

Science and Mathematics Education Centre

**An Investigation into the Environmental Knowledge, Attitudes, and
Behavioural Intentions of Elementary School Students**

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**This thesis is presented for the Degree of
Doctor of Philosophy
of
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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Signature:

Date: November 15, 2006

ABSTRACT

This study was designed to find out elementary students knowledge about the environment, their attitudes towards helping the environment and what they actually have done to help the environment. Specifically, during the northern spring of 2002 all grade-4 and grade-5 students in one public elementary school in Miami-Dade County, Florida were administered the Children's Environmental Attitude and Knowledge Scale (CHEAKS) instrument. In 2002, some students in both grade levels interviewed each other in pairs to determine why they answered the way they did on the CHEAKS instrument. In the interviews, students discussed what they had been taught in school, compared to what they had learned outside of school that was related to the environment.

The following year, during the northern spring of 2003, all grade-4 and grade-5 students in the same elementary school were given the CHEAKS instrument. Students at the elementary school were also asked questions which they answered in writing. These included: Which questions on the survey did you feel were difficult?; what do you remember learning about environmental education in school, at home or elsewhere? In addition, some gifted grade-6 students, who attended the nearby middle school and other grade-6 students who were in heterogeneous ability classes also responded to the CHEAKS instrument.

Analysis of the data showed that grade-4 students in this elementary school had a higher commitment to the environment than did grade-5 students and gifted students had more knowledge than regular students. Only the gifted students in grade-5 had a high commitment to the environment. Comparing independent t-test results in year 2002 between grade-5 regular students ($n=105$) and grade-5 gifted students ($n=30$), grade-5 gifted students were statistically less committed to the environment in terms of scores on the Verbal Commitment. There was no difference in knowledge or commitment in grade-6 students. Girls were more verbally committed to the environment than boys. Having knowledge about the environment did not necessarily mean students were committed to saving the environment or took action to solve environmental problems. The thesis concludes with explanations, discussions about the limitations of the study and suggestions for further research.

ACKNOWLEDGEMENTS

I wish to acknowledge several people who helped me through this journey of formulating the ideas, collecting and understanding the data and writing this thesis. I wish to expressly thank my supervisor, Professor David Treagust, who was my guiding light, and who gave me inspiration and expert help throughout the entire process.

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DEDICATION

This thesis is my story. It is dedicated to the memory of my mom, who taught me that everything in the world is related and that we, humans, are put on earth to improve what is here. My earliest memories include her showing me our garden which attracted birds of many species. She taught me concepts that I remember years later... that the male blue jay birds and cardinals are the colourful, beautiful ones of the species and that they care for their mates and offspring.

This story is also dedicated to my dad, who practiced dentistry and helped patients for almost 60 years and at age 95 still was concerned about my wellbeing.

It is dedicated to my husband of 40 years, my boyhood sweetheart who encouraged my accomplishments.

It is dedicated to our three children. Mark, a successful businessman, is my constant reminder that being self-taught and skipping a formal education does not limit one's achievements. Paul, a biomedical engineer, is inventing medical devices to help mankind. Tracy, a teacher, is enabling children to succeed.

And this thesis is written with the hope that our three grandchildren, Marley, Sophie and Aaron, will live in a world of peace and bright futures.

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PREAMBLE

“Many discoveries are reserved for ages still to come, when memories of us will have been effaced.” -Seneca, *Natural Questions*, Book 7, first century (Sagan, 1980 p.1).

We are living not only in the best of times but also in the worst of times. In the US, we have landed on the moon, sent probes to other planets, invented a wheelchair to go upstairs, increased our average life expectancies to close to 80 years, and can speak on the phone to someone around the world instantaneously. The technology that has given people the ability to cause harm upon the Earth is also the technology that permits the assessment of planetary health.

It is my hope that humans will be able to live for years to come, with food on their tables, water to drink, clean air to breathe easily, and healthy and happy children who also want to make the world a better place in which to live. Sounds like a movie with a happy ending. I hope. I hope. I am a teacher.

At least, just the process, the disciplined inquiry, of the whole thesis evolution is a catharsis for me. Maybe a spark of knowledge will help students realise that they will be the ones to make the decisions for the future in the next few years. I feel that students need to be empowered to act in their best interests and for the best interests of all. Our class bulletin board reads, “Think Globally, Act Locally” (McClaren, 1989). This third rock from the sun is our home. It is a special place. My classroom and the school are my students’ training grounds for both thinking and acting.

“In the vastness of space and the immensity of time,” as I quote Carl Sagan, in his book *Cosmos* “ it is my joy to share a planet and an epoch with Annie” (dedication page). Before his untimely death, I had the pleasure of meeting and speaking with Carl Sagan and “Annie”, Ann Druyan, his wife and producer of the television series *Cosmos*. They inspired me to bring the world to my students. I share a planet and an epoch with them (Sagan, 1980).

CHAPTER 1

BACKGROUND AND STATEMENT OF THE PROBLEM

1.1 Overview of Chapter 1

In Chapter 1, I introduced the study, provided an overview of the chapters (Section 1.2) and stated the background of the problem of why environmental education is necessary for elementary school students in this school (Section 1.3). I explained my teaching situation, and what type of environmental education was taught in the past few years. Science standards, which were mandated by the county and the State of Florida, were presented. I stated the problem (Section 1.4) and the purpose of the study (Section 1.5). The research questions (Section 1.6) and the significance of the study (Section 1.7) followed. A summary concluded the chapter (Section 1.8).

1.2 Overview of the Chapters

I presented a review and discussion of the literature that formed the background information in Chapter 2. This included a history of environmental education in the United States and the state of Florida. I described information about the research in education for a sustainable future. I described and discussed previous studies of environmental education programs.

I presented information of the research methods of this study in Chapter 3. I provided a description of the research design, the sample, instruments used, as well as a description of the data collected and an overview of data analysis. I reported the interviews, ethical considerations and limitations of this study in this chapter.

Tabulation and reports on the results obtained from quantitative and qualitative data analysis were presented in Chapter 4. In this Chapter, all the information reported was reviewed, and the findings were interpreted in the context of the research questions.

The main findings, implications, and recommendations arising from the study were presented. What this research says about the effectiveness, or otherwise, of the environmental education programme in my school was discussed in Chapter 5.

1.3 Background of the Problem

1.3.1 The world and the US

At times, it is the catastrophic environmental topics affecting our lives, such as the two news events on August 14, 2003 that glean our attention. First, the biggest power blackout in history hit several U.S. and Canadian cities. Second, there were abnormally high temperatures in France and other parts of Europe with an estimate of between 1,500 and 3,000 deaths due to the heat.

On the other hand, one of the environmental success stories is that after years of continuing thinning of the stratospheric ozone layer, the ozone layer will recover over the next several years as a result of international controls of ozone depleting substances (EPA's Report on the Environment, 2003).

It is necessary for mankind to be informed, take control and correct environmental problems. However, the best scenario would be to prevent these problems. Unfortunately, the average American knows very little about energy production and use even though our civilization is the most energy intensive the world has ever known. Coal is our most abundant fossil fuel but it is inevitably linked with climate change. No new nuclear plants have been ordered in the USA in 22 years. Renewable fuels are cost-effective but intermittent. A solution of efficient use of all kinds of energy requires time and capital. Therefore, as a nation, citizens of the U.S.A. must become more efficient in the use of energy (EPA, 2003). We must be educated about environmental issues, investigate the issues and be active in our communities. In order to best serve society in this regard, the institution of the school should be involved. Students at a very young age can become environmentally aware and thereby be motivated to take action.

Environmental education must prepare individuals to be responsive to a rapidly changing technological world, to understand contemporary world problems, and to provide the skills needed to play an effective role in the improvement and maintenance of the environment. (Ramsey, 2001 p.110)

Over the past three decades, environmental education has been, and is now, a minor part of our school's curriculum. Earth Day has become an annual event in our school and our local community. Some teachers and students in our school celebrate every day as Earth Day. However, this is not the case in all classrooms. Environmental education still has a largely inadequate, relatively inconsistent, and scattered presence in the curriculum (Hungerford & Volk, 2003).

