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### Title

Development of an Edutainment Product to Promote Free-Choice Ocean Sciences Learning-  
*TimeWhys* Pilot

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### Author

Sayce, Kelly

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DEVELOPMENT OF AN EDUTAINMENT  
PRODUCT TO PROMOTE FREE-CHOICE  
OCEAN SCIENCES LEARNING –  
*TIMEWHYS* PILOT



**Kelly Sayce**  
**ksayce@yahoo.com**  
**310-738-2665**

**Date submitted: June 14, 2007**  
**Approved by Sharon Franks** \_\_\_\_\_

## EXECUTIVE SUMMARY

Science educators are faced with the challenge of addressing new audiences not always well served by traditional presentations of scientific material (Jones 1997). Studies suggest that though science is taught in school, science is not exclusively learned in school (Anderson et al. 2000; National Science Board 1998; Korpan et al. 1997). Informal, or *free-choice* learning, occurs outside the classroom and is largely under the choice and control of the learner (Falk 2002). The expansion of free-choice learning opportunities to include audiences with limited exposure to science education may potentially engage a segment of the population currently underrepresented in the field of ocean sciences. *TimeWhys* is a non-traditional approach to free-choice learning intended for people and families who are waiting for short-to-moderate time periods. For the purposes of this pilot study, I designed and tested a set of educational cards that stimulate learning using science-based content. I set out to answer the following questions: 1) Is *TimeWhys* an appealing way for people to spend waiting time?; 2) How does content and design influence level of engagement?; and 3) Do the results of the pilot study inform further development of this approach? Formative and summative evaluation was performed, using both quantitative and qualitative methods. More than eighty-five percent of those surveyed (n=129) reported that the cards were visually appealing, educational, clear, interesting, and an appealing way to pass waiting time. Medical facilities, periods of extended travel, and Laundromats were identified as other promising venues for *TimeWhys*. Ambiguous question design, differences in test venues, and barriers to accessing non-English speaking participants were some of the challenges experienced during the pilot. Recommendations for the further development of this free-choice learning approach are discussed. This pilot study yields valuable information of a novel approach to informal ocean sciences education.

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## INTRODUCTION

Learning is a continuous process that does not begin, nor end, in a traditional classroom. The important role non-school sources play in sustaining lifelong learning in general, and science learning in particular, is well documented (Anderson et al. 2000; National Science Board 1998; Korpan et al. 1997). Such studies suggest that even though science is taught in school, science is not exclusively, or even primarily, learned in school. Informal education, also known as *free-choice education*, is a vast educational arena that supports lifelong learning of all citizens irrespective of age, background, interest, or education level (Falk 2002). Free-choice learning offers more educational opportunities to a greater number of people than schooling or workplace learning combined (Dierking and Falk 2003).

*TimeWhys* is an informal educational product and approach designed to transform waiting time into a free-choice learning interlude. Intended for people, especially families, who are waiting for short-to-moderate time periods, *TimeWhys* is a set of free-of-charge 'playing cards' that stimulate learning using science-based content. This approach to learning may be effective for reaching subsets of the population who have limited access to traditional informal education opportunities, e.g. through visits to science centers, museums and aquariums.

The *TimeWhys* pilot study asked the following questions:

- 1) Is *TimeWhys* an appealing way for people to spend waiting time?
- 2) How does content and design influence level of engagement?
- 3) Do results of the pilot study inform further development of this approach?

In view of a rapidly changing demography of the U.S. and persistently low diversity of the ocean sciences workforce, it is important to focus efforts on expanding opportunities to groups currently underrepresented in ocean sciences (Gilligan 2006). Science educators are faced with the challenge of addressing new audiences not always well served by traditional presentations of scientific material (Jones 1997). The expansion of free-choice learning opportunities to currently untargeted communities has the potential to actively engage a distinct subsection of the general population: the waiting public.

## **BACKGROUND**

### *Free-choice Learning*

La Belle (1992) defines free-choice learning (FCL) as “the lifelong process by which every person acquires and accumulates knowledge, skills, attitudes, and insights from daily experiences and exposure to the environment.” This lifelong learning is intrinsically motivated, voluntary, and largely under the choice and control of the learner (Falk 2005; Falk and Dierking 2000). Such elements provide an interesting opportunity to investigate the role of the learner’s motivation, choice and control, interest, and expectations in the learning process (Rennie et al. 2003).

An individual’s interests and life experiences guide them towards an endless array of FCL experiences. Museums, television, radio, the Internet, magazines, newspapers, books, parks, community organizations of all types– youth, adult, religious, environmental, health, sports and recreation, and a complex interpersonal network of families, friends and acquaintances all fall under the auspice of FCL (National Science Foundation 1998). Represented by a vast array of information resources for thousands of topics, FCL offers individuals the choice to develop a better understanding of themselves, their family, society, and the world (Falk 2002).

The flexible style of FCL leaves individuals room to explore their personal interests (Jones 1997), discovering science on their own initiative and not as part of a mandated school experience. This type of exploration can potentially lead to a more thorough understanding of scientific concepts, topics, and processes and an increased appreciation and understanding of science and its applications (National Science Foundation 1998). Many people with science-related careers credit their initial interest in science to informal rather than formal exposure, identifying museums and science centers as the most important stimulants to their childhood interest (National Science Foundation 1998). Lee et al. (1995) suggest that for individuals coping with the incongruity of a social system based on a second language or an unfamiliar value system, FCL can provide the freedom to learn in more comfortable ways.

As the United States continues to transition from an industrial society to an information society, understanding the ways in which lifelong learning take place is increasingly important (Dierking and Falk 2003). Segments of the population with higher socioeconomic status and greater access to technology tend to acquire information at a faster rate than lower status segments (Tichenor et al. 1970). As the infusion of mass media information increases, the gap in knowledge between these segments tends to become wider (Steele et al. 2005).

Level of formal education, income, and occupation are all found to strongly correlate with environmental knowledge holding in the United States, Canada, Japan, and Russia (Steel et al. 2005). If low levels of science-based knowledge are due to these factors alone, it may be difficult to increase knowledge levels with public information and media campaigns because of the relatively static nature of these factors (Steel et al. 2005). However, if low levels of knowledge can be explained by “situation-specific” factors that lead to the acquisition of information irrespective of socioeconomic status characteristics, there is more hope that outreach efforts may be successful (Steel et al. 2005).

Places where people wait are “situation-specific” opportunities where people, regardless of socioeconomic status, hold tremendous potential for the infusion of knowledge. Waiting environments may actually target people of lower economic status. Nichols et al. (1971), suggests that while individuals of higher economic status can afford to pay for services that reduce waiting time (eg. traveling as a first-class passenger) or remove waiting completely (eg. pay someone else to do the waiting), less-economically advantaged cannot afford to do so, and hence wait more frequently and for longer periods. By offering FCL opportunities to the waiting public, barriers of access (cost, time) to traditional forms of informal learning (aquarium, museum) are removed.

In order to be effective, FLC content must be designed so it is suitable to both the audience, and the environment. While an aquarium visitor makes an active decision to engage in a FCL experience, the waiting public does not necessarily expect to learn about ocean life at, say, a bank. The health sector has been incredibly successful in strategically targeting public subgroups with educational information and memorable messaging. Over the past two decades, *social marketing* has been used extensively by the health sector in advertising and mass media campaigns seeking to shape attitudes, increase awareness, and encourage either the use of certain services or changes in personal or collective behavior (Chapman Walsh et al. 1993). Social marketing has been advocated as a powerful set of tools for segmenting, profiling, and targeting populations; designing, positioning, testing, and refining products and services; and sometimes galvanizing effective social change strategies (Chapman Walsh et al. 1993).

Research indicates that initiatives to promote awareness and behavior changes are often most effective when they are carried out at a community level and involve direct contact with people (McKenzie-Mohr and Smith 1999). The emergence of community-based social marketing over the past several years can be traced to a growing understanding that conventional social marketing, which often relies on media advertising, can be effective in



creating public awareness and understanding of issues related to sustainability, but is limited in its ability to foster behavior change (Costanzo et al. 1986; Yates and Aronson 1983). This coupled approach to taking traditional social marketing techniques and tools and pairing them with community level engagement provides a quantitative framework for free-choice learning products, such as *TimeWhys*, to exploit.

### *Evaluation Methods*

While qualitative methods are frequently used in informal education evaluation, the integration of quantitative methods in the assessment of such programs can be extremely valuable. Dori and Tal (2000) suggest informal learning environments should be partnered with a suitable informal assessment methodology that is flexible and adaptable to less structure programs. Observation, interviews, and audiotaping conversations all provide insights into the learning process, enabling closer attention to the individual, the individual's interactions with objects (exhibits, animals, books, movies, and so on), the individual's interactions with others, and interactions among members of a group (Rennie et al. 2003). The combination of formative (Sanders and Cunningham 1973) and summative (Bloom et al. 1972) evaluation and the inclusion of qualitative and quantitative methods is common practice when evaluating educational programs (Fuchs and Fuchs 1993).

Pre-production evaluation, or *formative evaluation*, is typically conducted during the early development stages of a program or product (Scriven 1991), such as in a pilot study. Chambers (1994) and Scheirer (1994) suggest formative evaluation be used to examine the effect of the program, the process of delivery, and the reactions of participants in the program by using qualitative methods such as interviews, focus groups, and observations.

In contrast, *summative evaluation*, examines the effects or outcomes of some object by describing what happens subsequent to delivery of the program or technology; assessing whether the object can be said to have caused the outcome; determining the overall impact of the causal factor beyond only the immediate target outcomes; and, estimating the relative costs associated with the object (Social Research Methods 2007). Summative evaluation is applied extensively in the education sector primarily to assess learning as an outcome of program development (Basch 1987; Bloom 1971). Information gathered during formative evaluation activities may be reported in formal summative reports, particularly during the early development of new programs, in order to show how the program is responding to challenges and reaching benchmarks and milestones along the way toward intended outcomes (Northwest Region Educational Laboratory 2007).

For the purposes of this study, an assessment of learning as an outcome was not determined, however formative and summative evaluation was used to measure the interest in an educational product like *TimeWhys*.

## **METHODOLOGY**

The very nature of FCL requires creativity on behalf of the evaluation team and must include innovative research designs, methods, and analyses (Rennie et al 2003). Development and testing of *TimeWhys* utilized both formative and summative evaluation design. The study implemented a mixed-method approach, including quantitative and qualitative methodology. Green et al. (1989) noted that mixed-method evaluations are appropriate in social science research because they serve five purposes: (a) seeking convergence of results; (b) examining overlapping and different facets of a phenomenon; (c) discovering contradictions or fresh perspectives; (d) using the methods sequentially, such that results from the first method inform the use of the second method; and (e) adding breadth and scope to a project. This study fit well with purposes (c) and (d). This mixed-method approach is also in accordance with the three levels of pre-production research as identified by Flay (1987).

### *Content Topic*

When we began discussing options for the subject of the *TimeWhys* pilot, we took into consideration topics that would marry public appeal and also relate to research conducted at Scripps Institution of Oceanography (SIO). Our goal was to make a direct connection between the topic, learner, SIO, and the local marine environment. Initial themes included kelp forests, endangered species, foodwebs, algal blooms, ocean currents, sea-level rise, and ocean instrumentation.

Upon early consultation with Birch Aquarium educators, it became clear that a single unifying theme was needed so that the content would be cohesive, memorable, and relevant to the learner. We decided on climate change as our umbrella topic, with the sub-theme of 'Humans are driving current changes to Earth's climate' focusing the content even further. I then conducted an extensive literature review and a series of interviews with Scripps scientists. Through this process I was able to identify a number of key concepts that became the foci for the cards: ice cores as an indication of Earth's past climate; the ocean as a carbon sink; human contribution to the warming of the atmosphere; sea-level rise; algal blooms; temperature fluctuations on kelp forests; endangered California fish species; ocean circulation; ocean acidification; wave action; and gas exchange. Most content went through

seven revisions. The final set of eight cards (Appendices 1-8) included the following key concepts:

Card 1 – Introduction to *TimeWhys*

Card 2 – What is CO<sub>2</sub> and the greenhouse effect?

Card 3 – Ice Core as an indication of Earth's past climate

Card 4 – The ocean as a carbon sink

Card 5 – Sea-level rise

Card 6 – Ocean acidification

Card 7 – Human contributions of CO<sub>2</sub>

Card 8 – Conservation Tips

Each card is designed to build on the reader's knowledge as they make their way through the pack. This successional design was developed in response to feedback from Phase One (see pg. 19), where comments on weak connections between messaging and content were discussed. By designating entire cards to explain key elements behind the science of climate change, it was our intention to make these connections stronger.

#### *Card Design*

All cards developed for this study had a similar design layout. The front of the cards consisted of three panels: the top panel contained a sentence summarizing the concept of the card; the middle panel included information relating to the time needed for something to take place; and the bottom panel was either a question (true or false, multiple-choice) or a fact with an arrow indicating to turn the card over. The back of the card contained a 1-panel design: the top portion included the answer to the question; the middle contained facts or an activity; and the bottom included a conservation tip, inspirational quote, or directions to view another card.

#### *Reading and Comprehension Level*

We created the cards with a sixth-grader in mind (Appendix 9), aiming for a reading-level that could promote intergenerational exchange (per. comm. Evans and Hofmann 2006). Preserving scientific accuracy was a priority, and we worked diligently to find lay-language alternatives for scientific terms such as 'acidification', 'thermal expansion', and 'carbon sink'.

## **Phase One**

Formative evaluation, both qualitative and quantitative, informed the design and development of the final set of eight cards and survey.

### ***Expert Contributors***

Experts in four distinct disciplines were consulted to guide particular phases of this study. Obtaining pro bono expertise was not a simple undertaking, and I made many e-mail, phone calls, and visits to leading experts in the fields of education, evaluation, and climate change science. For the most part, I was met with enthusiasm and interest for the project. There were, however, e-mail and phone calls to scientists that went unanswered. I believe this to be a product of a) attempting to contact high-profile experts who are in high demand, and b) low prioritization of public education and outreach with some members of the scientific community.

### ***Science***

Originally my goal was to construct a focus group of three-to-four SIO researchers, however, due to scheduling conflicts, this was not possible. I interviewed, separately, six SIO scientists, including Dr. Nancy Knowlton, Dr. Enric Sala, Dr. Grant Deane, Dr. Dan Cayan, Paul Dayton, and Dr. Richard Norris. Informal discussions with Dr. Russell Chapman and Dr. Jeremy Jackson also took place. These specialists in climate, biodiversity, and marine ecology were selected to provide expertise on one or more of the key concepts previously identified. Interviews focused on gaining additional insight in the key processes behind each concept (ie. contributing factors to sea-level rise), thus enabling me to focus my literature review.

### ***Educators***

On several occasions I met with Kristin Evans and Michelle Hofmann, members of Birch Aquarium at Scripps' education staff who provided critical insights about developing 'exhibit-like' products. Specifically, they made recommendations about key features to include (and exclude) and provided guidance on use of language, tone, organization of content, and the formulation of the card's key messages. I also conducted an informal interview with Andrea Thorrold, Center for Ocean Science in Education Excellence's Program Coordinator at Woods Hole Oceanographic Institution who shared her experience in developing and testing similar types of educational products.

### *Design*

A Masters of Fine Arts candidate from the Visual Arts Department at University of California San Diego, Owen Mundy, was instrumental in developing the card design. We worked closely together to ensure a strong connection between images and text so both would easily translate to the general public.

### *Evaluation*

In developing evaluation instruments and methods, I consulted two experts, Dr. Louis Rae of Rae & Parker Research and Chris Parsons of Word Craft, who provided their input during Phase One.

The guidance of a marketing professional with experience in product or game development, which was not available during this pilot study, would have been valuable. We look forward to including this area of expertise in any future expansion of the project.

### ***Formative Evaluation***

Incorporating a wealth of input from these experts, I created a pair of prototype cards and surveys that I used for in-person and virtual focus groups. Two cards were used for this portion of the evaluation. Card A (Appendix 10) discussed ice cores as a form of measuring Earth's past climate and Card B (Appendix 11) discussed the ocean as a carbon sink. The formative evaluation portion of Phase One took place during April 2007.

