

- Are there any changes to the current Live Science format that should be made for the Outreach Program?
- Are there any potential problems that may need to be addressed in this Program?

- Do you think there would be significant interest in program participation among your colleagues? Yourself?
- How could the Museum interest other researchers in the Program?
- Do you have any suggestions for possible venues that the Program could visit?

B-3 Public Interview Protocol

Objectives:

1. To gather public opinion about the goal of Live Science
2. To gather opinions of a venue's population regarding a potential Live Science Outreach Program

Structure:

1. Interview conducted to answer specific questions.
2. Method: Standardised format
3. Facilitator role: Sophisticated Sympathetic

Schedule:

1. Give statement of purpose, appreciation, confidentiality statement
2. Opening statement:

"The London Science Museum currently sponsors an event called Live Science. This event involves a researcher collecting data for a study from Museum visitors. Past projects have included name and face recognition tests and facial features relating to DNA. The underlying goal of the Live Science event is to connect scientists to the public. Both the researchers and the public benefit from this program. First, the researchers gain data for their studies. Secondly, and most importantly, the public directly participates in science research."

Do you have any questions about what I just described for you?

Could you please share your thoughts on this type of event?

"Through this program, the researcher would receive data for their study. What do you think you would get out of this type of program?"

"The Museum has expressed an interest in creating an outreach program based on this event. In this program, researchers would travel to public venues, and collect data for their research. Using a scale of 1 to 5, with 1 being strongly uninterested and 5 being strongly interested, could you please rate your interest in participating in this proposed program?"

APPENDIX C: CODING OF TEACHERS INTERVIEWS

	Past Experiences	Thoughts on in-house	What they would need for them to participate in the in-house	Thoughts on Outreach	How it should operate	Benefits for them	Interest Rating	Stipulations for rating
Dr. Julie Hall	Had visited with classes	Thinks program is good idea Would interest students in science through real world experience **"Get the public and younger people as well involved in thinking about science and think about specific projects making it more real."**	It would need to have some sort of prepared lesson plan It would also need to be free, since it costs a lot to take a school group to the Museum Would not make a special trip unless free	Thinks it is a good idea Good for students	Could come at this time, due to exams being finished. Good for grade 9. Prepared consent forms consistent with county requirements Prepared lesson plans **"reasons why teachers don't do these sort of activities is that it takes a lot of work."**	students interest in science increased and personally relevance put on material **"make it more real to the students"**	5	if most of the work was done by the Museum, such as permission slips and lesson plans
Will Talbot	Just with the TAP program, has helped with evaluating future exhibits	Sounds like a great idea It would break down misconceptions about scientists	Didn't need any extra benefits	He would love it Would be a great educational tool	No suggestions	Happy with obvious ones of students interacting with researchers	5	
Koulla Stylis	Two years on panel Has also taken student to Museum	She would like to see it first Sounds benficial to the researchers	It would need to be brought down to the students level If they could see their names on something It would need to relate to them **"they would like to see some results, chart, or something, to see their name printed somewhere."**	Thought it was good idea because reduces costs for students **"I personally prefer the outreach, because you avoid all this fuss about getting children on transport, worrying about packed lunches, you wouldn't need parental help, and of course safety, and the children are at school you wouldn't need parental permission to take them on a journey."**	It should follow the NC		4	As long as the project relates to children

Kathy Twin	Addvised the Wellcome Wing Women Summer School visit Enrichment courses	Makes science real, especially to 5-16 year olds Brings curriculum to life **"It is a good idea, anything that makes science real, for the general public."** **"You know it is science in the 21st century as opposed to 19th century science."**	Fulfill an NC requirement Information on what was going to be there Cost Something for the young to take away **"for young people, I think there needs to be something for them, in terms of participating."**	Excellent idea More students can take part	Researcher should present what the project is about Needs to be structured Fit into the time limits of the NC Maybe look into "Science Clubs" **"they've got to see what that researcher will offer them in terms of something they can't really model or present to children in their standard classroom."**	Know it will motivate the students in science and make it more real to them Needs to show what the researcher will offer	4	Needs to be tightly managed **"if it's going to bear fruit and benefit everybody it has to be very tightly managed and focused."**
Jenny Frost	Just with the TAP program, hasn't taken students	Thinks it is a good idea Would break down misconceptions about science People would learn by participation	Would need info before the event Would want explaination to get the students enthusiastic Would like results and find out themes so far Print out of data from that class so that students could interpret it Have students evaluate the results	Nice	Should fit time slots Relate to NC Should look at the time of year and ages to present to	Same as in-house Would like to see students inside the study	5	Would like to see the program work with teachers in training Outreach Team should contact Jenny for more info on stuff **"Cause that is another spin off, once you've had real live scientists in, it gives teachers more ideas of what they can do."**
Michael Cousins	Works mainly with the TAP program and all his A level students go to the Museum	Good because the public's perception of the scientists is usually wrong	He wouldn't make a special trip for it he attends because of the many different things in the Museum	Good idea but needs to be understandable by the students. Also need to keep in mind the logistical problems	Suggested a person besides the researcher to keep the students busy while the researcher was taking the data It should also fit the NC Should be relevant to the students	It needs to have an educational benefit It should follow the NC **"you'd be able to link it to this possible curriculum, I don't see why the teachers wouldn't want to participate."**	5	Only if it has relevance to the NC If the program does get put into effect he would like to be contacted to participate in it

Susan Stuart	Mainly with TAP	Good to bring scietists out of the labs Helps with the public's perception of them#	Her students are very young (5-6) so they wouldn't really understand Would like the permission slips to be done for her	Make it simpler for the students and on her to set up **"One being that the children would be in their environment."**	Maybe pre-data collection visit to explain study and increase enthusiasm Then the researcher comes to collect later	Some kind of print out so that the students could see results and it needs to be simple so they can understand	3	Would need to know the research project before signing on
Leon Cych	Mainly with TAP Participated in STEM competition **"it sounds like it's highly relevant, because it actually calls people and puts them into science."**	Demistifies science Vergy good goal, to show why people do science	Would like to have an exhibition that addressed how the data would be collected Would like to have some sort of pre-activity to attract his attention Some type of advertising to hook his interest.	Really good idea, scietists working with real people Would like to see how permission is done	Make bureaucracy easy on school Letters to parents, kids and into booklets for the teachers Point out deadlines for the school	Children seeing what real science is Them getting a solid lesson in the material	5	
Alex Lundie	Been on panel for 7 years Attends the Museum	Excellent, having the public access science like that Excellent model	Seeing application to the Primary schools	Outreach is always good	Topics should fit the NC Could also include professional development	Exactly how the research relates to NC	5	If fitting to the NC 2 if the program doesn't

Liz Lawrence	Has been to three TAP meetings Has visited with a couple groups a long time ago	Really useful for both researcher and public Researcher gets population Public gets to take part Results need to be displayed to show big picture People also get to meet scientists and gain understanding **"I think they need to then see the big picture of where that research has gone, otherwise it's a limited experience."**	Find out what scientists really do and remove misconceptions about who they are Children would gain personal relevance and learn science isn't something distant from them but a part of their lives **"Finding out what scientists really do and getting rid of the perceptions that a scientist is just a person in a laboratory with test tube who doesn't connect with people."** **"They'd feel connected with science, even if it didn't inspire them to be a scientist, it would make them realise that science is relevant to them..."**	Great idea, but would really have to be sold to schools because of the pressure placed on them Once up and running and people see the benefits, it'll be great	During end of year or special event (science weeks) or outside of school not during Curriculum time Especially for primary kids results would need to come fast so they would feel connected	Just the involvement, the excitement, the feeling that science is something real Maybe older kids could take part in data collection, so they feel they are doing science	3	Likes the idea, but not too high on the list of priorities facing teachers
Mathew Rayner	Has done the TAP program Very little involvement with the Museum because kids all have severe learning difficulties	Worthwile event to have Researchers do have a limited population Greater connection between public and scientists is a good idea **"I think quite often scientists are thought of as people in white coats in labs or whatever, which is certainly not the case."**	Would need to affect his educational practices Might be difficult to get involved because of limited time	Much better way of collecting data, instead of expecting people to come down to Museum Might get a wider or more exact sample of the population For him it would require huge amounts of parental consent **"probably a much better way of collecting data, rather than expecting people to come to the Museum"**	End results should be given to those who could make the best use of them	Would want end results given to him quickly Would like to learn something from the research study, mainly with new ways to educate children with severe learning difficulties	4	Would need to be a relevant topic to him and his students