Educating today's youths to have the requisite knowledge, skills, and values to shape their lives and the world around them successfully is our greatest challenge (Wheeler & Bijur, 2000). Children are the future and need to experience ways of looking at issues in a multi-perspective approach, going beyond the classroom to realise that communities are built with participation. To be successful, public education needs to dissolve its old identity as a separated, contained institution within the society and evolve into a new identity with branches and roots engaging the whole community (Wheeler & Bijur, 2000).

Indeed, in the 21st century, the literacy of science, ecology and development will be as essential to comprehending the world, as were the traditional skills of reading and writing at the start of the last century (United Nations Educational, Scientific, and Cultural Organization, 2001). The basic dictum of pedagogy in science education is to find out the learner's background knowledge, to begin with the learner's understanding and to start with problems that people feel and understand at the local level (Treagust, Duit & Fraser, 1996). Such pedagogy entails both valuable knowledge in itself and, if need be, a basis for moving on to more complex and global understandings (UNESCO, 2001). Consequently, in an effort to learn what were the environmental knowledge, attitudes and behaviour of my students and the students in our school, I researched, found, and administered a survey that had already been given to students in another state. *This Children's Environmental*

Attitude and Knowledge Scale was likely to be valid and reliable for my elementary school students in Miami as well (see Appendix A-1) (Leeming, 1995).

The research was designed to provide a basis upon which others may develop and implement curriculum for environmental education. The means of reaching this purpose was to conduct an environmental education evaluation for the elementary school in which I taught. I wanted to investigate students' knowledge of environmental issues, attitudes towards the environment and behavioural intentions towards the environment. By comparing grade-4 and grade-5 students (gifted versus regular, boys versus girls) I wanted to provide a baseline so I could report my findings to our school Educational Excellence School Advisory Council (EESAC) committee of teachers, parents, business people and administrators, before implementing our School Improvement Plan. Extrapolation from these data to other populations should be done with care. For this study, I know what I had been teaching in environmental education to gifted students over the past ten years (see Appendix A-2). I know what the Sunshine State Standards mandate to teach (Florida Department of Education, 2005), but I did not know if students are motivated to take action within their school, their homes, and their community. Moreover, I did not know how the gifted students' knowledge and attitudes compared with their peers in regular classes, nor did I know how boys' and girls' attitudes and knowledge differed. The girls I had been teaching in science classes for gifted students, including an elective course in robotics, were very motivated to learn and they attended most of the classes after school. I compared their performance to girls in regular classrooms. Furthermore, I wanted to see if there was a change in students' knowledge and attitudes from year to year without any additional treatment or formal modification in the curriculum.

1.3.2 Background of the School and my Teaching Experience

I teach children in an urban elementary school, kindergarten through grade-5, who were mostly from families with middle class incomes. For ten years I taught intellectually gifted students who were identified, tested, and placed into the gifted programme (see Appendix A-3). Many English Speakers of Other Languages (ESOL) were in our multicultural gifted programme. Audubon's three-day field trip

to Sea Base at Pigeon Key was the highlight of the year for many of the gifted elementary school students at our school until 2003 when field trips became limited because of preparation for mandated state tests.

The school was in an urban area of northeast Miami-Dade County, Florida in the United States of America. The weather was subtropical and usually very pleasant since the school was located only a couple of miles from the Atlantic Ocean and the warm Gulf Stream. There were only two seasons in south Florida, wet and dry. During the summertime it rained almost every day. During the wintertime it was dry. In summer because of the closeness to the equator, there was almost 13 hours of daylight and many children spent much of that time playing outdoors.

The school was set in and amongst a hammock of old oak trees, gumbo-limbo trees and palm trees. Many times I took my students outdoors on nature walks or to visit our outdoor Botanical Learning Centre in the centre of the school campus. A few years ago, two of my gifted grade-3 students had the idea to build an ecosystem with native plants to bring butterflies and to replicate the way the Miami River looked one hundred years ago (see Appendix A-4).

Highland Oaks Middle School was located next to the elementary school. On the other side of it was a very busy highway going to Aventura, a high-income neighbourhood, there were about 1100 students in the elementary school. Most students came from the close proximity of the homes in the neighbourhood. Some students were bussed in from Aventura, a mile away in the East, a city of high rise buildings with the most modern of shopping malls and office buildings. Other students, who were allowed to attend classes by special permission from the region, were brought by their parents or by private bus. The grade-5 students matriculated to Highland Oaks Middle School. After grade-8 they matriculated to Michael Krop High School, a few blocks away, one of two other high schools in this region.

Miami-Dade County Public Schools has six regions and is a very diverse, large school system, being the fourth largest in the United States (Miami-Dade County Public Schools, 2003a) (see Appendix A-2) (Miami-Dade County Public Schools, 2003b). At the time of this study, a new superintendent for all Miami-Dade County

Schools was trying to balance the school budget, which is primarily funded by the local property taxes and the State of Florida, with some money that comes from the federal government (Florida Department of Education, 2003a).

Each year the School Public Accountability Report was given to every parent. It stated:

In accordance with the state law and district procedures, each public school in Miami-Dade County develops and implements a School Performance Excellence Plan. The principal, parents, teachers, students and community representatives cooperatively develop the School Performance Excellence Plan. This important effort to help all students perform at their very best is called Florida's High Quality Education System. (Miami-Dade County Public Schools, 2002)

In years 2002 and 2003 of this study, reading, writing, mathematics and science education were the priorities of improvement for the students in the school. There was no specific goal for environmental education or community action even though we had a well-established Botanical Learning Centre and curriculum materials available to each teacher. The school's administration and the Educational Excellence School Advisory Council (EESAC) committee of teachers, parents, and business people decided on the yearly goals. All school employees helped implement the School Improvement Plan. Assessments were the Florida Comprehensive Assessment Tests, termed "The FCATs", given in February and March each year. The FCAT Reading and Mathematics Sunshine State Standards (SSS) tests were criterion-referenced tests. They assessed student achievement on knowledge and skills described in the state curriculum framework called the Sunshine State Standards.

The State of Florida mandated an FCAT writing test for all grade-4 students. Average Student Performance for our students in the school in the Florida Writing Assessment for grade-4 in 2002 was a score of 3.8 on a 6-point scale, higher than the 3.4 for the District of Miami-Dade County. The State of Florida mandated that every student (unless they were learning disabled) in grade-3 should be reading on grade

level or they would be retained in grade-3. Since I was surveying grade-4 and grade-5 students, I was concerned with their reading ability. The mean scale scores for grade-4 and grade-5 for the Reading section of the Florida Comprehensive Assessment Test were 321 and 305, respectively, which was higher than the average of 285 and 299, respectively, in the State of Florida. I wondered if students who scored above average on testing would also be concerned about and had done something to help our environment.

The State of Florida mandated an FCAT mathematics test for students starting in grade-3. The mean scale score for grade-4 and grade-5 for the Mathematics section of the Florida Comprehensive Assessment Test was 330 and 346, respectively, in this school, which was higher than the average of 294 and 318, respectively, in the State of Florida. Results showed that the mean scores of the grade-4 and grade-5 students in this school were higher than the mean score for grade-4 and grade-5 students in the entire district and the entire state. The students that I surveyed had above average scores in standardized tests.

The first year that the State of Florida mandated a science test for students in grade-5, -8 and -10 was 2003. In the year 2007, the scores count towards grading of the school and ranking in the state. Teachers are not able to view the test, according to state law, so I was unable to see it. Hopefully, some of the test questions are relevant to environmental education, including the ecology of Florida and the world. A sample test booklet for Science grade-5 in 2003 is presented in Appendix A-6. Only two questions pertained to ecological concepts on the sample test.

Students, parents, teachers and administrators felt the emotional pressure of doing well on all the tests that were given each February. Many of the school districts in the State of Florida were requiring students to start school in early August, not September, as has been the custom for decades, so that the students would experience more hours of education before the test was given. The Florida legislature made its funding decisions for the Department of Education after the FCAT scores were reported in spring in Tallahassee in the northern part of the State. The Florida Comprehensive Assessment Tests partially guide the state's funding to each school district.