### *Sixth Grade Focus Group*

I conducted two focus groups with sixth-graders enrolled in two after-school programs. A total of 19 students participated. Students of Monroe Clark Middle School,<sup>1</sup> in affiliation with Aquatic Adventures<sup>2</sup> (FG1), and students at the Elementary Institute of Science<sup>3</sup> (FG2) were, on separate days, each divided into groups and given Cards A and B to review for five minutes. The groups then came together and were engaged in informal

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<sup>1</sup> Monroe Clark Middle School opened its doors in 1997 in the San Diego community of City Heights and was designed as a year-round middle school to meet the needs of a diverse population of students who live in the most impoverished area of the San Diego. The school is approximately 67% Hispanic, 15% Asian, 15% African American and 3% other populations. Many of the students are not yet English language proficient as most are first generation immigrants from a number of Central American, East African, Asian and Croatian nations.

<sup>2</sup> Aquatic Adventures educates urban youth about science, the ocean and nature through tuition-free programs, creating the next generation of scientific and environmental leaders.

<sup>3</sup> Elementary Institute of Science (EIS) began in 1964 as an after-school club, focusing on hands-on experimentation to teach scientific principles through all five senses. Over four-thousand children from more than 250 San Diego County schools have been inspired and encouraged in their scientific studies, as their natural scientific curiosity has been embraced and nurtured. EIS offers multi-tiered programs uniting elementary, middle, high school, and college students, and members of the scientific community in a continuum of learning.

discussion guided by open-ended questions for 10 minutes (Appendix 12) which was voice recorded.

Questions asked of both groups included first impressions, phrasing and wording of content, use of colors and images, and a general understanding of the card's over-arching messages. I also asked students where they typically wait and what they do while waiting. Inexpensive prizes (colored pencils, coloring book, and eraser) were given to the students following the session to thank them for participating.

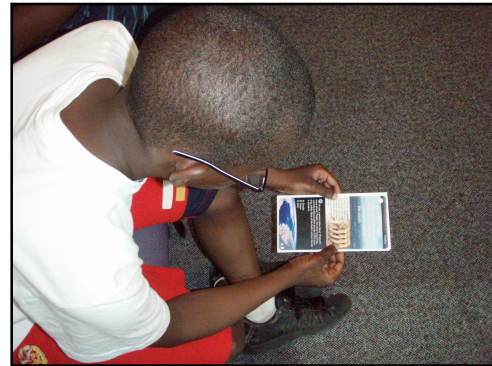


Image 1. FG1 student reviewing Card B.

MAS students acted as visual observers for both focus groups, taking notes regarding the student's behavior while reviewing the cards, conversations between students, and transcribing student's answers to the questions I asked both groups. I used the information of the visual observers to compare to the taped recording and to my own observations in an attempt to reduce any bias that I, as the product's developer, may have contributed.

#### *E-mail Group*

To gain additional feedback on the prototype cards, I conducted a survey using electronic mail (Appendix 13). I contacted 91 people chosen to represent five categories: university students, educators (both informal and formal), scientists, parents, and 'other,' which included law and medical professionals, artists, and a flight attendant among others. Via e-mail, I sent instructions for completing the survey, image files showing both sides of Cards A and B, and an eight-question survey that contained similar questions asked of the students. The survey questions were primarily yes/no with one question a five-point Likert scale. Three of the questions asked for additional comments and the final question was open-ended. Over a two-week period, I sent a sequence of messages – first to alert that a questionnaire was going to be sent, next to send the questionnaire, and finally follow-up messages to remind people to respond.

#### **Processing of Formative Feedback**

Together, the in-person focus groups and e-mail surveying yielded a great deal of useful feedback regarding the card content and design. Confusing design elements and unclear connections between messaging and content were brought to light through

comments made during Phase One. I applied what I learned from the formative assessment to the revision of the first two cards and the development of additional six cards and the survey used during Phase Two.

## **Phase Two**

During Phase Two of the pilot I conducted a summative evaluation involving quantitative methods. This phase of the project involved the field-testing of *TimeWhys* in places where people wait.

### *Locations*

I conducted the field research at three venues: a car wash with oil change services (Point Loma); a car wash without oil change services (Mission Valley); and an independently owned movie theater (Encinitas). Factors considered in selecting these venues included: a) a desire to achieve geographic distribution within San Diego County; b) the need to obtain permission from business owners/managers to conduct on-site surveying; and c) likelihood that people would be waiting for  $\geq$  ten minutes.



Image 2. Outside Point Loma venue.

### *Subjects*

Due to time and budget constraints, subject participation was determined in a non-random fashion, with every 'available' patron of each establishment solicited to participate. Individuals who were engaged in other 'waiting' activities (reading, watching television, engaged in conversation) were also solicited, however cell phone users, individuals with very young children, and one woman who was crying were not approached. In most cases subjects were approached upon exit of the cashier area to ensure they would have enough time to review the cards and complete the survey. Incentives were offered during the 'pitch' to help entice participation. Incentives included a free car wash, upgrade to deluxe car wash, and a SIO goody bag, depending on location.

### ***Summative Evaluation***

We used a survey that had twelve questions, with most of the questions having multiple-parts, thus resulting in total of 80 questions asked (Appendix 14). A 5-point Likert-

type scale was used, with higher values indicating a more negative rating. For example, respondents' perceptions of the extent to which *TimeWhys* was educational was rated according to the scale points: 1=strongly agree, 2=agree, 3=no opinion, 4=disagree, and 5=strongly disagree. Yes/No questions were also asked along with three questions requesting comments and a final open-ended question.

Subjects were asked for first impressions, estimated time taken to review cards, questions pertaining to level of attractiveness and understandability, and other waiting situations where one might engage in *TimeWhys*. Background questions regarding the subject's interest in the ocean, ocean sciences education, and interest in facts and trivia were also asked. Demographic questions including age, education level and ethnicity were optional.

I selected four cards for field-testing: Card 3 (ice core - Appendix 3), Card 4 (carbon sink - Appendix 4), Card 5 (sea-level rise - Appendix 5), and Card 6 (acidification - Appendix 7). Cards were divided into pairs identified as Package A (Cards 5&6) and Package B (Cards 3&4). Each package contained one card with an activity (Cards 4&6), and one card with more fact-based content (Cards 3&5). Subjects were given two cards from either Package A or B, survey, and pen, all of which were attached to a clipboard. Through casual observations I estimate it took about ten minutes to complete the survey once the subject had reviewed the cards.

### *Data Analysis*

Descriptive and inferential statistical techniques were applied to data collected during Phase Two. Although Likert scales are truly ordinal scales, I treated the five points in the Likert-scale as interval in nature. This allowed me to calculate mean scores so the data could be easily compared. Yes/No questions were treated as binary. For the purposes of this study, no comparisons between interval and binary data were made. Means, medians, and standard deviations were calculated for each question for each card (Cards 1, 2, 3, & 4), card type (Cards 1&3/Cards 2&4), and card package (Cards 1&2/Cards 3&4).  $T_{stat}$  analysis was conducted for each to test for correlations within and between cards and packages. Any unclear or ambiguous data collected during Phase Two was removed from analysis.



## **RESULTS**

### **Phase One**

Qualitative information gathered through discussions with scientific and educational experts helped structure the key concepts discussed in each card. SIO researchers provided scientifically accurate information on the pre-identified concepts and helped further expand a general understanding of key processes. Birch Aquarium educators were first to raise the issue of thermal expansion as a key contributor to sea-level rise, which was later expanded on by SIO scientist, Dr. Dan Cayan.

Challenges existed when attempting to translate interviews with SIO scientists into public-friendly language while maintaining scientific accuracy. Evidence of a strong disconnect between the scientific community's idea of public-friendly content was also observed. When asked for alternative language to explain thermal expansion, Dr. Cayan stated, "Just call it 'thermal expansion' – there's no need to dumb it down." Other contributing scientists including Paul Dayton, Dr. Nancy Knowlton, and Dr. Enric Sala, all of whom work on research projects that include public outreach components, were sensitive and cognizant of the existing barrier between the scientific community and the public.

Education contributors focused heavily on ensuring card content maintained a sixth-grade comprehension and language level. When reviewing the first run of cards, Kristin and Michelle immediately identified terms like 'carbon sink' as 'too scientific.' As an alternative to 'sink' they suggested using 'stored in' or 'absorbed by.' In addition to language, Sharon and I, with the help of both educators, worked to develop analogies to compare climate processes to common everyday activities. I developed an activity that made the connection between the ocean's limits to the amount of CO<sub>2</sub> it can absorb and the absorption capacity of a sponge. By making connections between natural processes and life experiences, complex relationships were better illustrated.

### **Formative Evaluation**

#### *Focus Groups*

Two focus groups helped identify confusing and ambiguous elements of card content and design. FG1 consisted of seven students, of which six were male, and FG 2 consisted of eleven students, five male and six female. Students were introduced to the evaluation team (one facilitator and 1-2 visual observer(s) and informed on how their comments would be used.

Students grouped themselves into twos and threes and were given five minutes to review the two cards. Interaction with the cards varied, with some groups reading the

content aloud to one another, while others read silently. Some students were observed rotating one card to read the information presented in a spiral and many students laughed aloud when reading content that included 'fish farting.' Of one of the groups who read silently to themselves was later identified as students from Tijuana with limited English language skills.

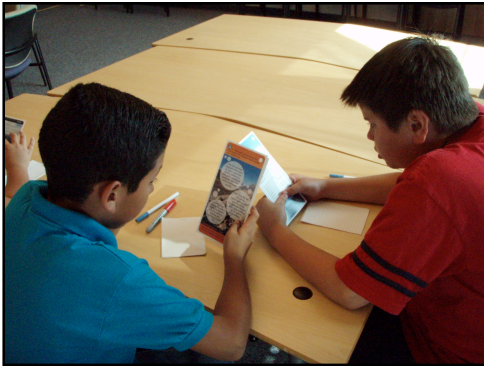


Image 3. Students from FG1 reviewing cards.

Students were then brought back together for ten minutes to discuss their impressions of the cards. Students were asked about situations where they wait. Answers included waiting for breakfast, at an airport during spring break, and during a 'time out.' When asked what students usually do while waiting, answers included play video games, watch TV, and 'do nothing.'

First impressions of the cards included 'interesting,' and 'too much text.' Most students liked the spiral text on Card A, however none of the students could identify the image the text was written on as an ice core.

Both groups expressed confusion regarding the usage of 'Q' and 'A' as symbols for 'Question' and 'Answer,' specifically when used for Card B (a multiple-choice question). Students were led to believe that 'A' indicated the correct 'choice' rather than the symbol for 'Answer.'

Both groups also expressed confusion surrounding the image of elephants on Card B. Inaccurate connections were made between the elephants and what the students anticipated the content would be discussing. This led many students to answer the question asked on the card incorrectly.

Overall, most students liked Card A more than Card B. When further prompted, students identified the back of Card B as too text heavy, which elicited groans from the students, with one student commenting 'I don't like to read.' Students were fascinated with Card A's image of the ice core (once they knew what it was) and the time it would take to drill an ice core 3 miles long. When asked what would make the cards more interesting, students suggested using more images, cartoons, and have more of the content written upside down and in circles. One student commented how he would like to know more information about the other multiple-choice options (do fish *really* fart?), even though they weren't the 'correct' answer.

Students were able to relay the main messages of the cards, with one student commenting, 'We produce global warming.' Regarding the experiment on Card B, one student made the connection between the sponge 'filling up' and the ocean only able to hold so much CO<sub>2</sub>. Some students had trouble identifying how the information in the cards related to them. When further probed, a student answered that CO<sub>2</sub> is produced when you exhale while another commented on how they 'eat ice.' Both groups agreed that having the cards available in Spanish would allow them to share the information with their families.

Due to my lack of experience as a focus group facilitator, the questions I asked to FG1 were less structured and focused than FG2. In both cases, however, the interview time of ten minutes was limiting and for any future focus groups I would suggest a minimum of twenty minutes.

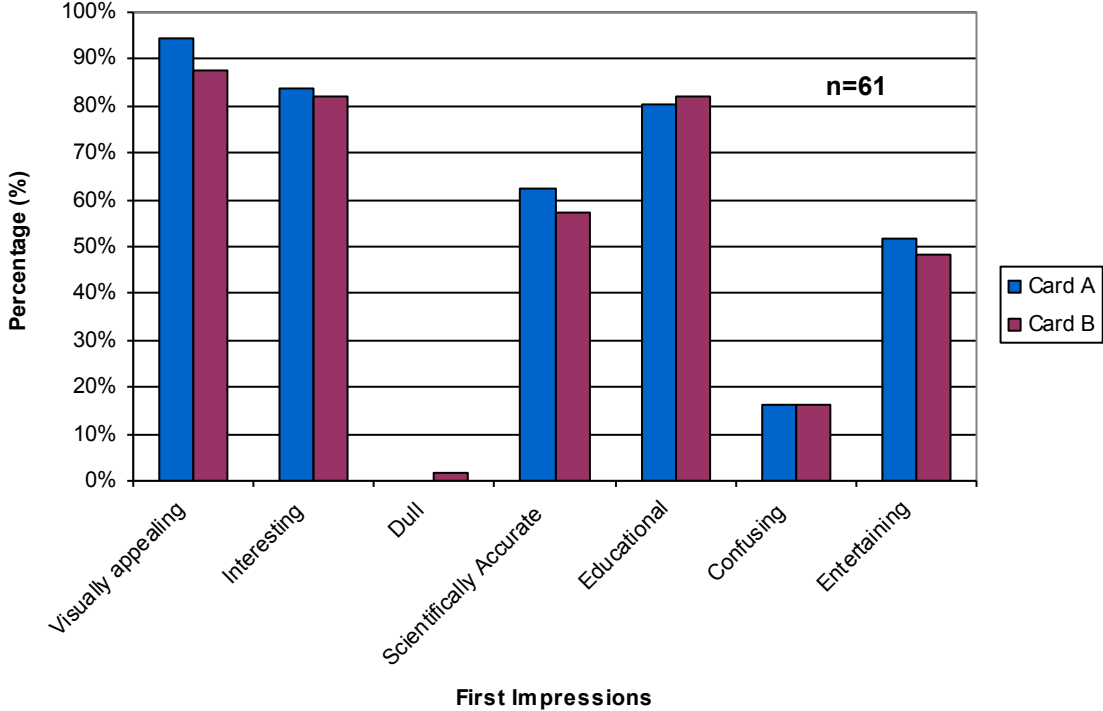
#### *E-mail Group*

A 68% return rate was achieved for the e-mail group (n=61). Over 85% agreed Cards A and B to be visually appealing (Figure 1). Over 80% found both cards interesting and educational.

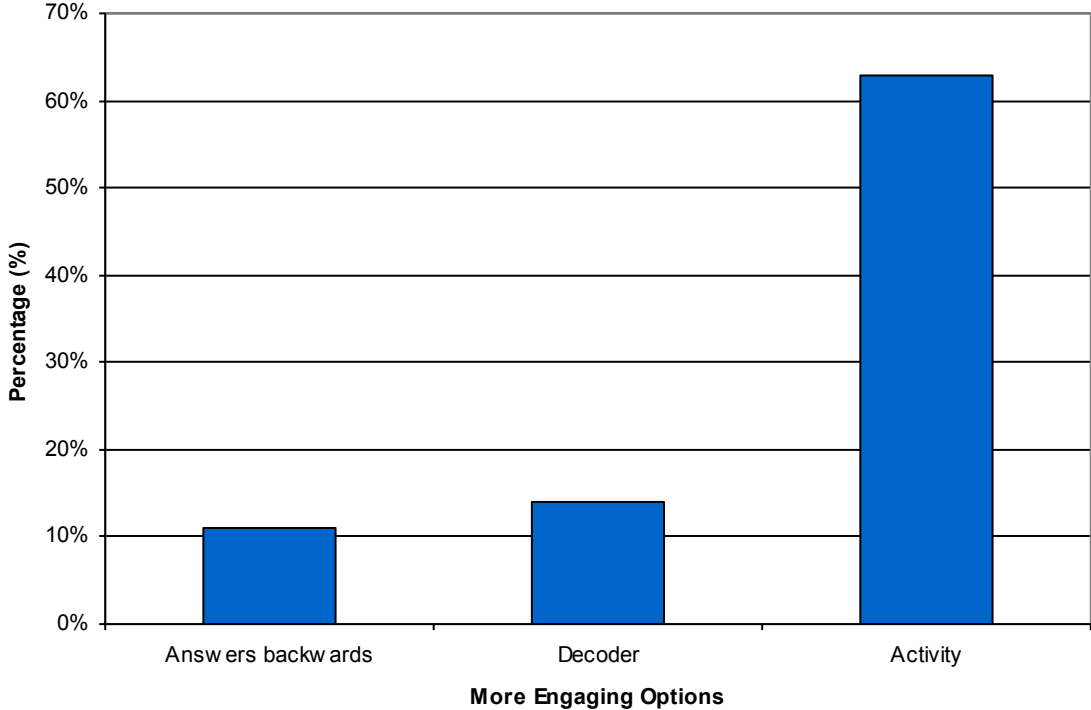
When asked about primary messages of both cards, 88% stated 'I can make lifestyle changes to reduce how much my own activities contribute to climate change' and 84% stated 'Human activities are driving some changes to Earth's climate.'