APPENDIX D: ESTIMATIONS OF THE POPULATION

Merton Abbey Mills **02-Jun**

	Number of People		Number of People
Walking		*Standing*	
11:00-:01	15	11:02-:03	10
11:10-:11	18	11:12-:13	18
11:20-:21	21	11:22-:23	15
11:30-:31	17	11:32-:33	20
11:40-:41	20	11:42-:43	23
11:50-:51	23	11:52-:53	25
12:00-:01	10	12:02-:03	50
12:10-:11	11	12:12-:13	48
12:20-:21	18	12:22-:23	55
12:30-:31	30	12:32-:33	65
12:40-:41	25	12:42-:43	52
12:50-:51	20	12:52-:53	33
13:00-:01	35	13:02-:03	12
13:10-:11	20	13:12-:13	16
13:20-:21	23	13:22-:23	14
13:30-:31	15	13:32-:33	15
13:40-:41	18	13:42-:43	20
13:50-:51	20	13:52-:53	21
Average	20		28

Totals (average people walking per minute times 180 minutes)

Location	Average People Walking	Number of Minutes (180/1)	=	
	20	180		3590
				3590

Total people standing (turnover every 40 minutes)

Location	Average People Standing	Number of minutes (180/30)	=	
	28	6.00		171
				171

GRAND TOTAL POPULATION	**People**
Walking	3590
Standing	171
AbbeyMills	**3761**

Finchley Road **02-Jun**

Sitting near the elevator and fish tank	**Number of People**		**Number of People**
Walking		*Standing*	
12.00-01	26	12.02-03	12
12.10-11	20	12.12-13	12
12.20-21	30	12.22-23	12
12.30-31	24	12.32-33	15
12.40-41	30	12.42-43	15
12.50-51	18	12.52-53	15
13.00-01	25	13.02-03	10
13.10-11	25	13.12-13	10
13.20-21	16	13.22-23	12
13.30-31	25	13.32-33	10
13.40-41	38	13.42-43	15
13.50-51	35	13.52-53	15
14.00-01	34	14.02-03	20
14.10-11	30	14.12-13	20
14.20-21	30	14.22-23	15
14.30-31	24	14.32-33	16
14.40-41	24	14.42-43	15
14.50-51	28	14.52-53	20
Average	27		14

Totals (average people walking per minute times 180 minutes)

Location	Average People Walking	Number of Minutes (180/1)	=	
Elevator	27	180		4820
				4820

Total people standing (turnover every 40 minutes)

Location	Average People Standing	Number of minutes (180/40)	=	
Elevator	14	4.50		65
				65

GRAND TOTAL POPULATION	**People**
Walking	4820
Standing	65
Finchley Road	**4885**

Stansted Airport		**31-May**		
Arrivals	**Number of People**			**Number of People**
Walking			*Standing*	
11.10-11	60		11.12-13	100
11.20-21	40		11.22-23	110
11.30-31	30		11.32-33	90
11.40-41	60		11.42-43	80
11.50-51	45		11.52-43	100
12.00-01	70		12.02-03	110
12.10-11	40		12.12-13	110
12.20-21	50		12.22-23	130
12.30-31	50		12.32-33	110
Average	49			104
BK and café areas	**Number of People**			**Number of People**
Walking			*Standing*	
12.45-46	70		12.47-48	50
12.55-56	70		12.57-58	100
13.05-06	60		13.07-08	100
13.15-16	40		13.17-18	60
13.25-26	55		13.27-28	80
13.35-36	40		13.37-38	80
13.45-46	40		13.47-48	80
13.55-56	45		13.57-58	75
14.05-06	55		14.07-08	70
Average	53			77

Totals (average people walking per minute times 180 minutes)

Location	Average People Walking	Number of Minutes (180/1)	=	
Platform 9+10	49	180		8900
Platform 17+18+Underground	53	180		9500
				18400

Total people standing (turnover every 5 minutes

Location	Average People Standing	Number of minutes (180/45)	=	
Platform 9+10	104	4		418
Platform 17+18+Underground	77	4		309
				727

GRAND TOTAL POPULATION	**People**
Walking	18400

Standing	727
	19127

Heathrow Airport **31-May**

	Number of People		Number of People
Walking		*Standing*	
11:00-:01	45	11:02-:03	26
11:10-:11	50	11:12-:13	30
11:20-:21	40	11:22-:23	33
11:30-:31	47	11:32-:33	28
11:40-:41	58	11:42-:43	31
11:50-:51	51	11:52-:53	23
12:00-:01	36	12:02-:03	33
12:10-:11	28	12:12-:13	24
12:20-:21	31	12:22-:23	22
12:30-:31	26	12:32-:33	23
12:40-:41	33	12:42-:43	27
12:50-:51	27	12:52-:53	20
13:00-:01	30	13:02-:03	10
13:10-:11	35	13:12-:13	12
13:20-:21	60	13:22-:23	18
13:30-:31	55	13:32-:33	15
13:40-:41	40	13:42-:43	20
13:50-:51	38	13:52-:53	22
Average	41		23

Totals (average people walking per minute times 180 minutes)

Location	Average People Walking		Number of Minutes (180/1)	=	
		41	180		7300
					7300

Total people standing (turnover every 30 minutes)

Location	Average People Standing		Number of minutes (180/30)	=	
		23	6.00		139
					139

GRAND TOTAL POPULATION	**People**
Walking	7300
Standing	139
Heathrow Airport	**7439**

Marylebone Station **30-Jun**

	Number of People		Number of People
Walking		*Standing*	
11:00-:01	20	11:02-:03	25
11:10-:11	19	11:12-:13	25
11:20-:21	10	11:22-:23	20
11:30-:31	15	11:32-:33	15
11:40-:41	30	11:42-:43	20
11:50-:51	28	11:52-:53	15
12:00-:01	13	12:02-:03	21
12:10-:11	19	12:12-:13	18
12:20-:21	15	12:22-:23	22
12:30-:31	20	12:32-:33	21
12:40-:41	43	12:42-:43	35
12:50-:51	28	12:52-:53	41
13:00-:01	25	13:02-:03	27
13:10-:11	24	13:12-:13	26
13:20-:21	18	13:22-:23	23
13:30-:31	23	13:32-:33	14
13:40-:41	38	13:42-:43	30
13:50-:51	34	13:52-:53	25
Average	23		24

Totals (average people walking per minute times 180 minutes)

Location	Average People Walking	Number of Minutes (180/1)	=	
	23	180		4220
				4220

Total people standing (turnover every 40 minutes)

Location	Average People Standing	Number of minutes (180/5)	=	
	24	36.00		846
				846

GRAND TOTAL POPULATION	**People**
Walking	4220
Standing	846
Marylebone	**5066**

Waterloo Train Station Observation **30-5**

Platform 9+10	**Number of People**		**Number of People**
Walking		*Standing*	
11.00-.01	45	11.03-.04	10
11.10-.11	35	11.12-.13	7
11.20-21	80	11.22-23	12
11.30-31	60	11.32-33	8
11.40-41	75	11.42-43.	10
11.50-51	30	11.52-53	10
Average	54		10