Consequently, in order to improve the test scores, the school in this study had voluntary Saturday classes and after school tutoring for students who wanted help in understanding practice test questions. The school also had community volunteers who came in to read with the students during class. There were special classes for early intervention for preschoolers with learning problems, as well as classes for elementary school students with learning problems. In addition, the school had special classes for students who speak English as a Second Language and offered in-service education classes to teachers to learn the best strategies to teach educational skills to students based on the Florida Sunshine State Standards. My students lived in this test-generated society. Even in the gifted classes that I taught, the pace of presenting the new material to the students was so rapid that many of the teachers, students and parents felt that they were unduly pressured to complete tasks on time.

Finding time to give the survey for my study was an issue. Granted, students do learn big ideas and how to connect new learning to already learned concepts with hands-on laboratory activities and presentations. But I wondered if teachers and administrators ever reflected and asked what our students are thinking and doing that would help the world.

In this school, during the time of this study, environmental information was taught to students in the classroom, using different media but not following a set environmental curriculum. The information included a variety of free printed and visual materials as classroom aids. Some teachers showed videos and television clips about environmental problems and discussed conservation. Field trips were not sanctioned nor allowed until after the State testing in March. There was no environmental curriculum that was followed school-wide from year to year. Rather the science standards for the state were the basis for the environmental education curriculum.

1.3.3 Environmental Education in our School in the Past

I first became aware of the environmental education in the school about 20 years ago as a parent of three students in the school, two of whom were in the Gifted Centre. My two children came home each day with knowledge and ideas about the environment of South Florida that had been discussed in their gifted classes. The teachers in the gifted programme taught the children that South Florida had some serious environmental problems, especially with trying to supply potable drinking water to a fast-growing population. Their teachers included these problems as part of the activities for a Future Problem-solving student competition.

The teachers of the gifted students incorporated an environmental curriculum as enrichment to the regular science and social studies programme. The investigations involved on-site studies of our campus' native oak hammock and its encroaching exotic species. Years ago there were field trips to county parks to study the flora and fauna of South Florida and to National Parks in the vicinity such as Biscayne Bay National Park. There were overnight camping trips to the Everglades National Park. Each year in the northern spring, the gifted students took an overnight two-day trip to Sea Base on a Florida Key where they were taken by boat out to the reefs to learn about the marine environment. They were immersed in ecology and experienced the outdoors. Environmental education was a part of their lives. Some of these students and parents told me years later that the trip had made a lasting impression on them and their views on saving the environment.

In order to paint a picture of some of the activities in which students participated over the past 20 years, I asked a teacher of the gifted, who retired a few years ago, to write what activities she remembered teaching and accomplishing with the students pertaining to the environment (see Appendix A-3) Firestone, S. (personal communication April 18, 2003). The way gifted students were instructed was strikingly similar to the Issue Investigation and Action Training (IIAT) proposed by Hungerford (Ramsey, 1993) and promoted by the North American Association for Environmental Education (NAAEE) and the Environmental Education and Training Partnership (EETAP).

Times have changed since this veteran teacher, Mrs. Firestone, retired. A few years later, during the time of this study, students were tested and re-tested for comprehension and skills in mathematics, science, writing and reading. Long-range problem-solving was limited. Very few field trips were allowed and then only after the month of testing. Most subjects were taught in isolation from one another. This writer had grave concerns as to whether or not this new paradigm of education enabled students to think about and actually affect the future.

1.3.4 Personal Experience and Rationale for the Study

I was unaware of the interconnectivity of my local South Florida's urban areas with the Everglades until about 10 years ago. I was not educated enough to understand the problem. I had first visited the Everglades in 1949 as a little child with my parents, and remembered the vastness and the swampland. About 10 years ago saving the Everglades started making the daily news. I wanted to find out more about the Everglades so I could teach my students some facts to help them solve future problems. Informational sessions were advertised in the newspaper and the public in many different cities became part of the process of deciding who should get the water coming from around the centre of the state (Orlando-Disney World area) to South Florida. Twenty other people and I met in a hall in Coral Gables where we learned about the history of the Everglades and the efforts of the state to improve the water flow. Before the end of the meeting, the group came to a consensus in deciding where we thought the water in South Florida should be used. Our decision was reported back to the Army Corps of Engineers and other groups that were involved. The Comprehensive Plan was developed a few years later through an inclusive and open process that engaged all stakeholders and interest groups. Numerous federal, tribal, state and local agencies were full partners and their views were considered. And so, all concerned people were involved and the process evolved (see Appendix A-7). As my own education of the environment of South Florida evolved my awareness of the need to educate young children about environmental issues heightened.

I had discussed the issues of educating young school children in environmental education and supporting the quality of our South Florida environment with Elaine Sevin who ran the very successful Officer Snook Programme in cooperation with the US Coast Guard. Mrs. Sevin, and her daughter Jennifer (who was a high school student at the time), designed and copyrighted *The Water Pollution Educational Coloring and Activity Book Officer Snook* for students in South Florida's schools. They have since expanded to many other programme. They were wonderful mentors to me for many years in helping students learn about protecting our oceans, lakes, rivers and canals from pollution (Sevin & Sevin, 1993).

In 1997, Elaine and Jennifer Sevin were instrumental in arranging for my students to go on a field trip to the International Oil Spill Conference held at Port Everglades, where the ocean liners come in to Ft. Lauderdale, Florida. My elementary students watched airplanes drop water and hydrophilic chemicals from the air to demonstrate how chemicals can break up and dissolve oil spills that occurred at sea. Students saw the large ship that was a combined purchase of three major oil companies that would go out to sea when notified to help contain the oil spill. The sailors would let out a solid plastic material to float around the oil spill like a ring, and then use chemicals to dissolve it before it came to shore where it could do major damage, as did the tanker Exxon Valdez in Alaska in the year 1989. This conference and show was a lesson I will never forget in teaching about improving environmental protection. It showed that the oil industry is trying to make progress and addressed their challenges and responsibilities.

In the years 2001-02, I wanted to find out if anyone had done a valid, reliable survey for South Florida elementary school students. I asked Mrs. Sevin if she had done one. She had not, but said she would like to do one so that she could deliver her lecture programme to the diverse groups and know more about her audience. We discussed having three schools in each ethnic sector of the county take a survey and wrote up some questions that are relevant to ask our students in South Florida whether the students are in Little Haiti, Little Havana, Homestead Migrant Area or Miami Lakes. The survey would be translated into Spanish and Haitian Creole for those students who needed it (see Appendix A-8). I decided that I would need to give

a survey that was valid and reliable before I undertook writing one of our own. We had hopes of writing our own survey in the future.

Then, I went to my school science coordinator who had been with the district working in environmental education for the past few years. She only knew of the surveys the Friends of the Everglades gave as a pre test/post test for their outreach speaker in the school. I had seen their ten-question test, which was geared for their 50-minute presentation. I asked other teachers in the school if they had heard of any environmental surveys. No one had heard of any.

I visited the Biscayne Nature Centre (see Appendix A-9). Our grade-5 students were having hands-on activities investigating South Florida's limestone, mangroves, and sea life of both vertebrates and invertebrates in 20-gallon saltwater tanks. The students had a booklet in which they could follow the activities they were doing and then write in their results, but had no pre test to assess their prior knowledge.

I visited MAST (Maritime Academy of Science and Technology) with my grade-3 students to see the solar celebration of inventions the senior high school students had on display (see Appendix A-10). I asked the teachers there if they knew of any environmental survey for elementary school students. Yet again, none had heard of any comprehensive survey pertaining to environmental education. I then attended and asked at an environmental workshop for Miami-Dade County teachers at Fairchild Tropical Garden where we learned about habitats, world environmental problems of endangered species and how to plant a butterfly garden. I met people from environmental coalition of agencies in South Florida who directed me to others. I emailed EPA Environmental Protection Agency, the Miami Museum of Science and the South Florida Water Management District (SFWMD) where I had taken numerous environmental courses geared for teachers. No one knew of any student surveys that were comprehensive for many environmental issues.

Subsequently, Sandra Jurban at SFWMD.gov emailed me on January 31, 2003 to find out if I had found a survey and how my survey turned out. She asked me if she would be able to get a copy of those results. I told her I would let her know when I get the results of my survey.

I asked the Florida Solar Energy Education Programme, the International Game Fish Association in Ft. Lauderdale, and the educator at Sea Base, Pigeon Key. None of the educators at these agencies knew of any environmental survey that I could give for South Florida elementary school students.