Sixty eight percent took between 1-3 minutes to review the cards and 61% stated the cards were very clear. Sixty three percent stated that more activities would help make the cards more engaging while less than 15% agreed that a decoder (such as 3-D glasses) or answers written backwards would make the cards more engaging (Figure 2). Other suggestions included jokes and having an activity that could take place while waiting.

**Figure 1. E-mail group first impressions of Cards A and B.**

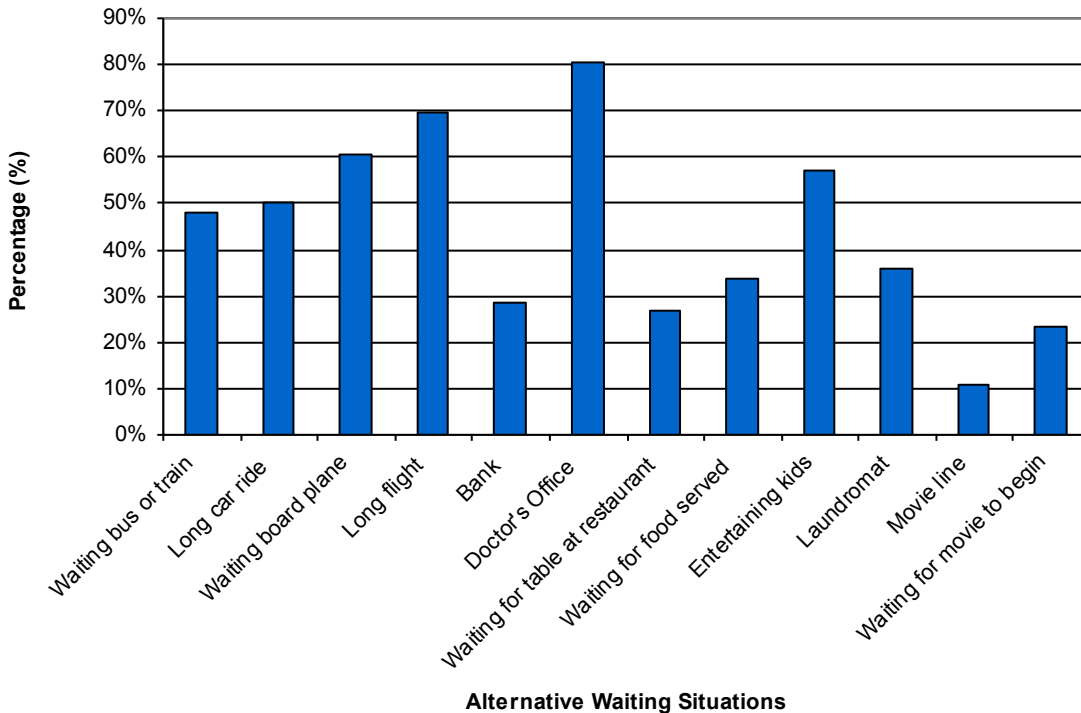


**Figure 2. Distribution of items that would make the cards more engaging.**



When asked what other waiting situations *TimeWhys* might be read, handled, or studied, 80% said a doctor’s office while only 11% agreed waiting in line for a movie would be a suitable waiting situation (Figure 3).

**Figure 3. Distribution of alternative waiting situations where *TimeWhys* might be read, handled, or studied.**



The e-mailed survey also included open-ended questions. Feedback on the card’s design and content elements was similar to the student groups, including confusion surrounding the use of ‘Q’ and ‘A.’ There were mixed opinions regarding the use of the elephant image. Some liked the connection between the marine and terrestrial environments and others thought an ocean animal would help to make a stronger connection between the image and the content.

There were also noticeable differences between the focus and e-mail groups. While the sixth graders became engaged when they read about fish farting, some participants of the e-mail group found the information to be distracting or inappropriate. Also, much of the e-mail group’s criticism (especially from the educators) focused on the weak connections between the card’s overall messaging. Many felt our attempt to contain a variety of elements in each card – facts, humor, a time element, imagery, conservation tips – diluted our unifying

theme. Questions were also raised as to whether or not the content provided was beyond our targeted sixth-grade comprehension level.

## **Phase Two**

### **Summative Evaluation**

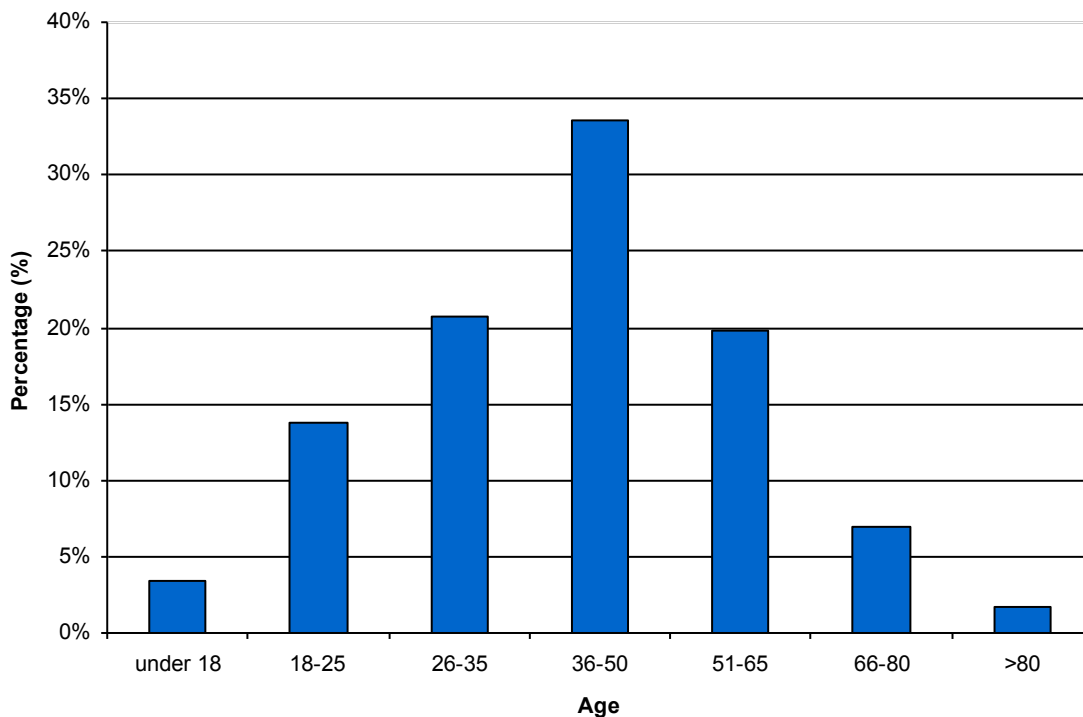


Image 4. Waiters conducting survey at Mission Valley venue.

A total of 129 people – 54% male and 46% female – participated in the field survey. Eighty-three percent of the people we approached agreed to review the cards and take the survey. Forty-nine surveys were completed at the car wash with oil change service, six were completed at the movie theater, and seventy-four were completed at the car wash without oil change service. Eleven surveys were handed in as incomplete.

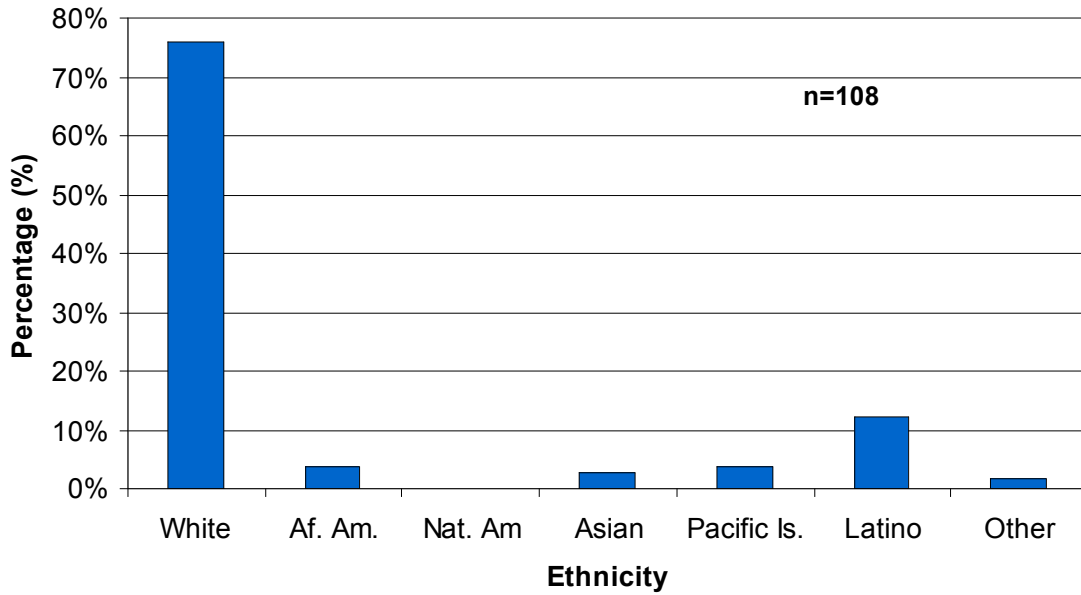
Three-quarters of the respondents were between 26 and 65 years of age (Figure 4).

**Figure 4. Age distribution of survey participants.**



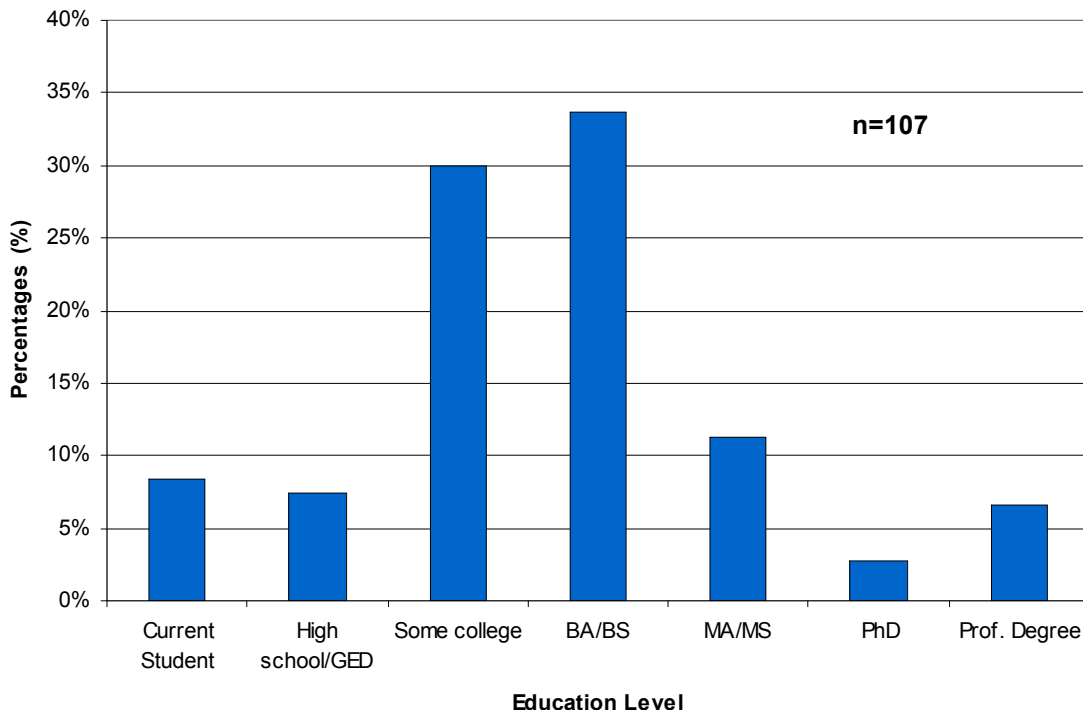
Three-quarters identified themselves as white, 12% as Latino (Figure 5). Five percent indicated they would prefer the cards in Spanish. We regard this as a highly conservative estimate of the preference for Spanish. In at least two cases potential participants we approached declined to participate indicating a discomfort with English.

**Figure 5. Ethnicity distribution of survey participants.**



The majority of participants had received some college education, thirty-one percent indicating their highest degree earned was a bachelor's degree (Figure 6).

**Figure 6. Distribution of highest degree earned by survey participants.**



When asked about their interest in the ocean, 96% (n=112) agreed or strongly agreed that they were interested in the ocean. Eight-four percent (n=112) indicated they had learned about the ocean in school, and 87% (n=111) reported they had learned about the ocean while visiting an aquarium. Eighty-one percent (n=111) indicated they were interested in learning how they impact the ocean.

**First Impressions**

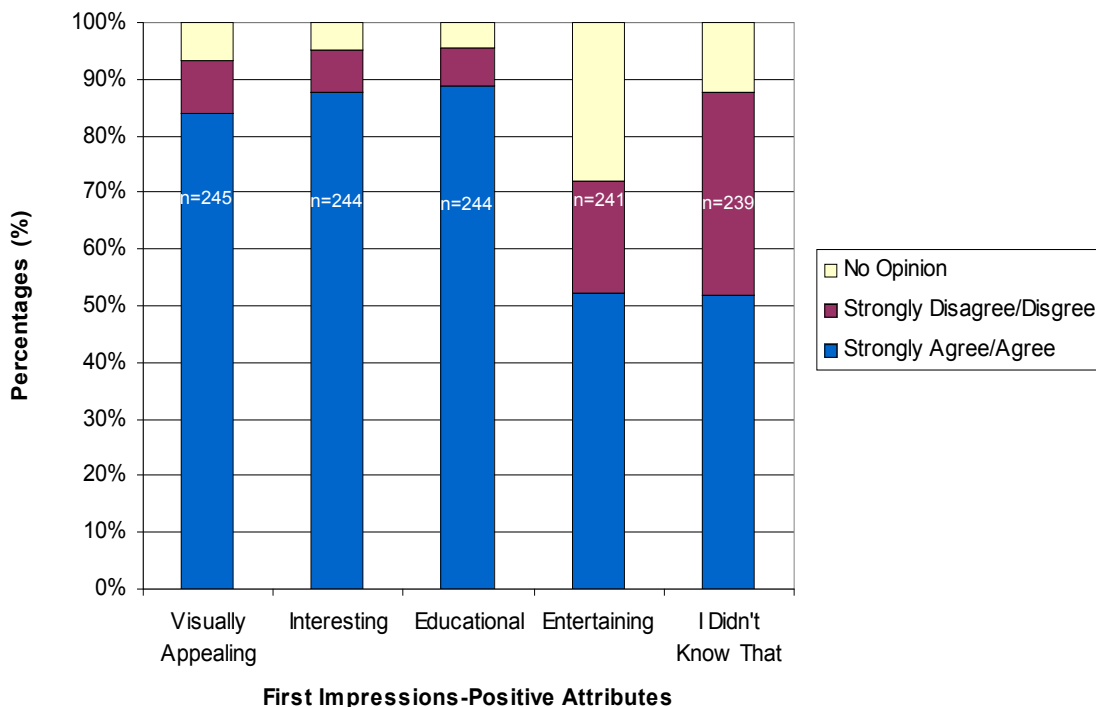
When asked about their first impressions, over 84% deemed the cards to be visually appealing, interesting, and educational (Figure 7). Half found them entertaining.

Of the cards tested, Card 4 (ocean-as-carbon-sink) received the highest marks for being educational and entertaining. Cumulatively, a little over half of the respondents indicated there was something on the cards that wasn't previously known to them (Figure 7).



Image 5. Father and daughter conducting survey at Mission Valley venue.