Platform 17+18+Underground	**Number of People**		**Number of People**
Walking		*Standing*	
12.00-.01	100	12.03-.04	45
12.10-.11	80	12.12-.13	30
12.20-21	80	12.22-23	25
12.30-31	70	12.32-33	30
12.40-41	70	12.42-43.	40
12.50-51	70	12.52-53	50
Average	78		37

Burger King+exit+info boards	**Number of People**		**Number of People**
Walking		*Standing*	
13.05-.06	55	13.07-.08	50
13.15-.16	80	13.17-.18	40
13.25-26	75	13.27-28	45
13.35-36	75	13.37-38	35
13.45-46	70	13.47-48	40
13.55-56	65	13.57-58	45
Average	70		43

Totals (average people walking per minute times 180 minutes)

Location	Average People Walking	Number of Minutes (180/1)	=	
Platform 9+10	54	180		9750
Platform 17+18+Underground	78	180		14100
Burger King+exit+info boards	70	180		12600
				36450

Total people standing (turnover every 5 minutes

Location	Average People Standing	Number of minutes (180/5)	=	
Platform 9+10		10	36	342
Platform 17+18+Underground		37	36	1320
Burger King+exit+info boards		43	36	1530
				3192

GRAND TOTAL POPULATION	**People**
Walking	36450
Standing	3192
	39642

Camden **03-Jun**

	Number of People		Number of People
Walking		*Standing*	
11:00-:01	52	11:02-:03	18
11:10-:11	60	11:12-:13	16
11:20-:21	55	11:22-:23	16
11:30-:31	50	11:32-:33	19
11:40-:41	53	11:42-:43	17
11:50-:51	45	11:52-:53	20
12:00-:01	43	12:02-:03	25
12:10-:11	52	12:12-:13	30
12:20-:21	49	12:22-:23	26
12:30-:31	65	12:32-:33	22
12:40-:41	61	12:42-:43	20
12:50-:51	58	12:52-:53	18
13:00-:01	30	13:02-:03	12
13:10-:11	33	13:12-:13	14
13:20-:21	27	13:22-:23	10
13:30-:31	35	13:32-:33	16
13:40-:41	30	13:42-:43	20
13:50-:51	25	13:52-:53	15
Average	46		19

Totals (average people walking per minute times 180 minutes)

Location	Average People Walking	Number of Minutes (180/1)	=	
	46	180		8230
				8230

Total people standing (turnover every 30 minutes)

Location	Average People Standing	Number of minutes (180/30)	=	
	19	6.00		111
				111

GRAND TOTAL POPULATION	**People**
Walking	8230
Standing	111
Camden	**8341**

APPENDIX D: CODING OF PUBLIC INTERVIEWS

MERTON ABBEY MILLS INTERVIEW CODING

Gender	Age Group	Thoughts	Experiences wanted	Rating Of Interest	Other Comments Made by Interviewee	Abbey Mills	
Female	Post-Family	Doesn't go to museums	Not interested in it	1		Total Interviews=	42
Male	Post-Family	Good idea	Not sure what he would want	3		NR=	17
Male	Post-Family	Interesting	Not sure	3		R=	25
Male	Independent Adult	Good idea and interesting	General information	3		RR=	59.52
Male	Independent Adult	Would not like to make a trip to see it	To participate in research and learn	3		Rating Mean=	3.92
Male	Independent Adult	Where is info going	Know that they have helped humanity	3			
Male	Post-Family	Interesting and different	To learn about Astronomy an Space	4			
Female	Pre-Family	Good idea, easy to access the scientist	Knowledge	4			
Female	Pre-Family	Neat idea, interesting	See resutls of the study	4		% of people at 1	4.00
Male	Pre-Family	"Fair enough, sounds scientific"	Would like to gain a little knowledge on the event	4		% of people at 2	0.00
Female	Pre-Family	Good idea to work with a scientist	How it relates to her, personal relevance	4		% of people at 3	20.00
Female	Pre-Family	Brilliant	Likes DNA stuff	4		% of people at 4	52.00
Female	Independent Adult	Sounds fine	Nothing	4	If it was easy to access	% of people at 5	24.00
Male	Family	Wonderful idea, very proactive	A new way to learn	4			
Male	Pre-Family	Likes the Musem but wouldn't make special trip	Would like to see what it is all about	4			
Male	Independent Adult	With constent it would be good	See results and get money	4			
Female	Pre-Family	Good idea to do that program	Know what the data is used for and who is using it	4			
Female	Independent Adult	Interesting	Learn	4			
Male	Family	Interesting	Money	5			
Male	Independent Adult	Interesting and a good idea	Interviewee didn't understand question	5			
Female	Independent Adult	Good, increases awareness of science	Info for everyone to understand	5			
Male	Independent Adult	Interesting type of event	Knoledge	5			
Male	Post-Family	Good idea and interesting	General information	5			
Male	Independent Adult	Sounds fine, good for learn science	Not sure	5			
Female	Independent Adult	NR	NR	NR			
Male	Pre-Family	NR	NR	NR			
Female	Independent Adult	NR	NR	NR			
Male	Family	NR	NR	NR			

Female	Family	NR	NR	NR			
Male	Family	NR	NR	NR			
Female	Family	NR	NR	NR			
Male	Post-Family	NR	NR	NR			
Male	Post-Family	NR	NR	NR			
Female	Independent Adult	NR	NR	NR			
Female	Post-Family	NR	NR	NR			
Male	Post-Family	NR	NR	NR			
Female	Family	NR	NR	NR			
Female	Independent Adult	NR	NR	NR			
Male	Pre-Family	NR	NR	NR			
Male	Independent Adult	NR	NR	NR			
Male	Family	NR	NR	NR			
Female	Pre-Family	NR	NR	NR			

MARYLEBONE INTERVIEW CODING

Gender	Age Group	Thoughts	Experience Wanted	Rating of Interest	Other Comments	Marylebone	
Male	Independent Adult	Interesting and makes sense	He wouldn't have time to do it	1	It makes sense in the Museum but not in a public place	Total Interviews=	99
Male	Independent Adult	No idea	Nothing	1		NR=	36
Female	Teen	Good idea	Not sure	1		R=	63
Female	Post-Family	Interesting idea	Insight into the research topic	2	She would be more inclinded to do it in the Museum, because she would be self-conscious in public	%RR=	63.64
Female	Family	Very good idea	No idea, anything would be good	2		Rating Mean=	3.63
Female	Teen	Interesting	Stuff about science	3			
Male	Post-Family	New	Amusement and general knowledge	3			
Male	Pre-Family	"Haven't the fogiest"	Not sure	3			
Female	Post-Family	Good idea and interesting	General information	3		% of people at 1	4.76
Female	Independent Adult	Sounds alright	What was going to happen with the data	3		% of people at 2	3.17
Male	Independent Adult	Not sure	Just the experience	3		% of people at 3	31.75
Female	Independent Adult	Very interesting, good idea	Learn what the scientist is doing	3		% of people at 4	44.44
Male	Independent Adult	Ok idea	Learn priciples behind it	3		% of people at 5	15.87
Male	Post-Family	Very good idea	To experience it and learn	3			
Male	Post-Family	Very good idea	To know that his info was helpful to the researcher	3			
Male	Post-Family	New	General knowledge and amusment	3	Depends if he had time or not		
Male	Pre-Family	"Haven't the fogiest"	Not sure	3			
Male	Independent Adult	Very interesting, good idea	Learn what the scientist is doing	3			
Male	Post-Family	Very good idea	To know that his info was helpful to the researcher	3	Depends if he had time or not		
Female	Post-Family	New	General knowledge and amusment	3			
Male	Pre-Family	"Haven't the fogiest"	Not sure	3			
Male	Post-Family	Not sure	Just the experience	3			
Male	Independent Adult	Very interesting, good idea	Learn what the scientist is doing	3			
Male	Post-Family	Very good idea	To know that his info was helpful to the researcher	3			
Male	Family	Good idea and interesting	Personal relevance, something relating to him	3			
Female	Independent Adult	Good idea	To know that helped society	4			
Female	Family	"Good science"	No idea, anything would be good	4			