I then called the Audubon Society. I spoke to the head of the children's outreach programme. She had previously been a counsellor in a three-day, two-night South Florida Ecology Programme at Pigeon Key, in the Florida Keys. I had arranged in years past for my gifted students to attend. We spoke about how wonderful the programme was. She said the programme was in jeopardy of closing because very few classes were signing up to attend due to the time involved preparing students for the mandated state testing. I told her my idea to use a survey to find out what the students know about the environment and she said she had taken a class about writing a survey at Pine Jog Environmental Centre in West Palm Beach, Florida taught by Professor Martha Monroe at the University of Florida.

I emailed Professor Monroe, Assistant Professor/Extension Specialist, School of Forest Resources and Conservation, University of Florida, Gainesville. She wrote, "I think it is always important to get a handle on what our learners are picking up from our teaching" (Monroe, 2003). She put me in touch with Julie Athman from the University of Florida education department. Ms. Athman recommended I find CHEAKS Children's Environmental Attitude and Knowledge Scale in the *Journal of Environmental Education*. I found the article Children's Environmental Attitude and Knowledge Scale: Construction and Validation. I decided to use this survey because it had high reliability with US students. The test-retest correlations were generally quite high and provided support for the stability of both environmental attitudes and knowledge.

My personal experience has made me more aware of environmental problems and concerns relating to our South Florida area and the world (see Appendix 11). My students have learned about them with me. A few other teachers in the school find time to teach about environmental problems of South Florida, especially since Florida is the theme for the grade-4 social studies curriculum. Environmental

education needs to have a presence in the elementary school curriculum with students involved in significant, although sometimes controversial, issues.

1.4 Statement of the Problem

In my classroom, students learned by sensory experiences (seeing, hearing, smelling, tasting, and touching) and learned by direct instruction, reading, researching, technology, collaborating, concept mapping, brainstorming, hands-on activities, journal writing, listening to speakers, gathering first-hand information from the environment, problem-solving and presenting projects. The gifted students were usually fast learners and liked to help others to succeed. They were usually the leaders of the school in academics and student-council activities and I had high expectations for them in life. Many of the former gifted students in our programme (which had been in existence for 30 years at the school) came back in the role of classroom guest speakers. They were extremely intelligent and altruistic and likely to be problem solvers and leaders in the community.

One of the most empowering gifts education in this country can bring to the individuals young and old is the recognition that we each have a role in the shaping our own lives, our homes, our workplaces, our communities, our world. And that is why education is so vital—not indoctrination—but empowerment—through access to information that allows us to make those decisions with the best information available. (Mortensen in Wheeler & Bijur, 2000, p. 15)

Another guest speaker to our class was Dr. David Wolf, an astronaut, who came to our school after being on the Russian Space Station MIR for four months. During that time in outer space, he communicated with my students through Star City in Russia. He told my class about experiments that he conducted in mini gravity in which he grew human tissue very quickly. He brought this tissue back to earth in hopes of curing some human diseases. Students began to think globally from his discussion.

Just as MIR was Dr. Wolf's laboratory, our classroom was the students' idea formation laboratory. It was their Petri dish, where their ideas could incubate and take form. The classroom was my students' launch pad, where they could share their ideas with others. Before the study, I, as their teacher, wanted to find out, "Do students know about any environmental problems? If they do know the problems, do they care? If they do care, what have they done about the problems?" I conducted the study within the school setting in hopes of finding out. This study drew on elements of the constructivist paradigm. There were many parallels between teaching strategies used in environmental education and teaching approaches informed by constructivism that resulted in meaningful learning for students. Both philosophies (environmental education and constructivist methods) required students to take an active role in learning and building on factual knowledge to improve investigation and critical thinking skills.

1.5 Purpose of the Study

The general purpose of this research was to examine elementary students' knowledge of the environment, attitudes towards helping the environment and what they actually do to help the environment. This study compared two different school grades in two consecutive school years, 2002 and 2003 in one south Florida elementary school.

The specific purpose of this study was to conduct an environmental education evaluation for the elementary school in which I taught. I wanted to investigate students' knowledge of environmental issues, attitudes toward the environment and behavioural intentions toward the environment. I wanted to compare grade-4 and grade-5 students, gifted versus regular, boys versus girls. I wanted to develop a baseline so I could report my findings to our school Educational Excellence School Advisory Council (EESAC) committee of teachers, parents, business people and administrators, to implement our School Improvement Plan. The study was an attempt to provide a basis upon which others may develop and implement curriculum for improving an environmental education program. The study contains data from a formal survey and from both formal and informal interviews and from photos the students took around the campus. This research includes the use of narrative and story as a way of knowing within science education (Bruner, 1990).

1.6 Research Questions

Good research is characterized by an evolving dynamic such that the research problems and questions may only be articulated fully when the study is far advanced. (Anderson & Arsenault, 1998, p. 38)

The general purpose of this research was to find out what elementary students know about the environment, what are their attitudes towards helping the environment and what have they actually done to help the environment. It is a comparison of two different grades in two consecutive school years, 2002 and 2003.

Research Question 1: How do students in grades- 4 and -5 compare in their

- (a) verbal commitment towards the environment,
- (b) actual commitment towards the environment,
- (c) feelings towards the environment, and
- (d) knowledge of the environment?

Research Question 2: How do students in grade-4 regular and grade-4 gifted compare in their

- (a) verbal commitment towards the environment,
- (b) actual commitment towards the environment,
- (c) feelings towards the environment, and
- (d) knowledge of the environment?

Research Question 3: How do students in grade-5 regular and grade-5 gifted compare in their

- (a) verbal commitment towards the environment,
- (b) actual commitment towards the environment,
- (c) feelings towards the environment, and
- (d) knowledge of the environment?

Research Question 4: How do students in grade-6 regular and grade-6 gifted compare in their

- (a) verbal commitment towards the environment,
- (b) actual commitment towards the environment,
- (c) feelings towards the environment, and
- (d) knowledge of the environment?

Research Question 5: How do boys in grade-4 and -5 compare with girls in grade-4 and -5 in their

- (a) verbal commitment towards the environment,
- (b) actual commitment towards the environment,
- (c) feelings towards the environment, and
- (d) knowledge of the environment?

Research Question 6: What is the correlation between students' verbal commitment, actual commitment, environmental attitudes and their knowledge of the environment?

1.7 Significance of the Study

This study was significant because it helped to evaluate the effectiveness of environmental education in our school. Having never been done before, the study formed a baseline of what students in our school knew and felt about the environment and what actions they took. I analysed the data and suggested recommendations based on student needs.

In my researching where to find a survey instrument, I asked the science team in our school, our District science director Gus Lorette de Mola and other supervisors in the District. I could not find a comprehensive student survey about the environment in our county. The survey was important to gather information that was standard for environmental education. Neither this study, nor one similar had been conducted before in a Miami-Dade County School, as far as I could determine.

In our elementary school, we had speakers who gave short written surveys to the children after they presented a lesson, but no speaker, except Friends of the Everglades ever gave a pre test to assess students' prior knowledge. I felt that

giving a pre-lesson survey was important so that the students could be taught what they do not know. Then the students could be guided in making the right decisions to protect Florida's fragile environment.

The additional significance of the study was to survey and interview elementary school students to see if they have developed the knowledge, skills and motivation necessary to become environmentally literate and responsible citizens. Education plays a large part in linking science, policy and action.

The reason I was comparing grade-5 to grade-4 students was to see if the mean class knowledge, attitudes and commitment have changed in one year spent in school.

Part of students' grade-4 education concentrated on Florida history and ecology. The students were immersed in learning about Florida for many months. I expected students in grade-5 to have more knowledge, a better attitude, and more commitment towards helping the environment than grade-4 students because they already have learned Florida history and ecology the previous year.

The reason I was comparing regular and gifted students was to see if the gifted students, who usually were faster learners and had enriched curricula, scored any differently on the survey than the regular students. The reason I was comparing boys and girls was to determine if there was any significant difference in the knowledge, attitudes and commitment of the genders.