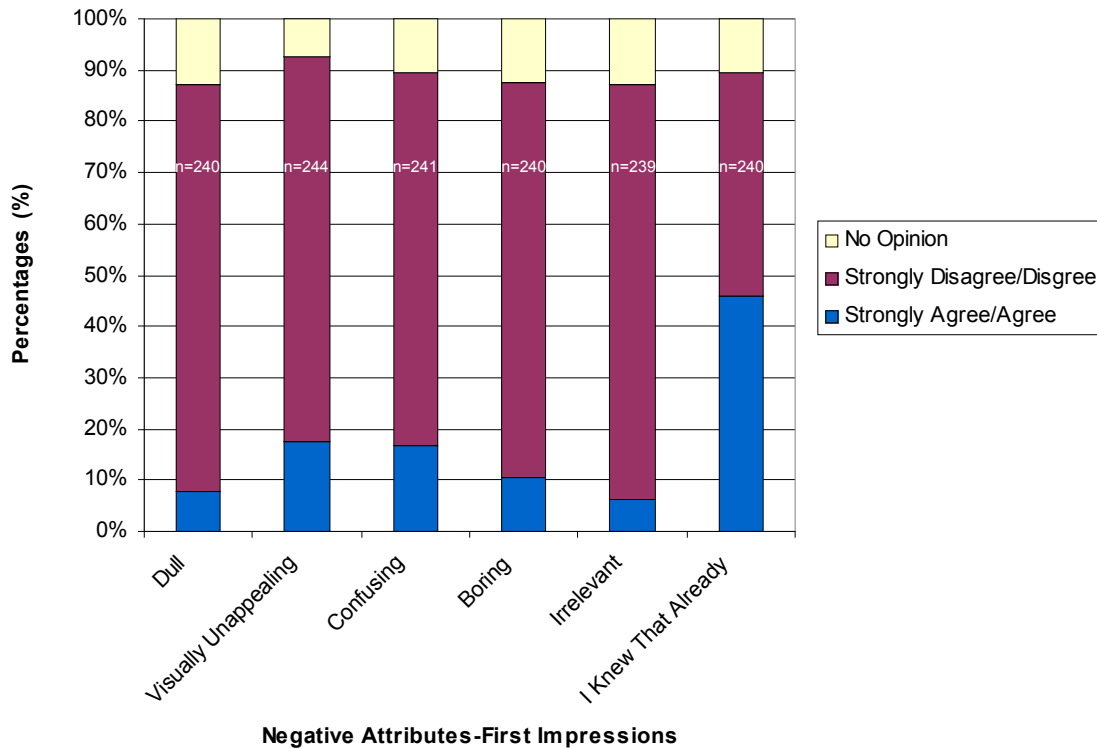
**Figure 7. Distribution of positive attributes for first impressions of all cards.**





Additional evidence supporting the reported favorable impressions is found in respondents' disagreement when asked if the cards were irrelevant, dull, visually unappealing, or boring (Figure 8).

**Figure 8. Distribution of negative attributes for first impressions of all cards.**



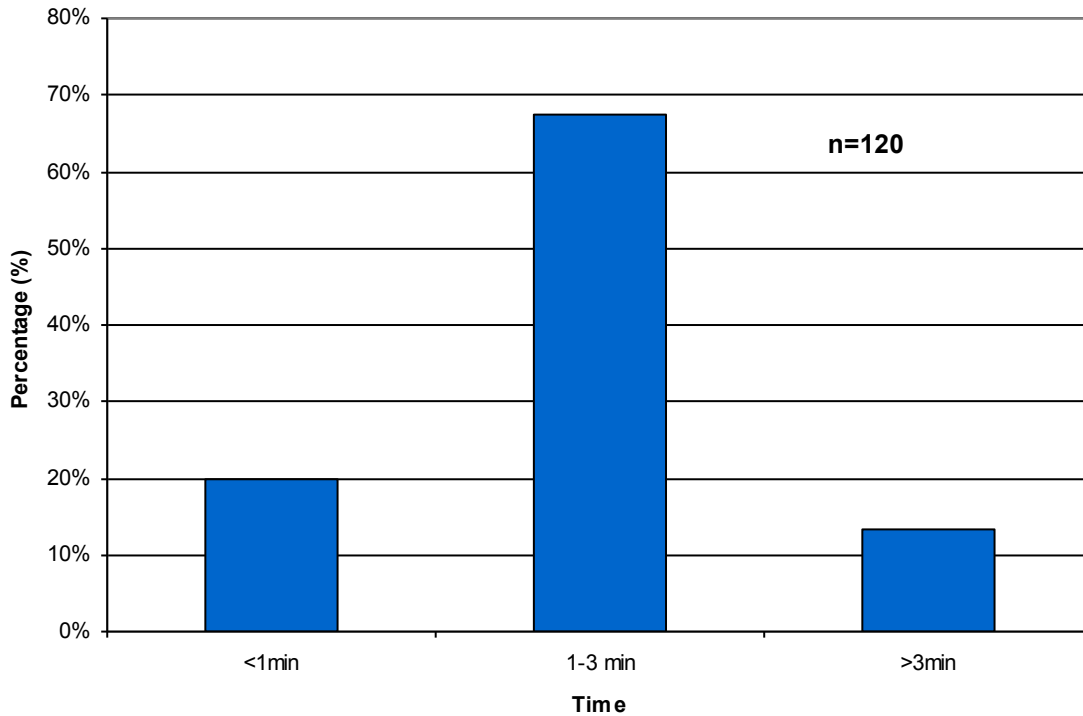
Those who reviewed Card 5 (sea-level rise) indicated agreement with the statement “I already knew that.” While this might suggest that the information on the card wasn’t new, hence potentially less interesting, we are unable to draw a meaningful conclusion because we cannot identify the specific content that was known by respondents.

Finally, in each Package, the card that included an activity was not deemed to be more entertaining than the card that did not include an activity. This surprised us because over 60% of respondents to our Phase One e-mail survey felt including an activity would make the cards more engaging. Our interpretation is that: a) those e-mailed may not have been representative of those surveyed in-person (our target audience); b) the types of activities we included on the cards were different than those the e-mail respondents had in mind; and/or c) engaging is not synonymous with entertaining in respondents' views.

### *Time to review cards*

Most people reported that they took 1-3 minutes to review the cards before the completing the survey (Figure 9). While this may be an ambiguous determination of time, as stopwatches were not provided to participants, we believe this to be an indication o short time it takes for the transfer of information, suggesting that every minute counts.

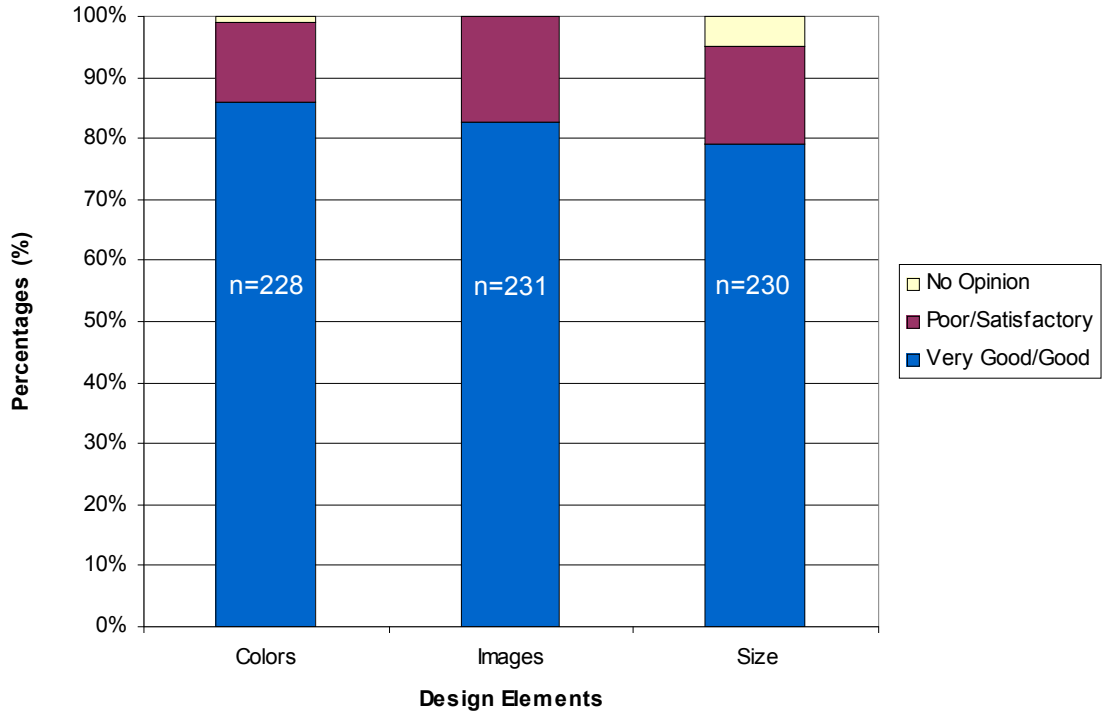
**Figure 9. Time taken to review cards.**



### *Design Elements (color, images, layout, size)*

Figure 10 shows respondents assessment of the cards' design elements. About 80% reported the cards' colors, images, and size to be good or very good. Seeing that the general design and layout of the four cards was similar, it is not surprising all four cards had similar responses to these design elements.

**Figure 10. Assessment of color, image, and size of all four cards.**



*Card Content (uniqueness, understandability, clarity)*

More than 80% indicated the cards were clear and understandable and seventy percent reported the cards were unique. While all three of these indicators contain varying degrees of ambiguity, we believe these positive reactions to the cards suggest the content was within the intellectual grasp of those who participated in the survey.



Image 6. Waiters conducting survey at Point Loma venue.

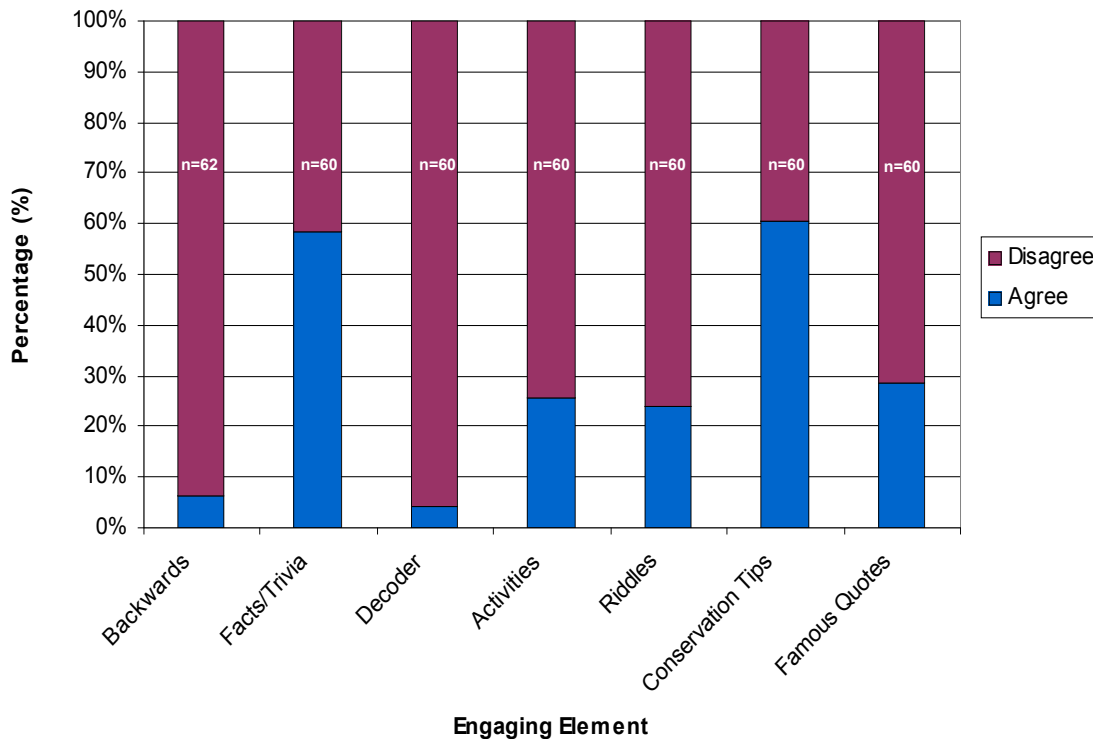
*More Engaging Elements*

Over 50% of respondents indicated that conservation tips and facts and trivia would make the cards more engaging (Figure 11). While not included in the field testing, a conservation tip card was designed and is included in the complete pack of eight cards.

Interestingly, 72% of those who reviewed Package B (Cards 3&4) agreed that facts and trivia would make the card more engaging, while only 38% of those who reviewed Package A (Cards 5&6) stated this to be true. Upon further review of the two packages,

Package B cards contained more fact-based content than Package A, thus potentially providing readers with a positive example of how facts and trivia could make the cards more engaging. Also, the few facts that were provided in Package A might have contained information identified as content previously known by the reader, such as facts about sea-level rise.

**Figure 11. Elements that might make cards more engaging.**



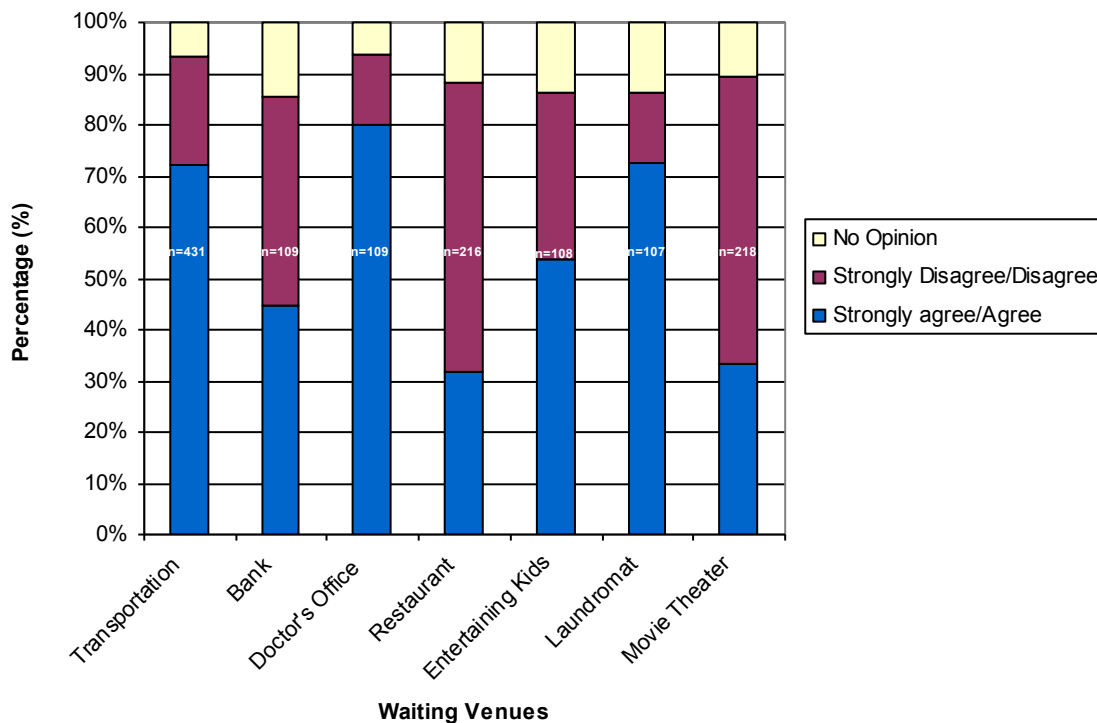
Only 4% agreed that content written backwards or the use of a decoder to reveal a card's answer would make the cards more engaging. It is important to note that those surveyed were primarily adults and perhaps the response of a child would have been quite different. This speculation is supported by the information gathered during the student focus groups that indicated that content written in 'spirals' and 'upside-down' would make the cards more interesting.

Not included among the options for features that might make the cards 'more engaging' were elements like additional images, diagrams, puzzles, cartoons, pop-ups, etc. Card 4, which contains an image of an ocra whale, received highest marks for design elements and positive content attributes. When I asked the focus group what would make the cards more engaging both groups suggest more photographs. This may support the idea that certain features not listed in the survey influence the reader's level of engagement.

### Additional Waiting Venues

We wanted to know in what types of waiting situations people might be receptive to *TimeWhys*. Of the venue options offered, respondents told us they would be most likely to use *TimeWhys* in doctors' offices, a Laundromat, or during public transportation-related waits (Figure 12). This was consistent with views expressed by those e-mailed. Interestingly, more than half of the respondents said they would not use *TimeWhys* in a restaurant or at a movie theater. We believe this difference in suitable venues is determined by the nature of the waiting environment. If you are waiting with a group of people or are in a social setting while waiting, such as at a restaurant, you are less likely to engage in an activity like *TimeWhys* rather than if you were waiting alone or somewhere you'd rather not be waiting, like in an airport.