Male	Teen	Interesting	Learn something with personal relavance	4			
Male	Independent Adult	"Makes Sense"	Personal relevance, something relating to him	4	Depends if he had time or not		
Female	Family	Very good idea	Results of final analysis of the study	4			
Female	Family	Good idea and interesting	General information	4			
Male	Independent Adult	"fine"	General knowledge, mentioned planet science	4			
Male	Family	Very good and interactive idea	Results of final analysis of the study	4			
Female	Pre-Family	Interesting	Information	4			
Male	Independent Adult	Good project	Knowledge	4			
Male	Family	Good idea, gets people involved	Knowledge, better understanding	4			
Male	Independent Adult	Science Museums are good	How he related to others in the results, money	4			
Female	Independent Adult	Very interesting, good idea	Learn what the scientist is doing	4			
Female	Independent Adult	Very interesting, good idea	Learn what the scientist is doing	4			
Male	Post-Family	Good idea, interesting	What they are doing, how study relates to the public, why they are doing it	4			
Male	Pre-Family	Very good idea	To experience it and learn	4			
Male	Independent Adult	"Makes Sense"	Personal relevance, something relating to them	4			
Female	Pre-Family	Very good idea	Results of final analysis of the study	4			
Male	Family	Very good and interactive idea	Results of final analysis of the study	4			
Female	Independent Adult	Interesting	Information	4			
Female	Pre-Family	Very good idea	To experience it and learn	4			
Male	Independent Adult	"Makes Sense"	Personal relevance, something relating to them	4			
Female	Pre-Family	Very good idea	Results of final analysis of the study	4			
Female	Family	Very good and interactive idea	Results of final analysis of the study	4			
Male	Independent Adult	Very interesting, good idea	Learn what the scientist is doing	4	Depends if he had time or not		
Female	Pre-Family	Very good idea	To experience it and learn	4			
Male	Independent Adult	Very interesting, good idea	Results of final analysis of the study	4			
Female	Post-Family	Good idea and interesting	To experience it and learn	4			
Female	Pre-Family	Good idea and interesting	General information	5			
Male	Independent Adult	Interesting	Personal relevance and the "why" behind the study	5	Depends if he had time or not		
Female	Independent Adult	Interesting	Personal relevance and the "why" behind the study	5			
Male	Independent Adult	Very good idea	Results of final analysis of the study	5			
Female	Pre-Family	Good idea	Not sure	5			
Female	Independent Adult	Good idea	Not sure	5			
Male	Post-Family	Not sure	Just the experience	5			
Male	Independent Adult	Very interesting, good idea	Learn what the scientist is doing	5			

Male	Pre-Family	Good idea	Not sure	5			
Male	Independent Adult	Interesting	Information	5			
Male	Independent Adult	NR	NR	NR			
Female	Independent Adult	NR	NR	NR			
Male	Independent Adult	NR	NR	NR			
Female	Independent Adult	NR	NR	NR			
Female	Post-Family	NR	NR	NR			
Female	Independent Adult	NR	NR	NR			
Male	Family	NR	NR	NR			
Female	Post-Family	NR	NR	NR			
Male	Independent Adult	NR	NR	NR			
Male	Independent Adult	NR	NR	NR			
Male	Post-Family	NR	NR	NR			
Male	Pre-Family	NR	NR	NR			
Male	Independent Adult	NR	NR	NR			
Male	Independent Adult	NR	NR	NR			
Male	Independent Adult	NR	NR	NR			
Female	Independent Adult	NR	NR	NR			
Female	Post-Family	NR	NR	NR			
Female	Post-Family	NR	NR	NR			
Female	Post-Family	NR	NR	NR			
Male	Independent Adult	NR	NR	NR			
Female	Independent Adult	NR	NR	NR			
Male	Pre-Family	NR	NR	NR			
Female	Independent Adult	NR	NR	NR			
Female	Post-Family	NR	NR	NR			
Female	Independent Adult	NR	NR	NR			
Male	Family	NR	NR	NR			
Female	Post-Family	NR	NR	NR			
Male	Independent Adult	NR	NR	NR			
Male	Independent Adult	NR	NR	NR			
Male	Post-Family	NR	NR	NR			
Male	Pre-Family	NR	NR	NR			
Male	Independent Adult	NR	NR	NR			
Male	Post-Family	NR	NR	NR			
Male	Independent Adult	NR	NR	NR			

Female	Post-Family	NR	NR	NR			
Male	Independent Adult	NR	NR	NR			

APPENDIX F: BENCHMARKING RESULTS

RESEARCH WEBSITE CODING

	Informational Fit-to-Task	Interactivity	Trust	Response Time
Astronomy Online	- Site no longer in use, most information is out-of-date - Site contains all information needed for project	- E-mail address for site contact - E-mail used for data submission	- Site provides statement of purpose - No confidentiality statement present	- Each page within site loads in less than one second
Project Atmosphere Australia Online	- All information on site is up-to-date - Site contains all information needed for project	- E-mail address for site contact - E-mail used for data submission - E-mail list for discussions	- Site provides statement of purpose - No confidentiality statement present - Registration to e-mail list required for data submission	-Each page within site loads in less than three seconds
CIESE	- All information for on-going projects is up-to-date - Site contains all information needed for each project	- E-mail address for site contact - Questionnaire used for data submission - Message board for discussions	- Site provides statement of purpose - No confidentiality statement present	- Each page within site loads in less than seven seconds
KanCRN	- All information for on-going projects is up-to-date - Site contains all information needed for each project	- Site contact located on website -Questionnaire used for data submission - Message board for discussion	-Site provides statement of purpose - No confidentiality statement present - Registration required to access and submit data	- Each page within site loads in about five seconds
Scientists in the City	- Site no longer in use, most information is out-of-date - Site contains some information needed for project	- E-mail address for site contact - Site uses links to project members sites for data submission	- Site provides statement of purpose - No confidentiality statement present - Anyone can access data since it is in the form of web pages	- Each page within site loads in less than three seconds
Journey North	- All information on site is up-to-date - Site contains all information needed for project	- E-mail address for site contact - Questionnaire used for data submission - Message board for discussion	- Site provides statement of purpose - No confidentiality statement present - Registration required to access and submit data	- Each page within site loads in less than one second
American Psychological Society	- All information on site is up-to-date - Site contains all information needed for each study	- E-mail address for site contact - Various types of questionnaires used for data submission	- Site provides statement of purpose - Confidentiality statement present - Contact information for researcher provided	- Each page within site loads in less than one second

Table F-1: Website Evaluations Using Modified WebQual Assessment Tool

Research Website Coding (cont.)