Environmental literacy is one major goal of environmental education. In this study, I evaluated what were the cognitive and affective dimensions of environmental literacy based upon these elementary school students in this particular school. I reported if any students were involved in issue investigation, action training, and community problem solving, which leads to responsible environmental behaviour as recommended by Volk and McBeth (2001).

Issue Investigation and Action Training model (IIAT) and Community Problem-solving model (AR&CPS) have a positive impact on attitudes, socio-political knowledge, environmental issue knowledge, cognitive skill

development, and both responsible environmental behaviour and several determinants of responsible environmental behaviour. (p. 78)

1.8 Summary of the Chapter

In this chapter, I have described the background of the elementary school and the teaching situation where the research took place. It revealed the problem that not all students are taught environmental education as a part of the elementary school curriculum. The chapter included the research problems and questions, and the significance of the study. The structure of the thesis promoted the investigation of the research questions, which were presented together with the background of the problem and my personal experience in environmental education and finding a suitable evaluation instrument.

CHAPTER 2

REVIEW OF RELATED LITERATURE

2.1 Overview of Chapter 2

In this study, I investigated the breadth of environmental knowledge, attitudes and behaviours of grade-4 and grade-5 students in the elementary school in which I taught. Guided by the purposes of this study, I reviewed three main areas of literature to help guide and frame the design of the study. Because environmental education was examined, the first area considered in this chapter was the research relevant to the history of the social development of environmental education in the United States and the world (Section 2.2). The second area considered was the current science and environmental education curriculum available in South Florida (Section 2.3). And the last area considered was research reported in the field of environmental education based on students' knowledge, attitudes, behaviours and environmental learning outcomes (Section 2.4). The chapter concluded with a summary of the literature review (Section 2.5).

2.2 Importance and History of the Development of Environmental Education

2.2.1 Importance of Environmental Education--A Challenge to Educators

One of the drawbacks to teaching environmental education (EE) in schools is that the subject has not found an established niche in the US curriculum. According to Ramsey (2001), “Most school-based educators have not adopted a frame of reference of either EE curriculum or instruction, although they are widely used in non-formal contexts (e.g., in zoos, museums, and parks). EE in US schools is not theoretical, systematic, or comprehensive” (p. 111). Consequently, educators have a challenge to promote environmental education into a more integrated systems’ approach rather than have discrete educational topics. Students should be aware of the interconnections and multiple perspectives as they learn about sustainability, thereby gaining the skills to understand and apply this systems thinking that includes their

own lives and communities. Wheeler & Bijur (2000) claim that educators have an additional challenge to develop students' self-awareness to understand, reflect on and communicate through new eyes of sustainability in order to find ways that will make life better for all, for a long time to come (p. 2).

The most promising areas of instruction appear to be in community investigations and citizenship participation. The instruction in community investigations is included in Hungerford's Issue Investigation and Action Training Model (IIAT) (Ramsey, 1993) which was based on the Tbilisi objectives and Stapp's Action Research and Community Problem-Solving model (AR&CPS) (Stapp, 1969). The group of studies appeared to have a positive impact on attitudes, socio-political knowledge, environmental knowledge, cognitive skill development, and both responsible environmental behaviour and several determinants of responsible environmental behaviour (Volk & McBeth, 2001).

2.2.2 International Environmental Policy Development

As early as 1957, Rachel Carson claimed that environmental education was necessary for everyone on this planet (Lear, 2003). She wrote several articles designed to teach people about the wonder and beauty of the living world, including *Help Your Child to Wonder* (1956) and *Our Ever-Changing Shore* (1957), and planned another book on the ecology of life. Embedded within all of Carson's writing was the view that human beings were but one part of nature, distinguished primarily by their power to alter it, in some cases irreversibly. (This question is posed as question # 39 on the Knowledge section of CHEAKS.)

Disturbed by the profligate use of synthetic chemical pesticides after World War II, Carson reluctantly changed her focus in order to warn the public about the long-term effects of misusing pesticides. In *Silent Spring* (1962) she challenged the practices of agricultural scientists and the government, and called for a change in the way humankind viewed the natural world. Rachel Carson wrote, 'The more clearly we can focus our attention on the wonders and realities of the universe about us, the less taste we shall have for destruction' (Lear, 2003).

Similarly, in attempting to understand Earth as a system, since the launch of the first spacecraft Sputnik by the Soviet Union in 1957, the public change in thinking and values moved towards a more holistic approach. In 1957, Charles David Keeling began taking measurements of carbon dioxide (CO_2) in the atmosphere from Mauna Loa, Hawaii. Those data revealed increasing atmospheric CO_2 at the planetary scale. The National Academy of Sciences issued reports from panels and committees organized under leading scientists such as Roger Revelle and Jule Charney in the 1970's and early 1980's hypothesizing that the burning of fossil fuels could enhance the greenhouse effect (Mortensen in Wheeler & Bijur, 2000, p.16). This is a concept I teach to all students.

The first landmark for Environmental Education at the international level was the United Nations' Conference on the Human Environment in 1972 in Stockholm (UNESCO, 2005a), which strongly expressed the need for an international framework for the development of EE. Following up on the recommendation of this conference, a series of regional and sub-regional meetings on EE were organized worldwide in the succeeding years, culminating in the International Workshop on Environmental Education in Belgrade in 1975 and the launch of the International Environmental Education Programme (IEEP) jointly by the United Nations Education, Scientific, and Cultural Organization (UNESCO) in cooperation with the UN Environment Programme (UNEP). One of the major recommendations of this workshop was to convene an international conference on EE specifically addressed to policy and decision-makers in education (UNESCO, 2005b). The major objective of the Intergovernmental Conference on Environmental Education, organized by UNESCO in co-operation with UNEP in Tbilisi in 1977 (UNESCO, 2005c) was to make recommendations to participating member states to enable them individually to adopt national policies promoting EE. The Conference marked the transition to the completely new level of ecological education all over the world (UNESCO, 2005a) (see Appendix B-1). The Tbilisi (Russia) Principles stated that an environmental education programme should "consider the environment in its totality—natural and built, technological and social, political, cultural-historical, moral and aesthetic" (Paden, 2000). Ten years later in 1987, UNESCO and UNEP organized an International Congress in Moscow, USSR. This was in order to determine an international strategy for action in EE and training for the 1990s.

The World Commission on Environment and Development (WCED) issued its report based on a four-year study commissioned by the UN General Assembly. This report developed the theme of sustainable development, a kind of development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs (United Nations General Assembly, 1987). Studies continued and found change in climate to be a global problem. Consequently, the United Nations Intergovernmental Panel on Climate Change (IPCC) was formed in 1988 (see Appendix B-2).

By the mid 1990's the IPCC projected that increased burning of fossil fuels may result in a rapid increase of atmospheric CO₂ with potential global average temperature increases of 1.5 to 4.5 degrees Celsius by the year 2100 producing worldwide climate changes. Subsequent periodic assessments continue to be conducted, representing scientific consensus around issues of global magnitude (Mortensen in Wheeler & Bijur, 2000, p. 17).

To assess 20 years of work in the field of environment following the 1972 Stockholm conference, the United Nations organized a Conference on Environment and Development (UNCED) also called the Earth Summit in Rio de Janeiro, 1992 (see Appendix B-3) (UNESCO-UNEP, 1992). Chapter 36 in Agenda 21 is the chapter concerned with education. The UN Commission on Sustainable Development (CSD) monitors progress on Agenda 21.

It is therefore, not only necessary to deal with the problems but even more essential to get our thinking right: to see interrelations among (these problems) and recognize the fundamental need to develop a new perspective rooted in the values of sustainability. It is this need, which makes education the key to creating a sustainable future (Mortensen in Wheeler & Bijur, 2000 p. 19).

The outcomes were crystallized in Agenda 21, entitled "Promoting Education, Public Awareness and Training" and established the basis for action in environmental education for sustainable development for the years to come. Ten years later, in September 2002, the UN organized the World Summit on Sustainable Development

(WSSD) in Johannesburg, South Africa. This was in order to assess progress made in sustainable development on a worldwide basis.

2.2.3 Global Change Education and Sustainability

The project "Educating for a Sustainable Future" was launched in 1994. It was the principal mechanism within UNESCO to follow-up the recommendations concerning education made by the major UN conferences of the 1990s and the conventions on biological diversity, climate change and desertification. It was intended to mobilize, integrate and innovate all disciplines.