**Figure 12. Waiting situations where subjects would read, study, or handle cards like *TimeWhys*.**

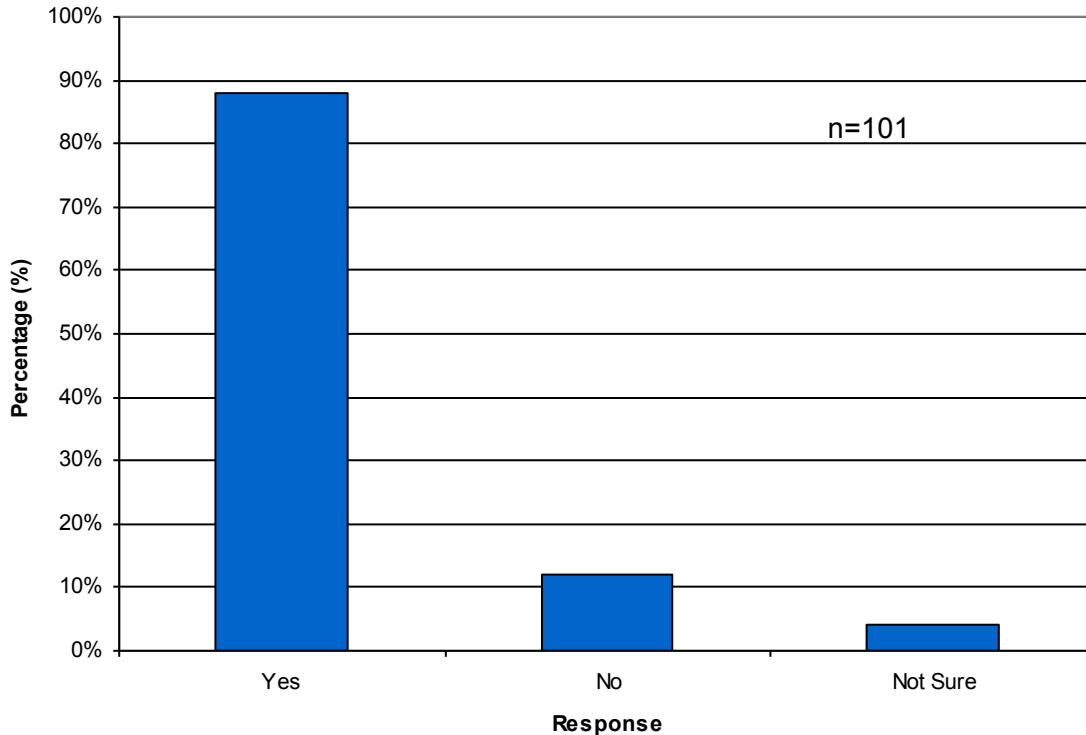


Because we did not distinguish among different types of restaurant, (e.g. family-friendly, fine dining, etc) we haven't yet learned if there might be a 'market' for *TimeWhys* content to be incorporated in dining-associated objects such as paper placemats, paper cups, or in the packaging of a fast food kids' meals. Along these lines, it's possible that a movie theater may be an appropriate venue if *TimeWhys* content was projected on a movie screen rather than made available in card format.

### Waiting Time

Eighty-eight percent of respondents reported that *TimeWhys* helped pass time while waiting (Figure 13). This is consistent with 90% of respondents' agreement that they like to have something to do while waiting. 79% (n=112) reported that *TimeWhys* was a fun way to pass waiting time.

**Figure 13. Distribution for Question 8: Did *TimeWhys* help pass waiting time?**



### Ambiguous Results

In an effort to determine what messages people would take away from the cards, we presented a list of options and asked subjects for the primary message(s) of the cards (Appendix 14, Question 2). Although the instructions asked respondents to limit their focus to the cards, we believe that the responses reflect preexisting knowledge and beliefs as well. As a result of this unclear information, data collected for Question 2 were not used as part of the analysis. This issue was not believed to have occurred when the same question was asked verbally to the focus groups. Students provided responses such as 'I produce carbon dioxide' and other statements that related directly the content provided in the cards.

## DISCUSSION

The goal of the *TimeWhys* pilot was to answer three main questions: 1) Is *TimeWhys* an appealing way for people to spend waiting time?; 2) How does content and design influence level of engagement?; and 3) Do the results of the pilot study inform further development of the *TimeWhys* approach? The results of this study strongly support *TimeWhys* as an appealing way for people to spend waiting time. We are further encouraged to discover the waiting public prefers to be engaged in an activity to help pass waiting time. These compelling results indicate the *TimeWhys* approach can be an effective public education strategy.

While it is a tremendous achievement to successfully answer the pilot's primary question, significant limitations were realized when attempting to interpret much of the collected data. Weak survey design (due to my inexperience in survey development) coupled with limited input from the two evaluation experts through all phases of the pilot left us with many more questions than answers.

### *Ambiguous Questions*

Attributes used as card descriptors proved to be ambiguous, subjective, and incredibly difficult to interpret. This proved to be the case for both positive (ie. interesting, educational, entertaining) and negative (ie. irrelevant, boring, confusing) attributes.

While the majority of people agreed the cards were 'unique,' it is unlikely everyone surveyed had the same understanding of what determines something to be unique. Without having providing a clear definition (ie. one of a kind), this term was left up to the interpretation of the reader. We ran into a similar problem when asking if content was 'irrelevant.' The use of such ambiguous terms limited our ability to truly understand people's perceptions of the content.

In my attempt to learn what *TimeWhys* content was previously known by the reader, I failed to limit the question by identifying specific element(s) of the card, leaving me unable to ascertain if they knew all or just some of the content beforehand. Readers deemed Card 5 (sea-level rise) as having the highest amount of previously known information. While it may seem logical that the card contained content the general public would recognize (such as the relationship between sea-level rise and the melting of land-based ice), it is surprising to us that readers were familiar with the concept of thermal expansion. Unfortunately, because of the way the question was worded, I cannot determine if the information provided about thermal expansion was new to the reader.

While over 80% of readers reported that the cards were understandable and clear, this does not mean the reader correctly interpreted the intended message. Without testing a subject's understanding of a concept before and after using *TimeWhys*, it remains unclear what elements of the cards were understood. The same argument can be made regarding clarity as it is unknown what particular content was clear and how 'clear' was defined by each reader.

It surprised us that cards containing activities (Cards 4&6) did not evoke a more positive response than those without interactive components. Studies evaluating museum exhibits have shown interactive displays hold the public's attention up to three times longer than noninteractive dioramas (Sandifer 2003). I am led to believe that because both experiments (saturating a sponge with water and dissolving chalk in lemon juice) were activities best conducted away from the waiting environment, they did not elicit a great deal of interest from the reader. Future versions of *TimeWhys* might focus on developing a series of activities designed specifically for *while* people are waiting. Also, better indicators of what 'engaging,' and 'interesting' mean to the general public are needed to ensure the activities fit within this definition.

Another surprising result was only half surveyed reported the cards as 'entertaining.' While I may believe educational or interesting are synonymous with entertaining, it appears the waiting public may not agree. We are interested in learning more about how the waiting public defines entertaining - perhaps it includes elements that evoke an emotion, like humor, or elicit a 'wow' response. Though it may not be possible to have each card contain an 'entertaining' element, it is our goal to construct a complete pack that shocks, mystifies, *and* tickles the funny bone.

#### *Historical Bias*

There is a growing level of awareness about climate change amongst the general public and it is more likely that people have been introduced to certain climate change concepts (such as Al Gore's documentary, *An Inconvenient Truth*). This may have led to a higher level of understanding of the content provided in the study. We believe this was the case for Question 2, which asked readers to identify the primary message(s) of the cards. While the question was phrased in an effort to avoid this problem – *Thinking about what you just read on the cards, circle the most appropriate response for each statement below* – we believe many of the answers contained opinions held previously to using *TimeWhys* rather than from information gathered from the card's content. A pre-posttest would help alleviate



this by ascertaining what information about climate change was known before the study and what new information was acquired after using *TimeWhys*.

### *Testing Two Packages*

Due to time restrictions, participants were only given two of the four cards to review. Because of this, however, we could not compare across packages or all four cards, as it was unclear if the differences expressed were in the viewpoints of the individuals or in the cards themselves. Also, we could not determine which of the four cards ranked 'highest' or 'lowest' because participants did not review all four cards to make such an assertion.

One element that was the same across all four cards was the design layout (3-panel on front, one-panel on back), however, when asked to rank the card's layout, participants could only comment on one design as they no comparable options. In future surveys, we plan to develop and compare fundamentally different card designs (e.g. one-panel vs. 3-panel per side, fluorescent or trendy colors vs. muted, 'conventional' colors, photographic vs. schematic images, etc.).

### *Language Barriers*

While it was not within the scope of the pilot study to create a bilingual or Spanish-only set of cards, if Spanish text is used, differences in Spanish dialects should be taken into consideration when developing card content and surveys. In addition to correct use of language, certain evaluation methods may prove more successful than others when surveying non-native English speakers, as studies have shown challenges in using Likert-type scales with low-literate ethnic populations (Bernal et al. 1997).

### *Waiting Environments*

Variations in waiting environments (noise, activity level, number of people) can potentially influence a person's receptivity to an activity or exercise. Differences between the three venues used for field-testing were observed. Rough observations of waiting time showed differences between the car wash with oil change service (up to 30 minutes) and the other two venues (10 minutes).

Waiting environments also differed between venues. The car wash with oil change service had an indoor waiting area, equipped with chairs, reading materials, and a television. This venue also had an outdoor waiting area which was relatively noise-free, as the car wash was located to the back of the building. The second car wash location, however, only had outdoor seating that was located in close proximity to the car wash,

which created a noisy and unpleasant waiting environment. The movie theater had low lighting and was very quiet.

While analysis was not conducted across waiting venues, a higher number of incomplete surveys were returned at the noisier car wash. This could have been influenced by the subject's ability to concentrate, however this is purely speculation. I did observe that the noisier car wash felt like people were in a rush to leave, as opposed to the car wash with the indoor lounge, but again, these are general observations that were not quantified. It would be interesting to test in venues with varying levels of disturbance and compare people's receptivity to the *TimeWhys* approach.

#### *Subject Characteristics (Selection Bias/Differential Selection)*

The target population of this study was people, and especially families, who were waiting. Since the study was conducted at two car washes and an independently owned movie theater, the field-testing included very few families. By including more families as subjects, we could have determined if differences observed between the student focus group and the e-mail group on aspects like language (fish farting) and design (text in a spiral) would also be prominent within the waiting public. To fully understand if *TimeWhys* is an appealing way for families to spend waiting time, we must conduct testing at venues where families are present.

#### *Data Collection Bias*

For this pilot project, I acted as both the developer and evaluator of *TimeWhys*, therefore potentially introducing bias to the collection, analysis, and interpretation of the data. To help reduce this threat, I enlisted the help of outside visual observers were included in Phase One of the study but absent during Phase Two. As resources permit, an independent, external evaluator should be engaged in all aspects of any future development and assessment of *TimeWhys*.

#### *Randomization*

Due to budget and time constraints, during the field-testing we did not ensure random selection of participants, such as selecting every nth person or drawing out of a hat. It is my recommendation that for future field studies a random sample is collected to remove any bias (such as not approaching someone with small children) that may occur from a non-random sample.

## *Time*

Waiters reported taking one to three minutes to review the *TimeWhys* cards (an estimated determination on behalf of the subject), suggesting that people can gather information in a relatively short timeframe. I believe this is an indication of how the *TimeWhys* approach can effectively relay science-based content even if for just a few minutes.

Sandifer (2003) reports that the average museum visitor spends 30 seconds per exhibit. It is important, then, for content to be constructed so it is suitable for brief 'glances.' One of the most time-consuming components in developing *TimeWhys* was producing scientifically accurate content that was easily digestible *and* succinct. Both Sharon and I grossly underestimated this process, with each card requiring about 48 hours of revisions and word-smithing. I do, however, believe this was time well spent. Further study is required to determine how the amount of time spent reviewing *TimeWhys* influences a waiter's level of comprehension.

The survey design used in Phase Two was wrought with ambiguity, making the interpretation of data extremely difficult. A set of clearly defined success indicators are needed so to limit the reader from attaching his or her values on the answers provided. Future evaluations of *TimeWhys* should ensure the development of a strong survey instrument so the evaluation can provide more answers than questions. That being said, the study clearly indicates that the *TimeWhys* approach is warranted of further development and expansion.

## **NEXT STEPS**

The following next steps are designed to support the advancement of the *TimeWhys* approach.

### **1. Test complete set of cards**

While only four cards were tested during Phase Two, a complete deck of eight cards was developed. The cards were designed to build on the reader's gained knowledge as they move from one card to another. We plan to evaluate the waiting public's response to the full deck and, more specifically, assess if utilizing

the cards in a 'connect-the-climate-change-dots' approach is effective. The evaluation will also include a set of Spanish-language cards.

## **2. Additional test venues**

The Capstone Panel suggested the development of *TimeWhys* should focus on venues where people would rather not be waiting (an airport), as opposed to locations where social interactions take place (a restaurant). We will begin testing *TimeWhys* in locations identified as most suitable by survey respondents: medical facilities, commercial airplanes and airports, buses and bus depots, trains and train stations.

## **3. Alternative *TimeWhys* formats**

We plan to develop additional non-card formats containing *TimeWhys* content. Cell phones, personal video game players, movie screens, and televisions located at grocery store checkout lines are some of the various places *TimeWhys* content can be communicated to a technically advanced society.

## **4. Measure Learning Outcomes**

Our plans also include measuring learning as an outcome of using *TimeWhys*. Measuring knowledge prior to intervention, during contact, or subsequent to the completion of a project can prove difficult (Gall et al. 1996), and experiment-based designs, such as pretest-posttest, can be restrictive (Rennie 2003). We will use evaluation methods to include a combination of multivariate statistics, naturalistic approaches to data collection and analysis, and innovative approaches to analyzing data (Ash 2003; Falk et al. 1998) to ensure the best possible measures are used when evaluating *TimeWhys* as a teaching tool.

## **5. Test alternate passive and active distribution methods**

We plan to evaluate how certain venues may favor specific distribution strategies. While active distribution may be appropriate for certain venues (eg. boarding an airplane or train), passive distribution may be more suitable in other waiting situations (eg. medical facilities, immigration offices). This evaluation would also include testing various *TimeWhys* displays including kiosks, posters, and display racks. Evaluations will be conducted without incentives to determine if and how self-motivated waiters will use *TimeWhys* cards when no incentives are offered.

## **6. Website Development**

*TimeWhys.com* is the product's companion website, and will be developed to provide additional information about *TimeWhys* topics. Our plans for the website include posting downloadable cards, supporting materials that elaborate on card content, and links to additional resources, including materials highlighting current research.

## **7. Corporate Partnerships**

*TimeWhys* holds great promise regarding corporate sponsorship and we plan to approach businesses that may be interested in collaborating in educational endeavors. The focus and content of *TimeWhys* can be readily adapted to mesh with the interests and missions of private and public organizations. Hospital emergency rooms might want content to focus on the connection between a healthy Earth and a healthy body, including food safety issues, effects of climate change on food production, and how our bodies use food energy.

## **CONCLUSIONS**

In 2003, the Pew Oceans Commission called for “a new era of ocean literacy that links people to the marine environment,” stressing the “need to provide the public with understandable information about the structure and functioning of coastal and marine ecosystems, how ecosystems affect daily lives, and how we affect ecosystems” (Pew Oceans Commission 2003). Fostering deeper connections between people and the ocean is a challenge that cannot be addressed solely by the formal education sector. Such a mandate requires a multi-faceted approach to building awareness and knowledge of issues pertaining to ocean science amongst the general public and across the socioeconomic spectrum.

The waiting public represents an untapped market that holds tremendous potential for the infusion of knowledge. *TimeWhys* is an innovative educational approach that can provide basic knowledge about ocean sciences to this diverse subset of the general population. *TimeWhys* sidesteps traditional access barriers to acquiring science knowledge, providing quality science-based learning to people of all walks of life.

The primary purpose of TimeWhys is not to provide in-depth scientific content, but rather offer information that intrigues, encourages, and inspires. Our goal is to strategically present free-choice learning in a way that engages the waiting public on a variety of learning levels – by sparking interests, generating discussions, and facilitating further investigation of a TimeWhys topic. By presenting TimeWhys as a ‘life’ experience, we create a environment which has the potential to transform attitudes, behaviors, and perceptions.