	Design Appeal	Intuitiveness	Visual Appeal	Innovativeness
Astronomy Online	- All graphics are clearly labelled - All text is easy to read	- Lack of central directory makes navigation difficult - All pages accessible, with some difficulty	- Site contains a lot of text - Few graphics - Low aesthetic appeal	- Site makes no use of new web technologies
Project Atmosphere Australia Online	- All graphics are clearly labelled - All text is easy to read	- Central directory makes navigation easy - All pages are easily accessible	- Site contains a lot of text - Average amount of graphics - Average aesthetic appeal	- Site makes no use of new web technologies
CIESE	- All graphics are clearly labelled - All text is easy to read	- Central directory makes navigation easy - All pages are easily accessible	- Site contains a lot of text - Few graphics - Low aesthetic appeal	- Site makes no use of new web technologies
KanCRN	- All graphics are clearly labelled - Most text is easy to read - Some diagrams difficult to understand	- Central directory makes navigation easy - All pages are easily accessible	- Site contains a lot of text - Few graphics - Low aesthetic appeal	- Site contains a few G2 videos
Scientists in the City	- All graphics are clearly labelled - All text is easy to read	- Lack of central directory makes navigation difficult - All pages accessible, with some difficulty	- Site contains a lot of text - Few graphics - Low aesthetic appeal	- Site makes no use of new web technologies
Journey North	- All graphics are clearly labelled - All text is easy to read	- Central directory makes navigation easy - All pages are easily accessible	- Site contains a lot of text - Average amount of graphics - Average aesthetic appeal	- Site makes no use of new web technologies
American Psychological Society	- All text is easy to read	- Central directory makes navigation easy - All pages are easily accessible	- Site contains only text - Extremely low aesthetic appeal	- Site makes no use of new web technologies