The project was organized on an experimental basis, in order to serve as a vanguard for UNESCO by bringing it closer to the realities within member states, and by developing new modalities of planning and action. The work of the project "Education for Sustainable Future" is based on the three-pronged concept of transdisciplinarity, innovation and partnering. The project has established close links with the rest of UNESCO's work in education, as well as with other sectors of the Organization and partners of UNESCO worldwide. The project states that education is the most effective means to confront the challenges of the future (see Appendix B-4).

Education, the key to a viable future, is essential to sustainable development. In many respects education makes a positive contribution to combating the problems of poverty, the degradation of the environment and the improvement of nutrition. Improved access to education for girls and women yields tangible benefits, including reductions in birth rates and improvements in female and infant health. Education is also an important factor in fostering social cohesion and democratic government.

Scientific education has a unique part to play in facilitating sustainable development because it can widen our capacities, especially in areas such as Eco-technology and the development of renewable energy sources, and it can ensure the widespread availability of scientific information, which in turn is

increasingly necessary for informed ethical decision-making (UNESCO, 2001).

Subsequently, national science education standards in the United States were established (National Research Council, 1996). I became aware of them in the year 1998 when I applied for National Board of Professional Teaching Standards and became a National Board Certified Teacher the following year.

The voluntary (US) national standards in various subject areas issued in the last few years provided a framework for integrating concepts of sustainability and issues of global change into the curricula (see Appendix B-5). Educators are utilizing these standards to give credibility and support for incorporating these concepts in multiple disciplines. As cautioned in 1993 by the Federal Coordinating Council for Science, Engineering and Technology,

The actual level of public understanding about the basic scientific concepts that explain and offer solutions to environmental threats such as those posed by global change and wetlands destruction remain limited. The problem is that without sufficient knowledge and training, the public may not be able to respond to an environmental challenge because they lack sufficient scientific understanding of the problem (Federal Coordinating Council for Science, Engineering and Technology, 1993). (quoted by Mortensen in Wheeler & Bijur, 2000, p. 21)

A US Executive Order in 1993 created The National Science and Technology Council (NSTC) and also established the President's Committee of Advisors on Science and Technology. This Council established clear US national goals for federal science and technology investments and ensured that the science, space and technology policies and programme were developed and implemented to effectively contribute to those national goals (Federal Coordinating Council for Science, 1993).

This vision had been reflected in the new international consensus and framework for action. At the nineteenth special session of the United Nations General Assembly held in June 1997 to review the implementation of Agenda 21 five years after Rio,

the work of Chapter 36 was given further impetus by the reaffirmation of governments of the importance of education in achieving sustainability. The resolution adopted by the session emphasized that a “fundamental prerequisite for sustainable development is an adequately financed and effective education system at all levels, particularly the primary and secondary levels, that is accessible to all and that augments both human capacity and well-being” (National Research Council, 1996).

UNESCO and the Government of Greece jointly organized the International Conference on Environment and Society, held in Thessaloniki, Greece in December 1997, at which 1,200 experts from 84 countries attended. The Declaration of Thessaloniki emphasised education and public awareness for sustainability of the environment, contributing to the work of the United Nations Commission on Sustainable Development (CSD) on Chapter 36 of Agenda 21, for which UNESCO is task manager (see Appendix B-6). This conference no longer defined education as an objective in and of itself, but as a means to bring about changes in behaviour and lifestyles, to disseminate knowledge and develop skills, and to prepare public support for change towards sustainability emanating from other sectors of society. All subject areas, including the humanities and the social sciences need to address issues related to environment and sustainable development. Addressing sustainability requires a holistic, interdisciplinary approach, which brings together the different disciplines and institutions while retaining their distinct identities (UNESCO, 2001).

More than 160 nations met in Kyoto, Japan in 1997, to negotiate binding limitations on greenhouse gases for the developed nations, pursuant to the objectives of the Framework Convention on Climate Change of 1992. The outcome of the meeting was the Kyoto Protocol, in which the developed nations agreed to limit their greenhouse gas emissions to at least five percent below 1990 levels by 2008-12. Article 3 of the Kyoto Protocol of 1997 states, "These and other international agreements demonstrate the link between science and policy. The link between policy and action is dependent in large part on education" (Mortensen in Wheeler & Bijur, 2000, p. 20). The United States agreed to reduce emissions from 1990 levels by seven percent during the period 2008 to 2012 (see Appendix B-7).

The World Summit on Sustainable Development of the 55th General Assembly of the United Nations was held in Johannesburg, South Africa in September 2002. In its decision, the UN General Assembly called for a 10-year review of progress achieved in the implementation of the outcome of the United Nations Conference on Environment and Development (UNCED). This was to reinvigorate, at the highest political level, the global commitment to sustainable development. Some important new targets were established, such as to halve the proportion of people without access to basic sanitation by 2015; to use and produce chemicals by 2020 in ways that do not lead to significant adverse effects on human health and the environment; to maintain or restore depleted fish stocks to levels that can produce the maximum sustainable yield on an urgent basis and where possible by 2015; and to achieve by 2010 a significant reduction in the current rate of loss of biological diversity (UNESCO, 2002).

2.2.4 United States National Environmental Policy Development

Thomas Jefferson first set aside land in 1774 in the Colony of Virginia for future generations to enjoy. This purchase of a gigantic natural limestone arch from British King George III protected it from harm. Early explorers mapped the United States' western frontier and developed a reverence for the West's seemingly limitless resources and expansive views. "America the Beautiful," an anthem to the United States' spacious skies, majestic mountains, and vast fields and forests, records their feelings.

Theodore Roosevelt was the first conservationist president of the United States. He set aside five national parks, more than 50 wildlife preserves, and hundreds of national forests. He made environmental protection--especially land conservation--a priority for the US government. Today, the National Park System that Roosevelt launched encompasses areas combined to equal land roughly the size of Germany. The United States government also manages another 220 million hectares of wildlife reserves, refuges, wilderness areas and marine sanctuaries.

On April 22, 1970, 20 million Americans gathered to celebrate the first Earth Day: A grass-roots movement was started to clean up the environment and protect it from

future harm. The National Environmental Policy Act (NEPA) established in 1969 in the United States declared a national policy, which encouraged productive and enjoyable harmony between human beings and their environment. The act promoted efforts to prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humans. Further, the act proposed to enrich the understanding of the ecological systems and natural resources important to the Nation and to establish a Council on Environmental Quality (CEQ) within the Executive Office of the President. The Environmental Quality Improvement Act of 1970 provided additional responsibilities. In enacting NEPA, Congress recognized that nearly all the federal activities affect the environment in some ways and mandated that before federal agencies make decisions, they must consider the effects of their actions on the quality of the human environment. NEPA assigned CEQ the task of ensuring that federal agencies met their obligations under the Act. The challenge of harmonizing our economic, environmental and social aspirations has put NEPA at the forefront of our nation's efforts to protect the environment.

As the nation's principal conservation agency, the Department of the Interior has the responsibility to insure the preservation of most of the United States' nationally owned public lands and natural resources. This responsibility includes fostering the wisest use of the land and water resources, protecting fish and wildlife, preserving the environmental and cultural values of the national parks and historical places, and providing for the enjoyment of life through outdoor recreation. (United States Geological Survey, 2005)

Assistant US Secretary of State for Oceans, International Environmental and Scientific Affairs, John Turner testified at a joint Senate hearing for both the Senate Committee on Environment and Public Works and the Senate Committee on Foreign Relations on July 2, 2002. He outlined the history and status of US involvement and implementation in five international environmental agreements: the Montreal

Protocol on Substances that Deplete the Ozone Layer; the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); the UN Framework Convention on Climate Change (UNFCCC); the North American Agreement on Environmental Cooperation (NAAEC); and the UN Convention to

Combat Desertification (UNCCD) (see Appendix B-8) [US Department of State's Office of International Information Programmes, 2002].

Two years later, in 2004, Secretary Turner once again stated

The years immediately following that first Earth Day were a vibrant period for environmental legislation in the US. The US environment is healthier today than it was when the modern environmental movement began. This is pretty impressive considering that in the past 30 years the US Gross Domestic Product (GDP) increased 160% while energy consumption grew only 45% [US Department of State's Office of International Information Programmes, 2004] (see Appendix B-9).