As complex environmental issues become increasingly pressing, there is a growing need to shift the public’s understanding of their connection with the natural environment. The TimeWhys approach is an example of how science information can partner with the joy of discovery and the wonder of exploration to provide attractive learning opportunities to all people, regardless of gender, age, education level, or ethnicity.

...to infuse education with the joy of discovery and  
an awareness of its connection to exploration.

(National Science Foundation 1998)

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2006/7 MAS Students

Russ Chapman

Jane Weinzierl

Kristin Evans

Michelle Hofmann

Louis Rea

Paul Dayton

Dan Cayan

Nancy Knowlton

Enric Sala

Grant Deane

Richard Norris

Cindy Clark, SIO Communications Office

Elementary Institute of Science

Aquatic Adventures

"Z" @ Genie Car Wash

Yogi @ Body Beautiful

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email group, and field surveys!

## REFERENCES

Anderson, D., Lucas, K.B., Ginns, I.S. and L.D. Dierking. 2000. Development of knowledge about electricity and magnetism during a visit to a science museum and related post-visit. *Science Education*, **84**(5): 658-679

Ash, D. 2003. Dialogic inquiry in life science conversations of family groups in a museum. *Journal of Research in Science Teaching*, **40**(2): 138-162

Charles E. Basch, C.E. 1987. Education focus group interview: an underutilized research technique for improving theory and practice in health. *Health Education and Behavior*, **14**: 411-448

Bernal, H., Wooley, S. and J.J. Schensul. 1997. The Challenge of Using Likert-Type Scales With Low-Literate Ethnic Populations. *Nursing Research*, **46**(3):179-181

Bloom, B.S., Hastings, J.T., Madaus, G.F., and E.W. Eisner. 1972. Handbook on Formative and Summative Evaluation of Student Learning. *Studies in Art Education*, **14**(1): 68-72.

Chapman Walsh, D., Rudd, R.E., Moeykens, B.A., and T.W. Moloney. 1993. Social Marketing for Public Health. *Health Affairs* **12**(2): 104-119

Chambers, F. 1994. Removing confusion about formative and summative evaluation: Purpose versus time. *Evaluation and Program Planning* **17**(1): 9-12

Costanzo, M., Archer, D., Aronson, E. and T. Pettigrew. 1986. Energy conservation behavior: The difficult path from information to action. *American Psychologist*, **41**: 521-528.

Dierking, L.D. and J.H. Falk. 2003. Optimizing out-of-school time: The role of free-choice learning. *New Directions for Youth Development*. 97: 75-88

Dori, Y.J. and R.T. Tal. 2000. Formal and informal collaborative projects: Engaging in industry with environmental awareness. *Science Education* **84**(1): 95-113

Evans, K. and M. Hofmann. January 2006. Personal communication.

Falk, J.H. 2005. Free-choice environmental learning: framing the discussion. *Environmental Education Research*, **11**(3): 265 - 280

Falk, J. H. 2002. The contribution of free-choice learning to public understanding of science. *Interciencia*, **27**:2

Falk, J.H., and L.D. Dierking. 2000. Learning from museums : visitor experiences and the making of meaning. Walnut Creek, CA : AltaMira Press. 272 pp.

Falk, J., Moussouri, T., and D. Coulson. 1998. The effect of visitors' agendas on museum learning. *Curator*, **41**: 107-120

Flay, B.R. 1987. Evaluation of the development, dissemination and effectiveness of mass media health programming. *Health Education Research* **2**(2): 123-129



- Fuchs, L.S. and D. Fuchs. 1993. Formative evaluation of academic progress: how much growth can we expect? *School Psychology Review*, **22**(1): 1-30
- Gall, M. D., Borg, W. R., & Gall, J. P. (1996). *Educational research: An introduction*. White Plains, NY: Longman.
- Gilligan, M.R. 2006. Ocean Science Policy, Education, and the Future of the Workforce in the U.S.: A Few Notions. *Ocean Science Meeting AGU*, **87**(36)
- Greene, J. C., Caracelli, V. J., and Graham, W. F. 1989. Toward a conceptual framework for mixed-method evaluation designs. *Educational Evaluation and Policy Analysis* **11**: 255–274.
- Jones, L. 1997. Opening Doors with Informal Science: Exposure and Access for Our Underserved Students. *Science Education* **81**(6): 663-677
- Korpan, C.A., Bisanz, G.L., Boehme, C., Lynch, M.A. 1997. What did you learn outside of school today? Using structured interviews to document home and community activities related to science and technology. *Science Education* **81**: 651-662.
- La Belle, T.J. 1982. Formal, nonformal and informal education: A holistic perspective on lifelong learning. *International Review of Education/Internationale Zeitschrift für Erziehungswissenschaft/Revue internationale l'éducation*. **28**(2): 159-175
- Lee, O., Fradd, S. H., & Sutman, F. X. 1995. Science knowledge and cognitive strategy use among culturally and linguistically diverse students. *Journal of Research in Science Teaching*, **32**(8): 797–816.
- National Science Board. 1998. *Science and engineering indicators: 1998*. Government Printing Office. Washington, DC. <http://www.nsf.gov/statistics/seind98/>
- National Science Foundation. 1998. A Report on the Evaluation of the National Science Foundation's Informal Science Education Program. <http://www.nsf.gov/pubs/1998/nsf9865/nsf9865.htm>
- McKenzie-Mohr, D. and W. A. Smith. 1999. *Fostering sustainable behavior : an introduction to community-based social marketing*. Gabriola Island, BC: New Society Publishers. 160 pp.
- Maister, D.H. 1984. *The psychology of waiting lines*. Boston, Mass., Harvard Business School. <http://www.virtualhold.net/PR/PsychologyofWaitingLines751.pdf>
- Nichols, D., Smolensky, E., and T. N. Tideman. 1971. Discrimination by Waiting Time in Merit Goods. *The American Economic Review*, **61**(3): 312-323
- Northwest Region Educational Laboratory. <http://www.nwrel.org/evaluation/summative.shtml>.
- Pew Oceans Commission. 2003. *America's living oceans: charting a course for sea change. A report to the nation*. Arlington, VA. 144 pp.

Rennie, L.J., Feher, E., Dierking, L.D., and J.H. Falk. 2003. Toward an Agenda for Advancing Research on Science Learning in Out-of-School Settings. *Journal Of Research In Science Teaching*, **40**(2): 112–120

Sandifer, C. 2003. Technological Novelty and Open-Endedness: Two Characteristics of Interactive Exhibits That Contribute to the Holding of Visitor Attention in a Science Museum. *Journal Of Research In Science Teaching*, **40**(2): 121–137

Sanders, J.R. and D.J. Cunningham. 1973. A Structure for Formative Evaluation in Product Development. *Review of Educational Research*, **43**(2): 217-236

Scheirer, M. A. 1994. Designing and using process evaluation. In J. S. Wholey, H. Hatry and K. Newcomer (Eds.), *Handbook of Practical Program Evaluation* (pp. 40-68). San Francisco : Josey Bass.

Scriven, M. 1991. Prose and Cons about Goal-Free Evaluation. *American Journal of Evaluation*, **12**: 55-62

Social Research Methods. <http://www.socialresearchmethods.net/>

Steel, B.S., Smith, C., Opsommerc, L., Curiela, S., and R. Warner-Steel. 2005. Public ocean literacy in the United States. *Ocean & Coastal Management*, **48**: 97–114

Tichenor PJ, Donohue G, Olien C. Mass media flow and differential growth in knowledge. *Public Opinion Quarterly* 1970;34:159–70.

Yates, S.M. and E. Aronson. 1983. A social psychological perspective on energy conservation in residential buildings. *American Psychologist*, **38**: 435-444

## REFERENCES ~TIMEWHYS CARDS

### Card 2 – What is CO<sub>2</sub> and the greenhouse effect?

Nova: Science in the News. 1997. *Enhanced greenhouse effect – a hot international topic*. <http://www.science.org.au/nova/016/016key.htm>

United States Environmental Protection Agency: Climate Change Kids Site. <http://epa.gov/climatechange/kids/greenhouse.html>

### Card 3 - Ice Core as an indication of Earth's past climate

Alley, R.B. and E.A. Boyle. 2001. The Two-Mile Time Machine: Ice Cores, Abrupt Climate Change, and Our Future. *Limnology and Oceanography*, **46**(6): 1580

Connor, Steve. 2006. *Ice bubbles reveal biggest rise in CO<sub>2</sub> for 800,000 years*. Article in: The Independent, London, 05 September 2006

Ice Core Working Group. 1998. *Ice Core Contributions to Global Change Research: Past Successes and Future Directions*. Prepared for the National Ice Core Laboratory, Science Management Office. 27 pp. <http://www.nicl-smo.sr.unh.edu/icwg/ICWG1998.pdf>

Morrison, Michael. *Ice cores that tell the past*. Prepared for Greenland Ice Project 2. [http://www.gisp2.sr.unh.edu/GISP2/MoreInfo/Ice\\_Cores\\_Past.html](http://www.gisp2.sr.unh.edu/GISP2/MoreInfo/Ice_Cores_Past.html)

### Card 4 – The ocean as a carbon sink

Feely, R.A., Sabine, C.L., and V.J. Fabry. 2005. *Carbon Dioxide and Our Ocean Legacy*. Pew Charitable Trusts. 4 pp.

Orca whale facts. <http://www.acsonline.org/factpack/KillerWhale.htm>

### Card 5 – Sea-level rise

Cayan, D. March 2007. Personal communication.

Evan, R.L. 2004. Rising Sea Levels and Moving Shorelines: New tools and techniques show promise for better predictions and decisions about coastline change. *Oceanus Magazine*, **43**(1): 1-6

Hofmann, M. February 2007. Personal communication.

Talley, L. February 2007. Personal communication.

### Card 6 – Ocean acidification

Feely, R.A., Sabine, C.L., and V.J. Fabry. 2005. *Carbon Dioxide and Our Ocean Legacy*. Pew Charitable Trusts. 4 pp.

Feely, R.A., Sabine, C.L., Lee, K., Berelson, W., Kleypas, J., Fabry, V.J., and F.J. Miller. 2004. Impact of Anthropogenic CO<sub>2</sub> on the CaCO<sub>3</sub> System in the Oceans. *Science*, **305**: 362-366

The Royal Society. 2005. Ocean acidification due to increasing atmospheric carbon dioxide. 68 pp. <http://www.royalsoc.ac.uk/document.asp?id=3249>

### **Card 7 – Human contributions of CO<sub>2</sub>**

Carbon Footprint Calculators:

[http://www.carbonfootprint.com/carbon\\_footprint.html](http://www.carbonfootprint.com/carbon_footprint.html)

[http://www.greenpeace.org/international/campaigns/climate-change/take\\_action/your-energy](http://www.greenpeace.org/international/campaigns/climate-change/take_action/your-energy)

Energy Information Administration. 2005. Greenhouse Gases, Climate Change and Energy. Executive Summary. 14 pp. [http://www.eia.doe.gov/oiaf/1605/ggrpt/pdf/executive\\_summary.pdf](http://www.eia.doe.gov/oiaf/1605/ggrpt/pdf/executive_summary.pdf)

Feely, R.A., Sabine, C.L., Lee, K., Berelson, W., Kleypas, J., Fabry, V.J., and F.J. Miller. 2004. Impact of Anthropogenic CO<sub>2</sub> on the CaCO<sub>3</sub> System in the Oceans. *Science*, **305**: 362-366

### **Card 8 – Conservation Tips**

Environmental Defense Fund. 2002. *20 Simple Steps to Reduce Greenhouse Gas Emissions*.

<http://www.environmentaldefense.org/article.cfm?contentid=1821>

Friends of the Earth. 2005 Breifing: Climate top tips 50 ideas for how to reduce your own greenhouse gas emissions. [http://www.foe.co.uk/resource/briefing\\_notes/50\\_climate\\_top\\_tips.pdf](http://www.foe.co.uk/resource/briefing_notes/50_climate_top_tips.pdf)

Greenpeace. 2007. *How to save the climate*. Adobe pdf. 32 pp.

<http://www.greenpeace.org/international/press/reports/how-to-save-the-climate-pers>

Institute for Lifecycle Environmental Assessment. *Ten big things you can do for the environment*.

<http://www.ilea.org/topten.html>

The City of Toronto. *The 20/20 Planner: A practicle guide to reduce energy use by 20% - at home and on the road*. 32 pp. [http://www.toronto.ca/health/2020/2020\\_residential\\_planner.htm](http://www.toronto.ca/health/2020/2020_residential_planner.htm)

### **All cards**

Bryson, B. 2003. *A Short History of Nearly Everything*. Broadway Books, New York. 566 pp.

Editorial. 2007. *It's inevitable: Climate change requires global, local action*. San Diego Union Tribune. March 11, 2007.

[http://www.signonsandiego.com/uniontrib/20070311/news\\_lz1ed11top.html](http://www.signonsandiego.com/uniontrib/20070311/news_lz1ed11top.html)

Kay, J. 2006. *A warming world: the difference a degree makes. Seashore sea change*. San Franscisco Chronical. January 16, 2006.

<http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2006/01/16/MNG9UGO2DO1.DTL>

Kolbert, E. 2005. Three-part series: *The Climate of Man*. The New Yorker.

Michaels, P.J. 2007. *What's hot, and what's not*. San Diego Union Tribune. March 11, 2007.

[http://www.signonsandiego.com/uniontrib/20070311/news\\_lz1e11michael.html](http://www.signonsandiego.com/uniontrib/20070311/news_lz1e11michael.html)

Morgan, R., Josey, R. and K. Josey. 1997. *In The Next Three Seconds...* Dutton Publishing, London.

Scavia, D., Field, J.C., Boesch, D.F., Buddemeier, R.W., Burkett, V., Cayan, D.R., Fogarty, M., Harwell, M.A., and R.W. Howarth. 2002. Climate Change Impacts on U.S. Coastal and Marine Ecosystems. *Estuaries*, **25**(2): 149–164

The Mad Scientist. *20 Little Known Facts About The Human Body*.  
<http://www.teach-nology.com/worksheets/science/trivia/human/>

The Royal Society. 2005. *A guide to facts and fiction about climate change*.  
<http://www.royalsoc.ac.uk/downloaddoc.asp?id=1630>

Trenberth, K.E. 2007. *On thin ice: It's unequivocal, it's already here*. San Diego Union Tribune. March 11, 2007. [http://www.signonsandiego.com/uniontrib/20070311/news\\_lz1e11trenber.html](http://www.signonsandiego.com/uniontrib/20070311/news_lz1e11trenber.html)

We Are What We Do Ltd. 2006. *Change the world for ten bucks: 50 actions to change the world and make you feel good*. New Society Publishers, Canada.

Weiss, K. 2006. Five-part series: *Altered Oceans*. Los Angeles Times.  
<http://www.latimes.com/news/local/oceans/la-oceans-series,0,7842752.special>

Yarrow, J. 2007. *1001 Ways to Save the Earth*. Chronicle Books, San Francisco. 384 pp.