Table F-1: Website Evaluations Using Modified WebQual Assessment Tool

WEBSITE SCREEN SHOTS

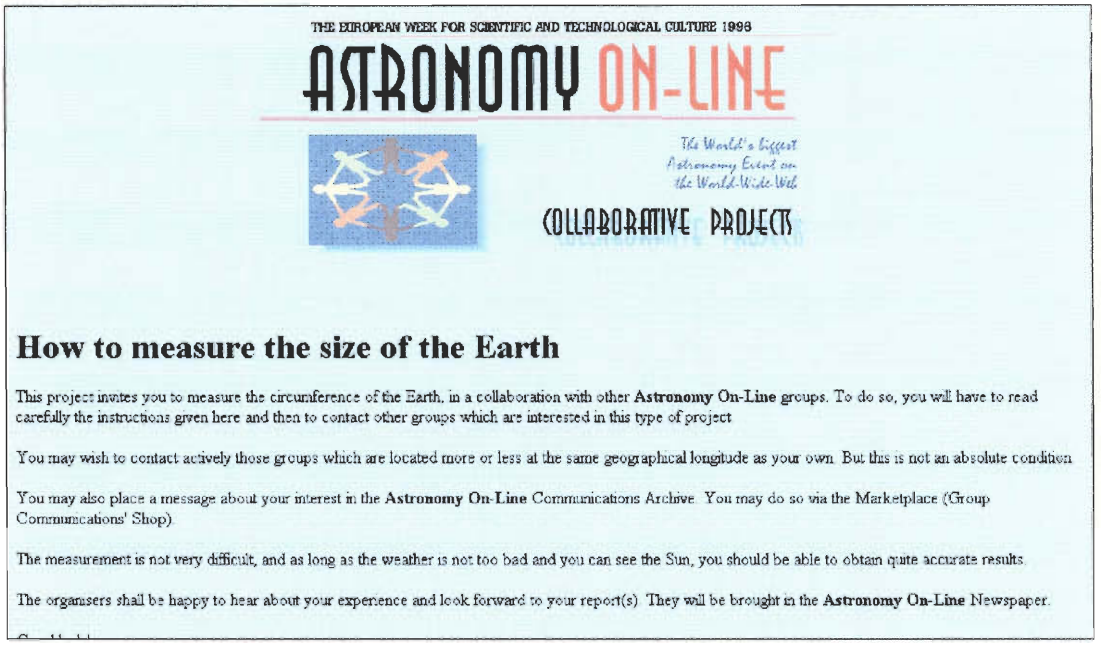

Figure F-1: Astronomy On-line Main page

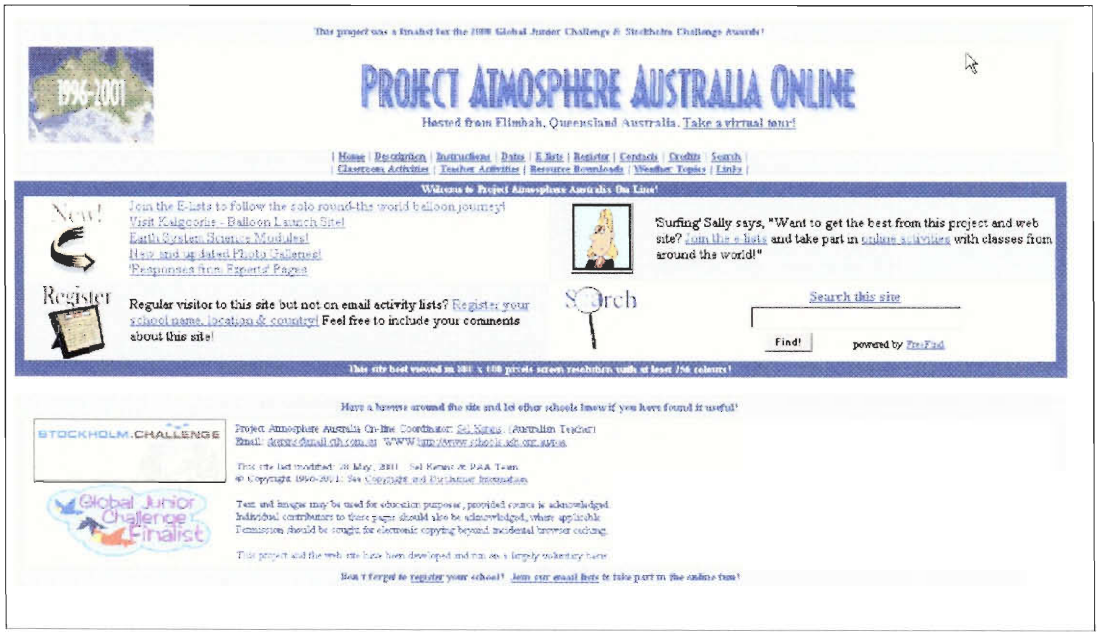

Figure F-2: Project Atmosphere Australia Online Main Page

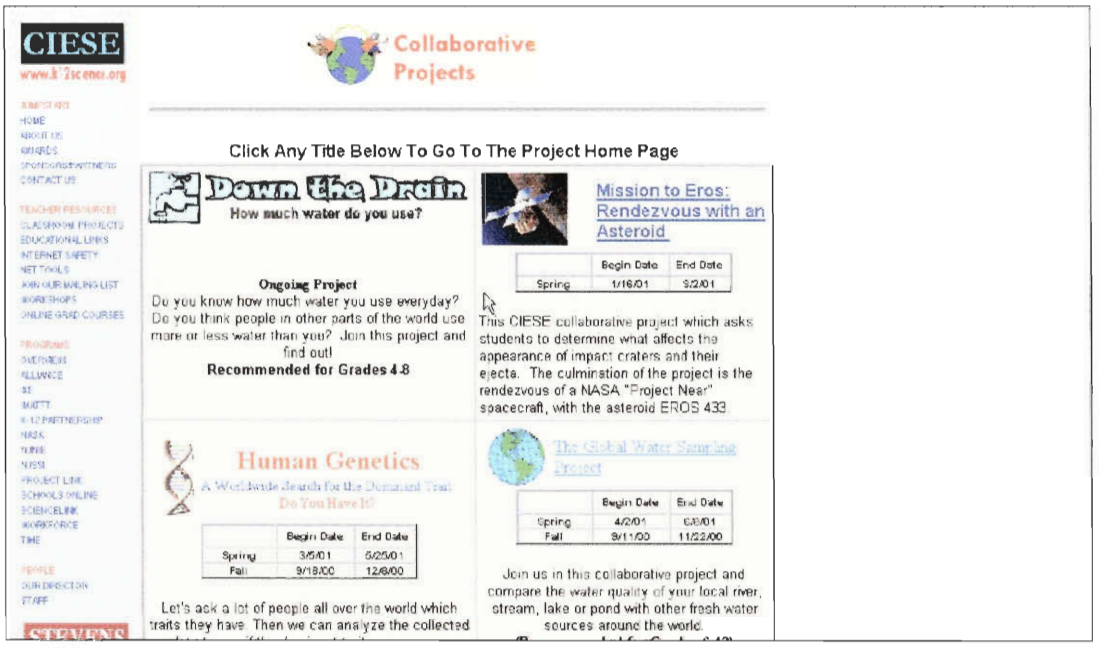

Figure F-3: CIESE Main Page

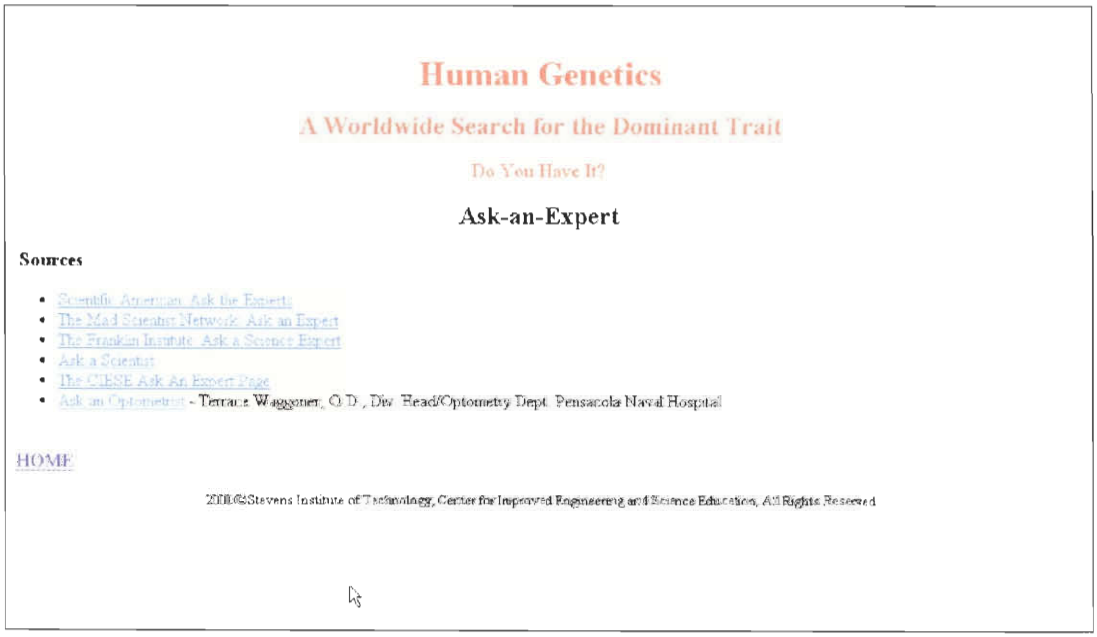

Figure F-4: CIESE Ask-An-Expert

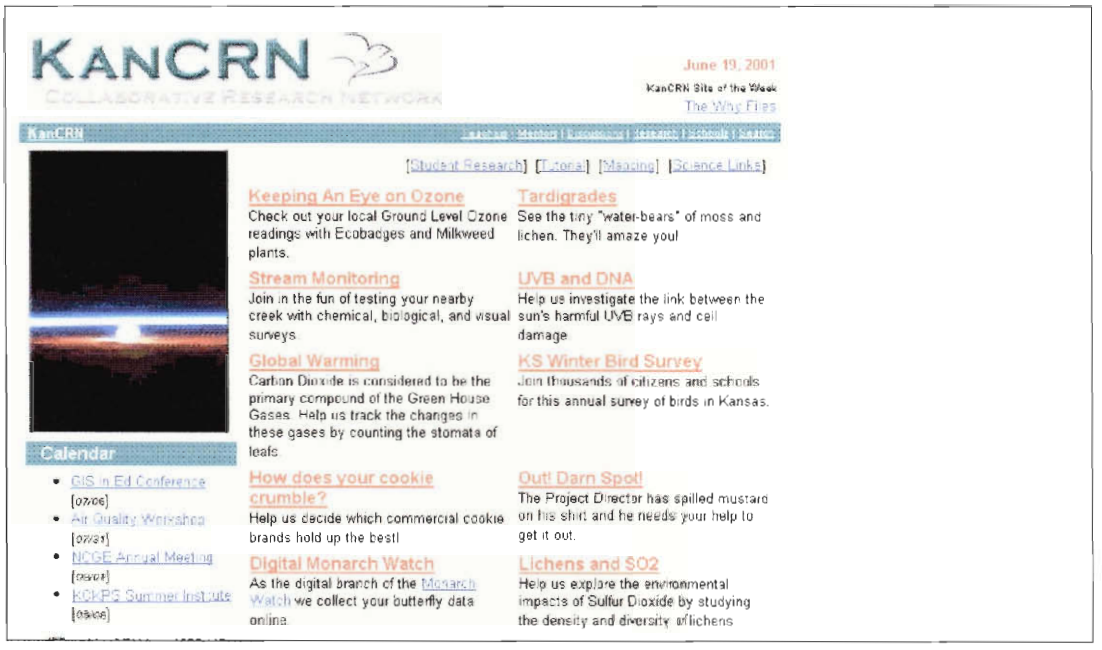

Figure F-5: KanCRN Main Page

Figure F-6: KanCRN Questionnaire

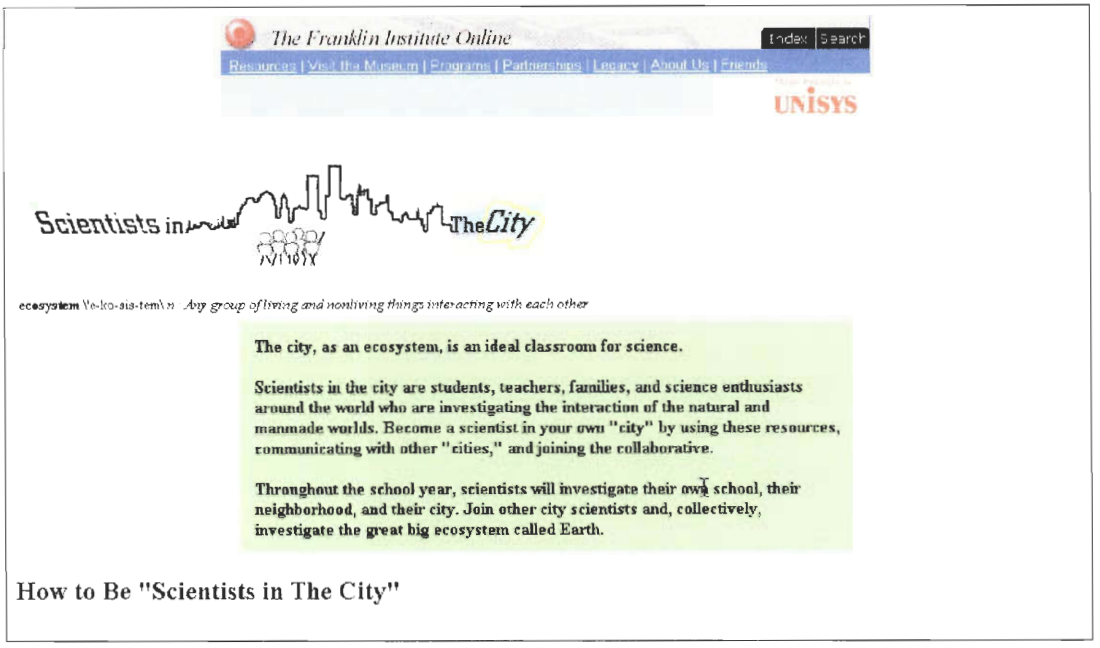

Figure F-7: Scientists in the City Main Page

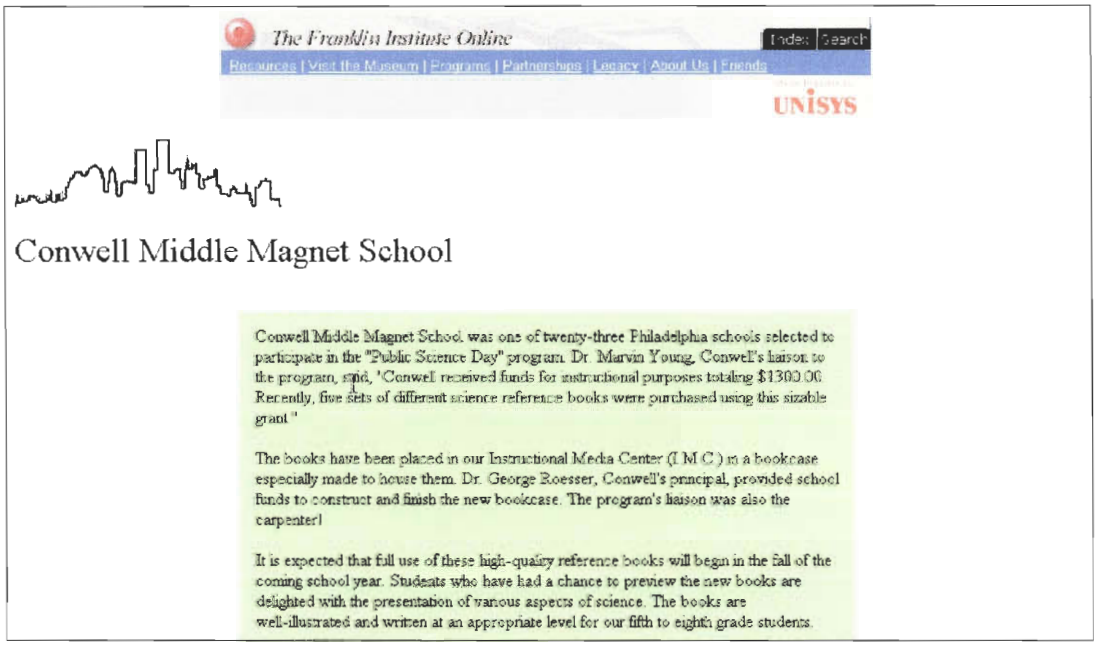

Figure F-8: Scientist in the City Student Web Page

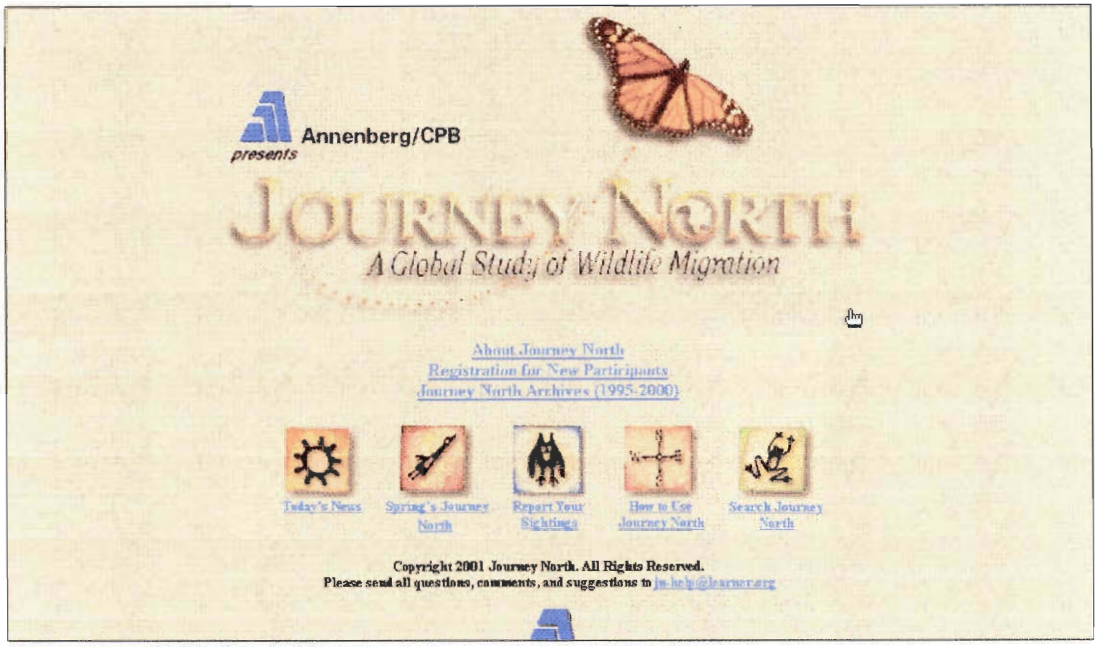

Figure F-9: Journey North Main Page

Figure F-10: Journey North Registration Form

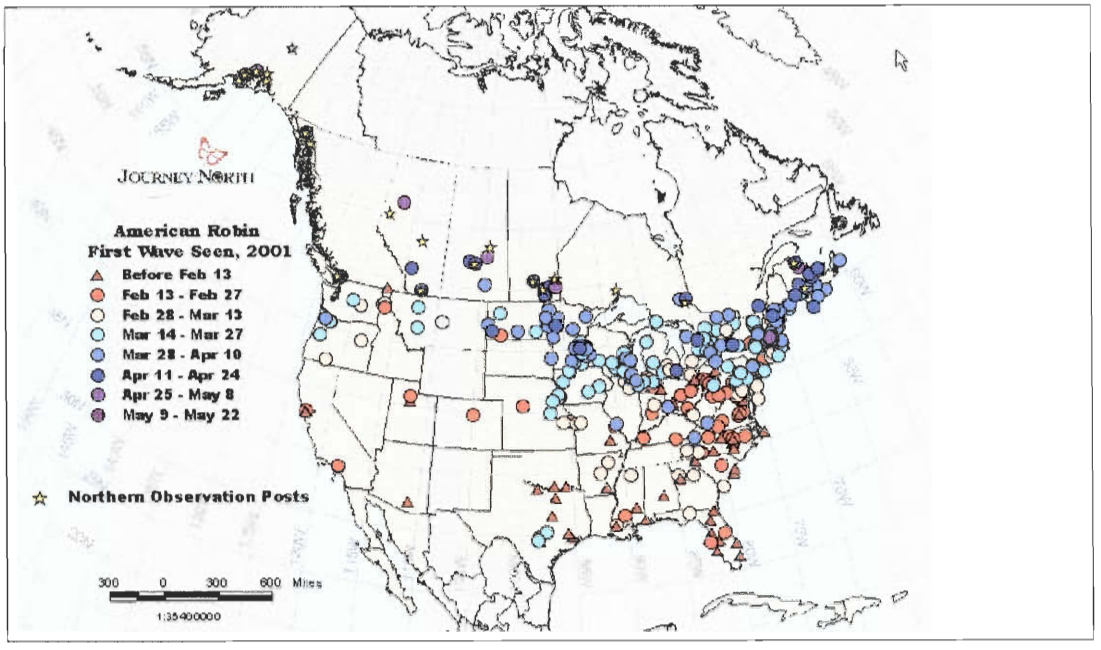

Figure F-51: Journey North Data Representations

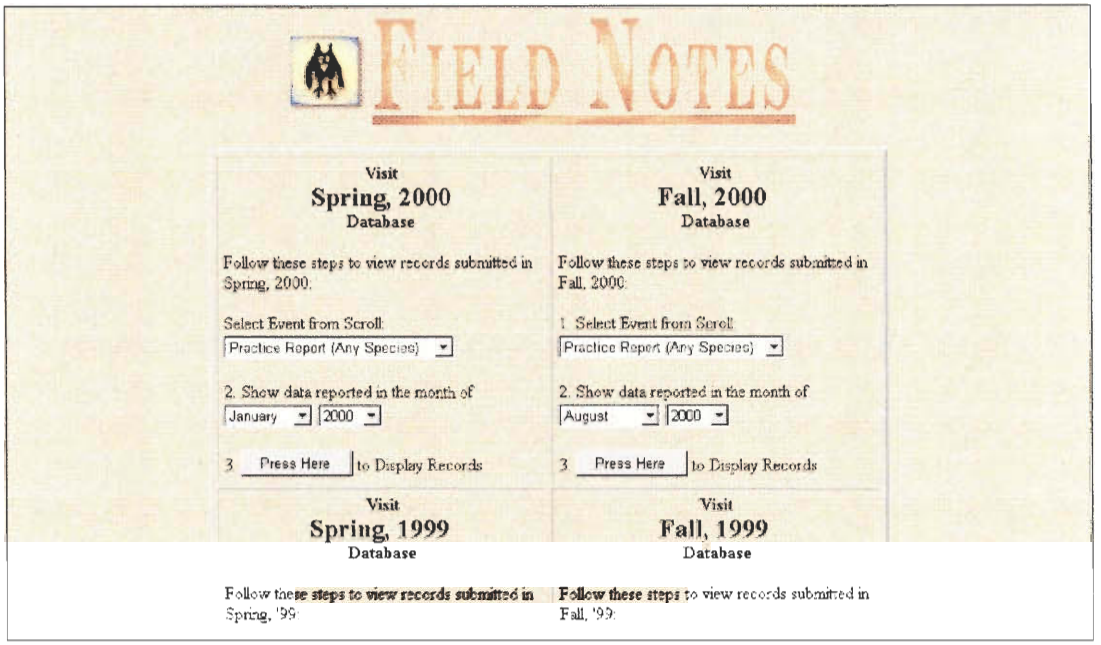

Figure F-16: Journey North Archives

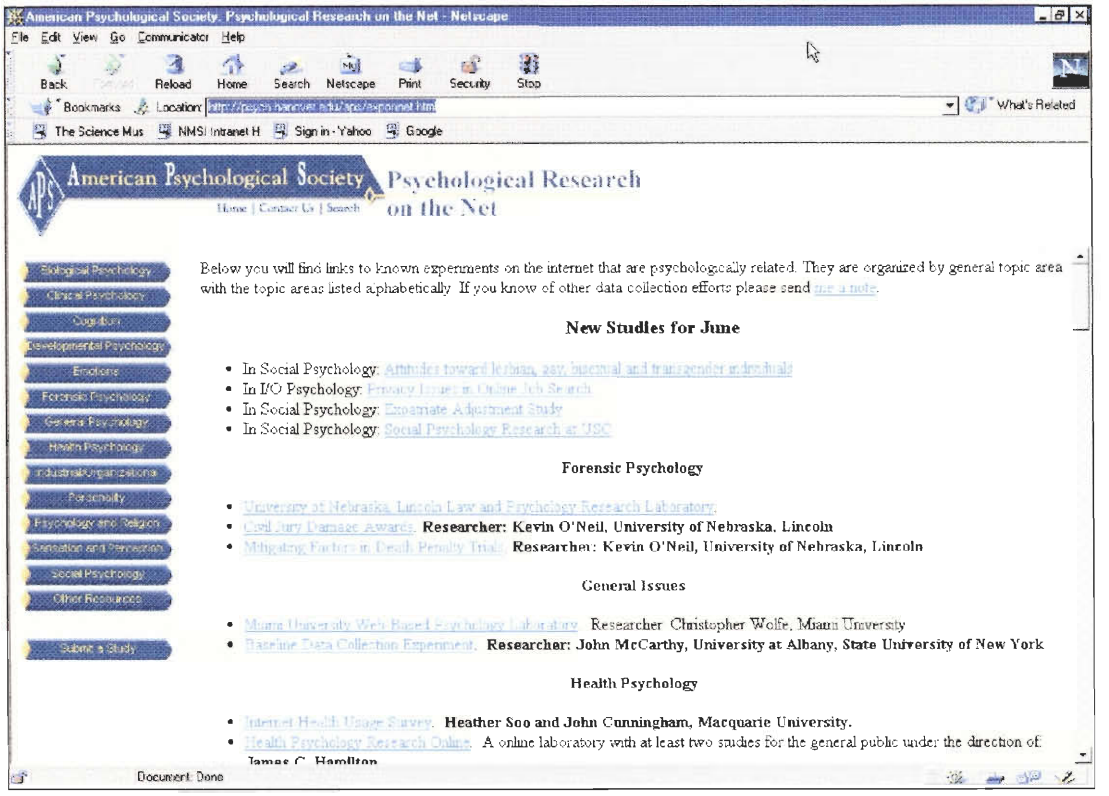

Figure F-17: American Psychological Society Main Page

The boy was learning to play Hong-Che an obscure and ancient game all but forgotten by his people. After a good play, his grandfather complimented him for his skillful playing.

Please rate the probability of each of these statements about the story above using a rating scale from 0% (impossible) to 100% (completely certain).

	Probability Hong	**Probability NOT Hong**	Sum column to 100%