Conversely, the New York Times and NBC Nightly News reported on Wednesday June 8, 2005

WASHINGTON (Reuters) - A White House official who previously worked for the American Petroleum Institute has repeatedly edited government climate reports in a way that downplays links between greenhouse gas emissions and global warming. In a memo sent last week to top officials dealing with climate change at a dozen agencies, Piltz charged that "politicisation by the White House" was undermining the credibility and integrity of the science programme. (See Appendix B-10) (NBC, 2005).

In order to defend and improve the environment for present and future generations of all living things, students and educators must make knowledge of, and attitudes towards the environment an educational goal.

2.2.5 A Summary of the Research on the Importance and History of the Development of Environmental Education

Environmental education as a lifelong study can help citizens respond to an ever-changing world. Environmental education is by its very nature highly interdisciplinary. Some aspects fit into existing curricula as science, and some as

social studies, but the two subjects are usually not coordinated with one another in the classroom. Currently, environmental education is only taught in United States schools to the extent that teachers want to include it.

The history of environmental education in the United States started with the founding of the country in the 1700's when land was put aside for public use. Rachel Carson's writing in 1957 alerted people that the environment is fragile and humans can do irreparable damage to it. International Conferences that addressed environmental education included: Tblisi Declaration 1977; UN Conference on Environment and Development (Rio de Janeiro) 1992; UNESCO Education for Sustainable Development; Declaration of Thessaloniki, Greece 1997 and UN Kyoto Conference of the Parties, 1997. Educating for a sustainable future today involves and integrates all disciplines.

2.3 Curriculum Foundations in Environmental Education

Public understanding about the basic scientific concepts that explain and offer solutions to environmental threats such as those posed by global change and wetlands destruction remains limited. Educators are using the voluntary national standards in teaching about environmental education, sustainability and issues of global change in all subject areas.

2.3.1 National Science and Geography Standards

The national science standards and the national geography standards readily show an acceptance of the need for students of all ages to understand the complexities of our global environment (see Appendix B-5).

However, without sufficient knowledge and training, the public may wish to respond to an environmental challenge, but may not be able to do so effectively because they lack sufficient scientific understanding of the problem (Federal Coordinating Council for Science, Engineering, and Technology, 1993) (Mortensen in Wheeler & Bijur, 2000). To acquire this knowledge and training, it is essential that multiple disciplines be engaged in the many faceted aspects of global change, including the human

dimensions. As stated in the Thessaloniki Declaration at an international conference in 1997,

All subject areas, including the humanities and the social sciences need to address issues related to environmental and sustainable development. Addressing sustainability requires a holistic, interdisciplinary approach, which brings together the different disciplines and institutions while retaining their distinct identities (Mortensen in Wheeler & Bijur, 2000, pp. 21-22).

2.3.2 The US Global Change Research Programme

In the United States, education is the responsibility of each of the states. One of the programmes of the United States Global Change Research is designed to develop a national literacy and teaching capability in global change education among US educators through state wide systemic approaches. In this programme, research in science and social science are communicated through integration in state-wide core curricula, through professional and association meetings at regional and national levels, and by programmes conducted in museums, science centres, and community groups (Mortensen in Wheeler & Bijur, 2000, p. 22) (see Appendix B-11).

2.3.3 The National Environmental Education & Training Foundation

Chartered by Congress in 1990, the National Environmental Education & Training Foundation (NEETF, 2003) is a private non-profit organization dedicated to advancing environmental education in its many forms. Since it was established, the Foundation has become a leader in the development of new policies, grant-making approaches, and direct programming to advance environmental literacy in America. I have applied for school gardening and environmental grants through NEETF (see Appendix B-12).

2.3.4 State Education and Environmental Roundtable

Issue Investigation and Action Training is used in the Environment as an Integrating Context (EIC Model™) which is a part of State Education and Environmental

Roundtable (SEER). SEER is a cooperative endeavour of 16 state Departments of Education which works to enhance student achievement, improve K-12 instructional practices and help schools achieve their improvement goals by implementing the EIC Model™ using the Environment as an Integrating Context for improving student learning. SEER investigates the academic and behavioural efficacy of environment-based education and organizes seminars to facilitate collaboration among SEER's member state agencies. <http://www.seer.org/> (Lieberman, 2002).

2.3.5 Environmental Education in Florida

The Florida Legislature has mandated that the public educational system, from kindergarten through university, act as the primary delivery system to create environmentally literate citizens. The legislature recognized that environmental education is critical to maintaining the delicate relationships among all forms of life and to preserve the earth's capability to sustain life in the most healthful, enjoyable and productive environment possible (Florida Statutes, 229.8005, sec. 30, para. 2, 1989). The Office of Environmental Education was charged with the responsibilities (in part) to: (a) assess environmental education needs in all school districts; (b) assist with environmental education comprehensive plans; and (c) evaluate the success of student and in-service training. The Florida Legislature mandated that the public school system, from kindergarten to university, act as the primary delivery system to create environmentally literate citizens (see Appendix B-13) (Florida Natural Resources Conservation, Reclamation and Use Act, 2002).

Within this context, Bogan & Kromrey (1996) conducted an evaluation of the environmental education curriculum in two school districts in central Florida. According to Bogan, prior to the 1989 legislation, environmental education was taught primarily at the discretion of the individual school districts. Curricula, when present, varied widely and depended on the interests of individual teachers and the monetary allocations of their districts.

Florida's Office of Environmental Education provides support for educational initiatives within the Department of Environmental Protection as well as those conducted by the diverse community of environmental education providers

throughout the state. Emphasis is on compliance education and environmental citizenship. The Office of Environmental Education programme seeks to cultivate and support environmental citizenship: the awareness, understanding, and appreciation of Florida's environment; and the capacity to think critically, and participate constructively in its protection. Together with other government agencies, non-profit organizations, the academe, and the private sector, the Office of Environmental Education contributes to the structure, programme and funding of environmental education in Florida.

The Florida Department of Environmental Protection is the lead agency in state government for environmental management and stewardship (see Appendix B-14). The department is the main architect of the \$7.8 billion funding and management plan to restore America's Everglades – the largest water restoration project in the history of the world. Learning about the Everglades is a part of the curriculum for fourth grade students and I invite speakers to the school to teach students about saving the Everglades (FDEP, 2004).

2.3.6 TV Channel 10 (Local) News

TV Channel 10 (local) News has a website pertaining to Early Development: Everglades National Park. It is a good resource for the students and indicates how people who once thought they were doing the right thing in draining the Everglades actually were doing harm to the entire ecosystem (see Appendix B-15).

2.3.7 Comprehensive Everglades Restoration Plan

The primary and overarching purpose of the Comprehensive Everglades Restoration Plan, CERP (not to be confused with CERP, the Wisconsin Campus Ecology Research Project) is to restore the south Florida ecosystem, which includes the Everglades. This purpose has guided all aspects of the Plan's development and proposed implementation. It is a framework and guide to restore, protect and preserve the water resources of the greater Everglades ecosystem. The Plan has been described as the world's largest ecosystem restoration effort, and includes restoring natural flows of water, water quality, and more natural hydro/dry periods within the

remaining natural areas. The Plan is intended to result in a sustainable south Florida by restoring the ecosystem, ensuring clean and reliable water supplies and providing flood protection. With no change, the region soon will experience frequent water shortages, there will be continued degradation of the Everglades, coastal estuaries, fisheries and other natural resources. Flooding will become more frequent.

The implementation of the Comprehensive Everglades Restoration Plan will result in the recovery of healthy, sustainable ecosystems in South Florida. The Plan will lead to a stronger economy and a much-improved environment for people, animals and plants that depend on the natural system for their survival. The Plan will redirect how water is stored in south Florida so that excess water is not lost to the ocean, and instead can be used to support the ecosystem as well as ever-increasing urban and agricultural needs. Projections of future water demands without the implementation of the Plan indicate serious levels of water supply cutbacks and significant impacts to natural areas. Under the Plan, new storage facilities will be built throughout the region to ensure a more reliable water source for the natural, urban and agricultural areas. The ability to sustain the region's natural resources, economy, and quality of life depends, to a great extent, on the success of the efforts to enhance, protect and better manage the region's water resources.