## **Appendices**

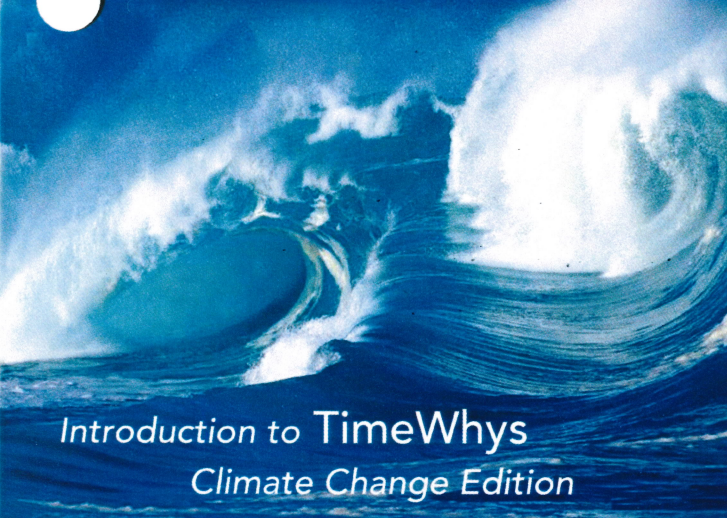
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# Appendix 1

## Card 1 - Introduction to *TimeWhys*

TimeWhys




*Introduction to TimeWhys  
Climate Change Edition*

*Introducing TimeWhys – a fun and entertaining way to pass time while you’re waiting. Discover fascinating facts, creative activities, and amazing anecdotes about climate change and the ocean. Show off your newfound knowledge, and quiz family and friends.*

*TimeWhys is sure to help pass time whether you’re waiting for minutes or hours. Time flies with TimeWhys!*

**Places to visit:**  
Birch Aquarium at Scripps, (858) 534-FISH  
<http://aquarium.ucsd.edu>

Don't miss 'Feeling the Heat: the Climate Challenge' opening May 19, 2007



### Resources:

#### EcoKids Online:

<http://ecokids.earthday.ca/pub/index.cfm>

#### EPA Climate Change

<http://www.epa.gov/climatechange/>

#### NOVA Online: Warnings from the Ice:

<http://www.pbs.org/wgbh/nova/warnings/>

#### Secrets of the Ocean Realm:

<http://www.pbs.org/oceanrealm/>

### Books:

"An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It" by Al Gore, Rodale Books, 2006

"Collapse: How Societies Choose to Fail or Succeed" by Jared Diamond, Viking, 2004

"Field Notes from a Catastrophe" by Elizabeth Kolbert, Bloomsbury Publishing PLC, 2006

"Hello Ocean: Hola Mar" by Pam Munoz Ryan, Yanitzia Canetti and Mark Astrella, Charlesbridge Publishing; Bilingual edition, 2003

"I Wonder Why the Sea is Salty: And Other Questions About the Oceans" by Anita Ganeri, Kingfisher, 2003

"The Ocean Book: Aquarium and Seaside Activities and Ideas for All Ages" by Center for Marine Conservation, John Wiley and Sons, 1989

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## Appendix 2

### Card 2 - What is CO<sub>2</sub> and the greenhouse effect?

TimeWhys

#### What is carbon dioxide?

Carbon dioxide, CO<sub>2</sub>, is one of the so-called 'greenhouse' gases in the air. Flip this card to learn how CO<sub>2</sub> helps keep Earth comfortably warm.



#### Where does it come from?

CO<sub>2</sub> comes from deep inside Earth (it seeps out from natural springs and erupts from volcanoes), from animals (like us) breathing, and from burning anything that contains carbon – like trees, coal, oil and natural gas.



#### What's the big deal?

The Greenhouse Effect



Greenhouse gases like CO<sub>2</sub> form a natural 'blanket' around the planet, trapping heat in Earth's atmosphere and maintaining a comfortable average temperature of 68°F. This is the 'greenhouse effect.'

The Enhanced Greenhouse Effect



More CO<sub>2</sub> from driving cars and heating homes traps more heat. This causes Earth to heat up – it's like throwing on another blanket! This is the 'enhanced greenhouse effect.'

#### What's the problem?

What's the problem with Earth getting warmer? TimeWhys can help you understand the downside of warming up and what you can do about it.

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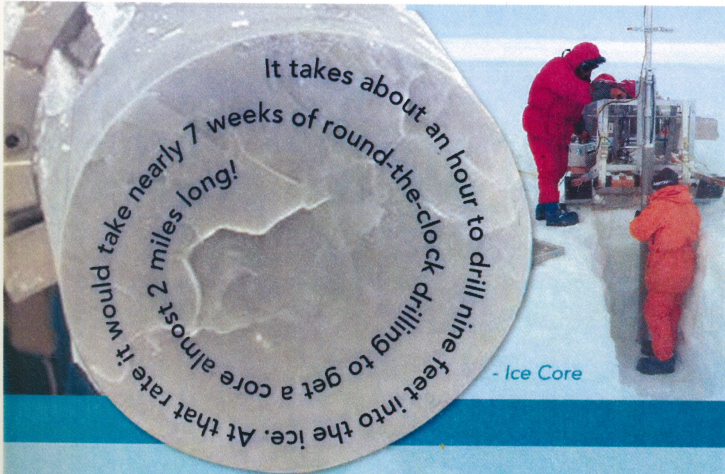
# Appendix 3

## Card 3 - Ice Core as an indication of Earth's past climate

TimeWhys

### Ice reveals the mystery of Earth's past climate

The layers of this glacier in Alaska show where snowfall (light areas) and melting (dark areas) have taken place. Each light/dark layer equals one year.

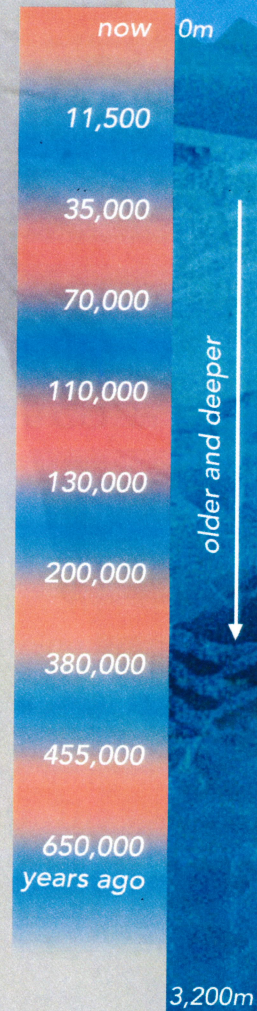


Ever notice ice cubes aren't perfectly clear? Tiny air bubbles get trapped in the freezing water, making the ice look cloudy.

Did you know scientists use air and dust trapped in ice sheets to learn how Earth's climate has changed over time?

### Oldest ice core

(not to scale)



fact - Trapped air tells scientists how much CO<sub>2</sub> was in Earth's atmosphere thousands of years ago

fact - Current CO<sub>2</sub> levels are higher and increasing 200 times faster than any time in the past 650,000 years

fact - Burning coal and gas, cutting down trees, and farming are pumping CO<sub>2</sub> into Earth's atmosphere at an alarming rate.

### Cool Your CO<sub>2</sub> Contribution

Each person in the U.S. pollutes and consumes as much as 40 people in developing countries.

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## Appendix 4

### Card 4 - The ocean as a carbon sink

TimeWhys

Much of the carbon dioxide produced from powering our homes and cars ultimately ends up in our oceans.

In one year, the average American produces 22 tons of CO<sub>2</sub> (the weight of about 3 orca), six times more than an average person outside the U.S.

#### Question

Most of the Earth's CO<sub>2</sub> is stored in:

- A) Forests
- B) Ocean
- C) Soils
- D) Atmosphere

#### Answer

If you chose "B" YOU GOT IT RIGHT!!!

The ocean acts like a sponge, soaking up 22 million tons of CO<sub>2</sub> each day. However, the ocean is becoming overloaded with CO<sub>2</sub>.

#### A CO<sub>2</sub> OVERLOAD MEANS...

- The ocean becomes acidic, harming shelled sea animals.
- The ocean soaks up less CO<sub>2</sub> leaving more CO<sub>2</sub> in Earth's atmosphere.

#### TimeWhys Try It:

Imagine holding a dry sponge under a dripping faucet. How long before the sponge is completely soaked? Now imagine the water was on full blast. The sponge can hold only so much water; likewise, the ocean can hold only so much CO<sub>2</sub>.

#### Words of Wisdom

There are no passengers on Spaceship Earth. We are all crew.

—Marshall McLuhan, educator


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## Appendix 5

### Card 5 - Sea-level rise

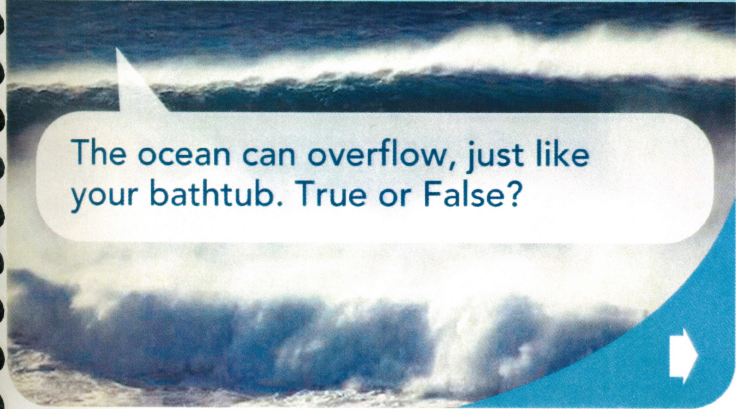
TimeWhys



As Earth warms, rising sea level will cause coastal flooding.



Who will this affect? Every day, about 3,500 people move to the U.S. coast to join the 115 million that already call the coast home.



The ocean can overflow, just like your bathtub. True or False?

#### Answer

TRUE! As Earth heats up, sea level will rise because:

1. Warmer water takes up more space than cooler water. (Know how mercury in a thermometer rises as the temperature goes up? Scientists call this "thermal expansion", and water does it too!)
2. Ice sheets melt, adding water to the ocean.

Unlike your bathtub, the ocean doesn't have an overflow drain. If water is added **and** the water already there takes up more space, sea level will rise. Scientists think sea level could rise more than one foot in the next 100 years, causing coastal flooding.



#### Words of Wisdom

You must be the change you want to see in the world.

—Mahatma Gandhi

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## Appendix 6

### Card 6 - Ocean acidification

TimeWhys

The ocean is becoming more acidic as  $\text{CO}_2$  builds up in the atmosphere and ocean.

Adding  $\text{CO}_2$  to seawater makes the ocean more acidic.

A more acidic ocean means animals like barnacles, mussels, clams, and corals will have trouble making their shells and skeletons...

Why should you care?

Each year, coral reefs and shellfish support a \$100 billion fishing and recreation industry.

Less Acidic

- Sea Water
- Pure Water
- Milk
- Coffee
- Vinegar
- Lemon Juice
- Battery Acid

More Acidic

**TimeWhys Try It:**  
Chalk It Up! Soak a piece of old-fashioned sidewalk or blackboard chalk (it's calcium carbonate, like the shells of many marine animals) in lemon juice (an acid) overnight. Watch what happens.

Cool Your  $\text{CO}_2$  Contribution

No single item you own pumps out more  $\text{CO}_2$  than your car. Find creative ways to drive less.

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## Appendix 8

### Card 8 - Conservation tips

TimeWhys

#### Wise ways to reduce your CO<sub>2</sub> contribution

1. Purchase a more efficient automobile and drive less. No single item you own pumps out more CO<sub>2</sub> than your car.

2. Increase your home's energy-efficiency. Taking shorter showers, adjusting the thermostat, and unplugging appliances can add up.

3. Volunteer your time. Participate in workshops and public events to learn more about environmental issues. Self-education is the first step towards meaningful action.

photo: ikea.com

TimeWhys

4. Eat more veggies. It takes between 4 and 20 times more land, 100 times more water, and about 30 times more energy to raise animals than grow crops. Going easy on meat might be good for you and the environment.

5. Family planning? Each person in the industrial world consumes and pollutes as much as about 40 people in developing countries.

6. Vote. Participate in our democracy as an environmentalist. Educate yourself on candidates' environmental records and vote in every election.



Need more things to do?  
Check out [timewhys.com](http://timewhys.com).

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# Appendix 9

## Grade Six

### Science Content Standards.

#### Focus on Earth Science

##### Plate Tectonics and Earth's Structure

1. Plate tectonics accounts for important features of Earth's surface and major geologic events. As a basis for understanding this concept:
  - a. *Students know* evidence of plate tectonics is derived from the fit of the continents; the location of earthquakes, volcanoes, and midocean ridges; and the distribution of fossils, rock types, and ancient climatic zones.
  - b. *Students know* Earth is composed of several layers: a cold, brittle lithosphere; a hot, convecting mantle; and a dense, metallic core.
  - c. *Students know* lithospheric plates the size of continents and oceans move at rates of centimeters per year in response to movements in the mantle.
  - d. *Students know* that earthquakes are sudden motions along breaks in the crust called faults and that volcanoes and fissures are locations where magma reaches the surface.
  - e. *Students know* major geologic events, such as earthquakes, volcanic eruptions, and mountain building, result from plate motions.
  - f. *Students know* how to explain major features of California geology (including mountains, faults, volcanoes) in terms of plate tectonics.
  - g. *Students know* how to determine the epicenter of an earthquake and know that the effects of an earthquake on any region vary, depending on the size of the earthquake, the distance of the region from the epicenter, the local geology, and the type of construction in the region.

##### Shaping Earth's Surface

2. Topography is reshaped by the weathering of rock and soil and by the transportation and deposition of sediment. As a basis for understanding this concept:
  - a. *Students know* water running downhill is the dominant process in shaping the landscape, including California's landscape.
  - b. *Students know* rivers and streams are dynamic systems that erode, transport sediment, change course, and flood their banks in natural and recurring patterns.
  - c. *Students know* beaches are dynamic systems in which the sand is supplied by rivers and moved along the coast by the action of waves.
  - d. *Students know* earthquakes, volcanic eruptions, landslides, and floods change human and wildlife habitats.

##### Heat (Thermal Energy) (Physical Sciences)

3. Heat moves in a predictable flow from warmer objects to cooler objects until all the objects are at the same temperature. As a basis for understanding this concept:
  - a. *Students know* energy can be carried from one place to another by heat flow or by waves, including water, light and sound waves, or by moving objects.
  - b. *Students know* that when fuel is consumed, most of the energy released becomes heat energy.
  - c. *Students know* heat flows in solids by conduction (which involves no flow of matter) and in fluids by conduction and by convection (which involves flow of matter).
  - d. *Students know* heat energy is also transferred between objects by radiation (radiation can travel through space).

##### Energy in the Earth System

4. Many phenomena on Earth's surface are affected by the transfer of energy through radiation and convection currents. As a basis for understanding this concept:
  - a. *Students know* the sun is the major source of energy for phenomena on Earth's surface; it powers winds, ocean currents, and the water cycle.
  - b. *Students know* solar energy reaches Earth through radiation, mostly in the form of visible light.
  - c. *Students know* heat from Earth's interior reaches the surface primarily through convection.
  - d. *Students know* convection currents distribute heat in the atmosphere and oceans.

- e. *Students know* differences in pressure, heat, air movement, and humidity result in changes of weather.

**Ecology (Life Sciences)**

- 5. Organisms in ecosystems exchange energy and nutrients among themselves and with the environment. As a basis for understanding this concept:
  - a. *Students know* energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis and then from organism to organism through food webs.
  - b. *Students know* matter is transferred over time from one organism to others in the food web and between organisms and the physical environment.
  - c. *Students know* populations of organisms can be categorized by the functions they serve in an ecosystem.
  - d. *Students know* different kinds of organisms may play similar ecological roles in similar biomes.
  - e. *Students know* the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water, a range of temperatures, and soil composition.

**Resources**

- 6. Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their formation. As a basis for understanding this concept:
  - a. *Students know* the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process.
  - b. *Students know* different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and know how to classify them as renewable or nonrenewable.
  - c. *Students know* the natural origin of the materials used to make common objects.

**Investigation and Experimentation**

- 7. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:
  - a. Develop a hypothesis.
  - b. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
  - c. Construct appropriate graphs from data and develop qualitative statements about the relationships between variables.
  - d. Communicate the steps and results from an investigation in written reports and oral presentations.
  - e. Recognize whether evidence is consistent with a proposed explanation.
  - f. Read a topographic map and a geologic map for evidence provided on the maps and construct and interpret a simple scale map.
  - g. Interpret events by sequence and time from natural phenomena (e.g., the relative ages of rocks and intrusions).
  - h. Identify changes in natural phenomena over time without manipulating the phenomena (e.g., a tree limb, a grove of trees, a stream, a hillslope).

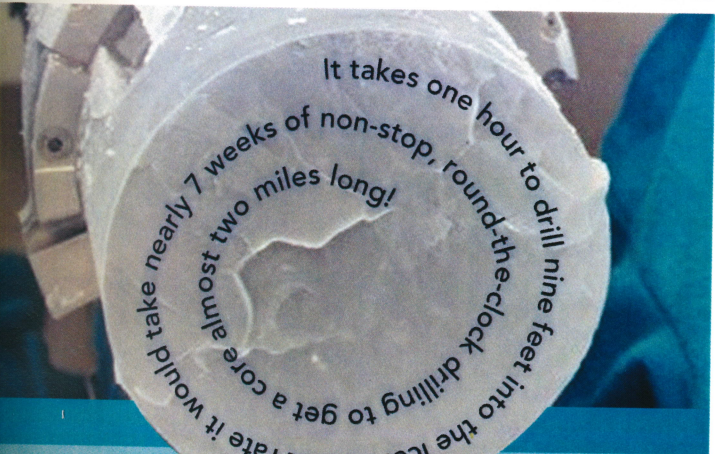


## Appendix 10

### Card A - Ice Core as an indication of Earth's past climate

TimeWhys

#### Ice reveals the mystery of Earth's past climate



**Q** Ever notice ice cubes aren't perfectly clear? Tiny air bubbles get trapped in the freezing water, making the ice look cloudy. What do trapped air and particles in Earth's ice sheets tell us?