Probability Che	Probability both hong and che =	Probability che but not hong =	Probability che =
Probability NOT Che	Probability hong but not che =	Probability neither hong nor che =	Probability NOT che =
Sum row to 100%	Probability hong =	Probability NOT hong =	**Total** = **100%**

What is the probability that his grandfather complimented him for scoring a symphony? ___ %

What is the probability that his grandfather complimented him for scoring a hong? ___ %

What is the probability that his grandfather complimented him for scoring a che? ___ %

What is the probability that his grandfather complimented him for scoring a hong that is a che? ___ %

Figure F-18: American Psychological Society Questionnaire

Overview and Informed Consent

This research examines the way people estimate the likelihood of events, and everyone who completes the experiment will be entered in a drawing for a **$45** prize. After a few general questions you will receive 12 very short stories or vignettes (2 or 3 sentences long) and you will be asked to estimate the probability of some events (for example, "What is the probability that Bud is a lawyer"). It will take about 25-30 minutes to complete. Your responses will be confidential. The data will be stored in a locked office on a password protected computer. Data will be analyzed in aggregate, and thus your specific responses will not be revealed to anyone. There are no reasonably foreseeable risks or discomforts associated with this research. Benefits from participating in the research include learning about the process of estimating probabilities, and achieving insights into your own mental processes. You may quit the experiment at any time by going to another Web page or turning off your computer. However, everyone who completes the experiment will be entered into a drawing with a chance to win a $45 Web Certificate that works like a credit card number and can be used virtually anywhere on the Web. Each person may only participate in this experiment once. Entering your e-mail address below and clicking on the button below indicates that you are over 18 years of age and that you are giving your informed consent. If you would like any additional information, or would like to learn the results of this study, you may contact Dr. Christopher Wolfe at

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If you have any questions or comments about your rights as a participant in research at Miami University please call the Office for the Advancement of Scholarship and Teaching at (513) 529-3734 or send e-mail to Dr. Carol Willeke at willekeb@po.muohio.edu. Thank you for your cooperation!

Please provide your e-mail address so that we can verify your participation and enter you in the drawing. If you are a winner, you will be notified via e-mail in the next four months.
(You must be over 18 years old to participate.)

Figure F-19: American Psychological Society Consent Form