- A) The ocean is full of bubbles
- B) Fish fart a lot
- C) Earth's climate has changed over time

**A**

**A** C – The longest ice core (almost two miles long!) shows changes in Earth's climate over 740,000 years

**Fact:** Air and dust trapped in the core's icy layers show that Earth's climate has changed – sometimes gradually, and other times surprisingly quickly.

**Fact:** Over the last 200 years, heat-trapping gases such as carbon dioxide and methane have been building up in Earth's atmosphere.

**Fact:** The gas build-up is caused mainly by human activities such as farming and burning coal and oil.

#### Conservation Tip

Burn calories rather than fossil fuels: Walk more, drive less. Organize a walk-to-school day.



# Appendix 11

## Card B - The ocean as a carbon sink

TimeWhys

*Much of the carbon dioxide from powering our homes and cars ultimately ends up in the ocean.*

In one year, the average American produces 22 tons of carbon dioxide (the weight of 3 or 4 elephants), six times more than the average person living outside the U.S.



**Q** At rest, a person takes about 15 breaths every minute. People, like many living things, naturally produce carbon dioxide (CO<sub>2</sub>) when they exhale. Most of the Earth's carbon dioxide is stored in:

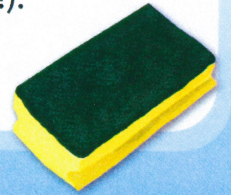
- A) Forests
- B) Ocean
- C) Soils

**A** 

**A** B – The Ocean stores most of Earth's CO<sub>2</sub>, but it has limits to how much extra CO<sub>2</sub> it can absorb...

*TimeWhys Experiment:* Turn on a faucet so only one drop comes out at a time. Take a dry sponge and hold it under the drops. What happens? Count the number of drops it takes for the sponge to be completely soaked with water. What happens then? Take a second dry sponge and put the water on full blast. What happens now?

The ocean acts as a sponge, absorbing some of the carbon dioxide in the air. However, humans are pumping CO<sub>2</sub> into the atmosphere at an alarming rate by activities such as burning oil and gas (the faucet is on full blast!).



### Conservation Tip

Help turn off the CO<sub>2</sub> faucet – reduce the electricity you use and set your thermostat at 68° F in the winter and 78° F in the summer.



## Appendix 12

# TimeWhys Pilot Focus Group Questions

## *Sixth-grade version* *Personal Interview Format*

Introduction paragraph to be read by evaluator

Good afternoon everyone. My name is Kelly and I am a graduate student at Scripps Institution of Oceanography at the University of California San Diego. I want to thank you all for staying a little later after school today to help me with a project I am working on. As a way to say thank you, I have some fun prizes for you once we're done, which should be in about ten minutes or so.

I am developing a product called *TimeWhys*, which is a series of cards that are to be used when people are waiting. How many of you have waited before? (Show of hands) I'm sure just today you waited in a line here at school. I will ask you more questions about what you do when you're waiting, but first, let me tell you what we're going to be doing today.

Each of you is going to find a buddy (not yet!) and the two of you will be handed two *TimeWhys* cards. You will have about three (3) minutes to look at the cards and talk about them with your buddy. Then, I will collect the cards and we'll get together and talk about the cards and your experience with them for about ten (10) minutes.

### PHOTOGRAPHY AND VOICE RECORDING

I am looking for all of you to tell me as openly and honestly as you can about your experience with *TimeWhys*. Your comments will be used to help make this product better so anything you have to say is valuable. Please know that there are no right or wrong answers – we are truly interested in everything you have to say.

Before we begin, are there any questions?

Everyone find a buddy – anyone who doesn't have a buddy should come and see me. Once you have your buddy and have the cards, go and find a quiet place around the room where you both can talk. Please use quiet voices and be considerate of those around you.

Three minutes of interaction with cards. Collect cards.

So let's start by going around the table and introducing ourselves. Please say your name, age, if you like the ocean, and what your favorite ocean animal is.

**The *TimeWhys* cards will be placed out on the table.**

Great. So let's go back to a topic I mentioned a while ago – waiting.

Can anyone give me some examples of where you wait?

What do you do when you wait?

Who are you usually waiting with? What do they do?

Now let's open the discussion up to anyone who has a comment about the cards in general.

*Leading Questions:*

Card content:

What was your first impression of the cards?

Word Usage:

Were there any words/concepts used that you didn't understand?

Clarity:

What was the primary message of the cards?

Design:

Which card do you like the most? Least? Why?

Interest:

What would make the cards more fun?

Knowledge:

What was the coolest thing you learned?

## Appendix 13

Thank you for participating in this survey. The following are a set of cards (think kids trading cards) designed to pass 'waiting' time, eg. at the bank, a restaurant, the Laundromat, for a bus, or before a movie. Your feedback will help improve these cards. Thank you in advance for your time - remember there are not right or wrong answers. Your comments will be kept confidential and will be used only for the purposes of this project.

Attached, please find samples of two cards (Card A and Card B, each of which would be printed front and back). It will take about 10 minutes to review the cards and complete the eight (8) questions.

### PLEASE REVIEW CARDS NOW (SEE ATTACHED)

#### Questions

1. What was your first impression of the cards? *Mark (x) all that apply.*

#### CARD A

- a) Visually appealing \_\_\_
- b) Interesting \_\_\_
- c) Dull \_\_\_
- d) Scientifically Accurate \_\_\_
- e) Educational \_\_\_
- f) Confusing \_\_\_
- g) Entertaining \_\_\_
- h) Other (specify) \_\_\_\_\_

#### CARD B

- a) Visually appealing \_\_\_
- b) Interesting \_\_\_
- c) Dull \_\_\_
- d) Scientifically Accurate \_\_\_
- e) Educational \_\_\_
- f) Confusing \_\_\_
- g) Entertaining \_\_\_
- h) Other (specify) \_\_\_\_\_

2. What is the primary message of the cards? *Mark (x) all that apply.*

- a) Science is complicated. \_\_\_
- b) I can make lifestyle changes to reduce how much my own activities contribute to climate change. \_\_\_
- c) Scientists collect information about Earth's past climate. \_\_\_
- d) There is nothing I can do to reduce my contribution to climate change. \_\_\_
- e) Human activities are driving some changes to Earth's climate. \_\_\_
- f) The ocean plays an important role in Earth's climate. \_\_\_
- g) Global warming will affect marine animals. \_\_\_
- h) Other (specify) \_\_\_\_\_



**3. About how much time did you spend looking at the cards?**

- a) Less than 1 minute \_\_\_
- b) 1-3 minutes \_\_\_
- c) More than 3 minutes \_\_\_

**4. How clear was the content of the cards? *Mark (x) only one answer for each card.***

CARD A    Very clear \_\_\_    Somewhat clear \_\_\_    Unclear \_\_\_  
CARD B    Very clear \_\_\_    Somewhat clear \_\_\_    Unclear \_\_\_

Comments:

**5. Rate the cards on the following elements:**

*Type a number on the corresponding line (1= Very Good, 2=Good, 3=No opinion, 4=Satisfactory, 5=Poor)*

**CARD A**

Colors \_\_\_  
Photographs/Images \_\_\_  
Layout \_\_\_  
Understandability \_\_\_  
Level of Interest \_\_\_  
Uniqueness of content \_\_\_

Comments:

**CARD B**

Colors \_\_\_  
Photographs/Images \_\_\_  
Layout \_\_\_  
Understandability \_\_\_  
Level of Interest \_\_\_  
Uniqueness of content \_\_\_

Comments:

**6. Do you think any of the following would make the cards more engaging?**

**Mark (x) all that apply.**

- a) Answer written backwards (need a mirror to decipher) \_\_\_\_
- b) 'Decoder' reveals answer (such as 3D glasses) \_\_\_\_
- c) Card included an activity (such as Card B) \_\_\_\_
- d) Other (specify) \_\_\_\_

**7. In which of the following situations might you find reading, handling or studying cards like these an interesting way to pass waiting time? Mark (x) all that apply.**

- a) You're waiting for a bus or a train. \_\_\_\_
- b) You're a passenger on a long car ride. \_\_\_\_
- c) You're waiting to board a plane. \_\_\_\_
- d) You're on a long flight. \_\_\_\_
- e) You're in a long line at the bank. \_\_\_\_
- f) You're in the waiting room at doctor's office. \_\_\_\_
- g) You're waiting for a table at a restaurant. \_\_\_\_
- h) You're waiting for your food to be served at a restaurant. \_\_\_\_
- i) You're entertaining kids after school. \_\_\_\_
- j) You're waiting at the Laundromat. \_\_\_\_
- k) You're waiting in line to buy movie tickets. \_\_\_\_
- l) You're waiting for the movie to begin. \_\_\_\_
- m) Other (please specify) \_\_\_\_

**8. Any other suggestions/comments?**

## Appendix 14

Thank you for participating in this questionnaire. The following are a set of cards (think kids trading cards) designed to pass 'waiting' time, such as at a doctor's office, the Laundromat, a car wash, or waiting for a movie begin. Your feedback will help improve these cards. All comments will be kept strictly confidential and used exclusively for the purposes of this study. There are no right or wrong answers.

Please review the sample cards and answer the following questions. It will take about ten minutes to complete the questionnaire.

**Don't forget your FREE GIFT when you have completed the questionnaire.**

PLEASE REVIEW CARDS BEFORE ANSWERING QUESTIONNAIRE.

1. a) What was your first impression of the Card 1? Circle the most appropriate response for each (a-k).

### CARD 1

a) Visually appealing	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
b) Interesting	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
c) Dull	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
d) Visually unattractive	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
e) Educational	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
f) Confusing	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
g) Entertaining	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
h) Boring	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
i) Irrelevant	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
j) 'I didn't know that'	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
k) 'I knew that already'	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
l) Other (specify) _____	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree



1. b) What was your first impression of the Card 2? Circle the most appropriate response for each (a-k).

**CARD 2**

a) Visually appealing	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
b) Interesting	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
c) Dull	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
d) Visually unattractive	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
e) Educational	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
f) Confusing	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
g) Entertaining	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
h) Boring	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
i) Irrelevant	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
j) 'I didn't know that'	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
k) 'I knew that already'	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
l) Other (specify) _____	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree

2. Thinking about what you just read on the cards, circle the most appropriate response for each statement below (a-g).

a) Science is complicated.	Agree	Disagree	N/A
b) I can make lifestyle changes to reduce how much my own activities contribute to climate change.	Agree	Disagree	N/A
c) Scientists collect information about Earth's past climate.	Agree	Disagree	N/A
d) There is nothing I can do to reduce my contribution to climate change.	Agree	Disagree	N/A
e) Human activities are driving some changes to Earth's climate.	Agree	Disagree	N/A
f) The ocean plays an important role in Earth's climate.	Agree	Disagree	N/A
g) Global warming will affect marine animals.	Agree	Disagree	N/A

3. About how much time did you spend looking at the cards? *Mark (x) only one response.*

- a) Less than 1 minute \_\_\_
- b) 1-3 minutes \_\_\_
- c) More than 3 minutes \_\_\_

4. How clear was the content of the cards? *Circle the most appropriate response.*

CARD 1 \_\_\_\_\_ Clear \_\_\_\_\_ Very clear \_\_\_\_\_ No opinion \_\_\_\_\_ Unclear \_\_\_\_\_ Very unclear \_\_\_\_\_

CARD 2 \_\_\_\_\_ Clear \_\_\_\_\_ Very clear \_\_\_\_\_ No opinion \_\_\_\_\_ Unclear \_\_\_\_\_ Very unclear \_\_\_\_\_

Comments: \_\_\_\_\_

5. a) Rate the Card 1 on the following elements. *Circle the most appropriate response for each.*

**CARD 1**

Colors	Very good	Good	No opinion	Satisfactory	Poor
Photographs/Images	Very good	Good	No opinion	Satisfactory	Poor
Layout	Very good	Good	No opinion	Satisfactory	Poor
Understandability	Very good	Good	No opinion	Satisfactory	Poor
Uniqueness of content	Very good	Good	No opinion	Satisfactory	Poor
Size of card	Very good	Good	No opinion	Satisfactory	Poor

Comments:

5. b) Rate the Card 2 on the following elements. Circle the most appropriate response for each.

**CARD 2**

Colors	Very good	Good	No opinion	Satisfactory	Poor
Photographs/Images	Very good	Good	No opinion	Satisfactory	Poor
Layout	Very good	Good	No opinion	Satisfactory	Poor
Understandability	Very good	Good	No opinion	Satisfactory	Poor
Uniqueness of content	Very good	Good	No opinion	Satisfactory	Poor
Size of card	Very good	Good	No opinion	Satisfactory	Poor

**Comments:**

6. Would any of the following make the cards more engaging? Mark (x) all that apply.

- a) Answer written backwards (need a mirror to decipher) \_\_\_
- b) Facts and trivia \_\_\_
- c) 'Decoder' reveals answer (such as 3D glasses) \_\_\_
- d) Activities (like Card 2) \_\_\_
- e) Riddles \_\_\_
- f) Conservation tips \_\_\_
- g) Famous Quotes \_\_\_
- h) Other (specify) \_\_\_



7. In which of the following situations might you find reading, handling or studying cards like these an interesting way to pass waiting time? Circle the most appropriate response for each (a-n).

- a) You're waiting for a bus or a train. Strongly agree Agree No opinion Disagree Strongly Disagree
- b) You're a passenger on a long car ride. Strongly agree Agree No opinion Disagree Strongly Disagree
- c) You're waiting to board a plane. Strongly agree Agree No opinion Disagree Strongly Disagree
- d) You're on a long flight. Strongly agree Agree No opinion Disagree Strongly Disagree
- e) You're in a long line at the bank. Strongly agree Agree No opinion Disagree Strongly Disagree
- f) You're in the waiting room at doctor's office. Strongly agree Agree No opinion Disagree Strongly Disagree
- g) You're waiting for a table at a restaurant. Strongly agree Agree No opinion Disagree Strongly Disagree
- h) You're waiting for food to be served at a restaurant. Strongly agree Agree No opinion Disagree Strongly Disagree
- i) You're entertaining kids after school. Strongly agree Agree No opinion Disagree Strongly Disagree
- j) You're waiting at the Laundromat. Strongly agree Agree No opinion Disagree Strongly Disagree
- k) You're waiting in line to buy movie tickets. Strongly agree Agree No opinion Disagree Strongly Disagree
- l) You're waiting for the movie to begin. Strongly agree Agree No opinion Disagree Strongly Disagree
- m) Other (please specify) Strongly agree Agree No opinion Disagree Strongly Disagree
- n) There is no situation where I would read TimeWhys. Strongly agree Agree No opinion Disagree Strongly Disagree

8. Did TimeWhys help to pass time while waiting?

Yes No Not Sure

9. Would you prefer the cards in Spanish?

Yes No Not Sure

10. Circle the most appropriate for each (a-d).

- a) I'm interested in ocean life Strongly agree Agree No opinion Disagree Strongly Disagree
- b) I've learned about the ocean in school Strongly agree Agree No opinion Disagree Strongly Disagree
- c) I've learned about the ocean at an aquarium Strongly agree Agree No opinion Disagree Strongly Disagree
- d) I want to learn about how I impact the ocean Strongly agree Agree No opinion Disagree Strongly Disagree

11. Circle the most appropriate response for each (a-c).

a) I enjoy facts and trivia	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
b) I like to have something to do while waiting	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree
c) TimeWhys is a fun way to spend waiting time	Strongly agree	Agree	No opinion	Disagree	Strongly Disagree

12. Any other suggestions/comments?

## OPTIONAL

Age: Under 18 18-25 26-35 36-50 51-65 66-80 Over 80

Gender: M F Other

Ethnicity: (Circle all that apply) White African American Native American Asian Pacific Islands (including Hawaii) Hispanic/Latino Other  
Highest degree earned: Current student High school / GED Some college BA/BS MA/MS PhD Professional degree (JD, MD, etc)

Do you live with people under 18 years of age? Yes No

**Thank you for participating in this study.  
Enjoy your FREE GIFT!**

### Office Use Only

Card Package:

Location:

Time of day:

How busy venue:

General comments/observations:

# People in party:

Weather:

Slow Moderate

Busy