The Comprehensive Plan contains essential components to achieve the goal of making South Florida sustainable. Many believe that no other plan, especially one on a smaller scale or one lacking appropriate balance between ecosystem restoration and future urban and agricultural water supply objectives, will achieve a similar level of success.

2.3.8 South Florida Water Management

The South Florida Water Management District (SFWMD) is a regional agency of the State of Florida, and is charged with managing and protecting water resources of the region by balancing and improving water quality, flood control, natural systems and water supply. SFWMD's boundaries extend from central Florida to Lake Okeechobee, and from coast to coast, from Fort Myers to Fort Pierce, south through the sprawling Everglades to the Florida Keys and Florida Bay. South Florida Water

Management District (SFWMD) offers classes for teachers. I have taken two of their classes and have found them extremely informative. They sponsor writing and art contests to help inform students of saving water. My students have won many of their awards.

In collaboration with Florida State University, they published *A Needs Assessment and Evaluation of the South Florida Water Management District's Environmental Education Programme* prepared by the Energy and Environmental Alliance in 1994 by Morrell, Doty and La Hart. The survey had been given to environmental professionals, some of the general population of Floridians and some tourists. I received this final report of the environmental professionals, general population of Floridians, and tourists. The report concluded that:

- All groups share the common value that environmental education is an important and worthwhile activity;
- Although the general population of Floridians is concerned with environmental issues, there is an extremely low level of information and understanding about the environment, even at the most basic level.
- Water resource issues are currently the most important environmental concern to the general population of Floridians—others are growth management/land use, habitats and ecosystems, coastal protection and personal action, all of which are connected to water resources; and,

Environmental action programme can and should be a part of environmental education programme in Florida (Morrell, Doty and Lahart, 1994).

2.3.9 The Officer Snook Water Pollution Programme

Each year the Officer Snook Water Pollution Programme is presented to the students of Highland Oaks Elementary School at my request. My students have attended the International Oil Spill Conference as guests of Officer Snook Programme. The Officer Snook Water Pollution Programme was created in 1993 by Jennifer Sevin, then a high school student, for the purpose of educating children about the causes, effects and solutions to water pollution. In 1994, the Officer Snook Programme was

incorporated into the US Coast Guard Sea Partners Campaign. Since its inception, the Programme has been expanded tremendously and today is designed to target a variety of audiences using multiple educational methods and community activities nationwide and abroad. To date, the Officer Snook Programme has been employed to educate well over 1.2 million students and over 65,000 educators nationally (Sevin & Sevin, 1993).

2.3.10 Young Friends of the Everglades

Each year I arrange for representative of the Young Friends of the Everglades Programme to come to our school to talk to the grade-4 students about the issues involving saving the Everglades. Grade-4 and grade-5 students in South Florida founded the Young Friends of the Everglades in 1994. This student organization was initially formed in response to plans to build a sports entertainment theme park on a site needed for wetlands restoration. The students learn about South Florida and its unusual features of climate, biology, and geography in the Everglades. This presents a living laboratory for global studies of nearly every environmental problem evident in the world today (Douglas, 2004a).

2.3.11 Audubon Sea Base at Pigeon Key

Audubon's three-day trip to Sea Base at Pigeon Key was the highlight of the year for many of the gifted elementary school students at our school until 2003 when field trips became limited because of FCAT preparation. During the time of this study, the students in this school did not go to Sea Base. For two days, students snorkelled on near-by Sombrero Reef and in the bays where mangroves harboured natural nurseries for newborn marine life. Students participated in the Pigeon Key's education programme offerings, which included a host of shoreline studies on a unique island location in the heart of the Florida Keys where the coral reef system is the third largest in the world. Sea Base programme were designed to challenge and enlighten young students with hands-on educational opportunities. They offered a variety of field trips to other nearby attractions and other in-house educational programme such as snorkelling around the entire island with the aid of the natural current, visiting the

Dolphin Research Centre and watching hundreds of tarpon fish roll in the water under a nearby pier (Pigeon Key, 2006).

2.3.12 Biscayne Nature Centre

Each year, the entire grade-5 cohort of this elementary school spends a half-day at Marjory Stoneman Douglas Biscayne Nature Centre on Key Biscayne, an island off the City of Miami. This centre is a not-for-profit organization dedicated to protecting the natural environment. The centre offered environmental educational programme to private and public school systems. Our school took part in these programme which included laboratory and field study about the Biscayne Bay area and its vast precious resources. The students learned about mangroves, sea grasses, the fossil rock reef, sand dunes and hammocks, dry land in the midst of the Everglades (Douglas, 2004b).

2.3.13 Earth Man Video Clips

The Earth Man video clips were about five minutes long and were shown to the students in the entire school every morning on closed circuit TV during the month of April during this study. The power of music and the arts that emanated from the Earth Man public performance helps to reopen people's eyes to the beauty of our Planet Earth, and the power each of us has to make a difference in our community, and our world. The students watched the clips but there was no formal class discussion about them.

2.3.14 Earth Man Project

The Earth Man Project started in South Florida and the Nashville area of Tennessee. Lanny Smith was the founder of this musical outreach, which brought a vital environmental message to more than 175 major South Florida festivals, community events, and more than 500 elementary schools. The fourth grade students in our school saw Earthman concerts at the City of North Miami Beach Water Fest each year. They were powerful interactive jazz, and blues music about the world and took the students on theatrical journeys. The concerts reconnected the audience with the

gift of life our Earth gives us, and the power people have to make a difference (www.Earthman.tv) (Smith, 2004).

2.3.15 City of North Miami Beach Water Fest

Each year our grade-4 students attend a programme at the City of North Miami Beach Performing Arts Theatre. Over 1,800 Miami-Dade County School youth learned about the importance of water conservation in South Florida. The event, sponsored by the City of North Miami Beach (NMB), South Florida Water Management District (SFWMD), and Miami-Dade Parks, was a part of ongoing water conservation and education initiatives targeting our youth. The City of North Miami Beach Public Services Department was a model for other water utilities in South Florida for many reasons. NMB Water Fest was a shining example of North Miami Beach's leadership in community water education. Earth Man performed an interactive, educational show that taught water conservation, Everglades' preservation, clean drinking water and recycling by using music and arts. The students in this study attended the Greynolds Park Water Education Expo. This included the US Coast Guard's Officer Snook Water Pollution programme, Hemispheric Centre For Environmental Technology, The Everglades Yours and Mine programme, Miami Dade Parks, Macro Invertebrate Mayhem and Incredible Journey activities, Miami-Dade Community College, Fire and Water exhibit, the SFWMD, Air Boat and Dive Boat displays.

2.3.16 The League of Environmental Educators in Florida

The League of Environmental Educators in Florida (LEEF) was committed to environmentally educating Florida's citizens. This organization provided a network for awareness, communication and growth about Florida's natural environment. The mission of LEEF was to promote environmental education in Florida at all levels and through a variety of methods and resources.

The objectives of the organization are:

- To promote community-based support for environmental issues.

- To support positive government action on environmental issues.
- To increase community involvement with the environment through education.
- To facilitate communication among environmental educators.
- To use education as a change mechanism towards a society that lives on renewable resources.

Only two out of 50 teachers were members of this organization in the school where this study took place (LEEF, 2004).

2.3.17 Project Learning Tree

From its start in 1976, Project Learning Tree was on the leading edge of educational reform, while building on tried-and-true principles of learning and teaching. Natural resource managers and educators from the American Forest Institute (now the American Forest Foundation) and Western Regional Environmental Education Council (now the Council of Environmental Education) formed a partnership to develop an unbiased, educationally sound programme for elementary and secondary students and their teachers. The partners designed PLT to be shared through trained facilitators (educators, resource managers, or other interested people) who in turn, trained others to use the curriculum and materials most effectively and efficiently (see Appendix B-16). There was a grassroots network of 3,000 active volunteers and state coordinators who trained more than 300,000 educators to reach students. New workshops took place almost every week. I had taken a few of these very informative workshops.

An evaluation of teacher's use of PLT in Florida was conducted for the Florida PLT Steering Committee. Interviews, focus groups, and mail surveys found that 75% of those who are trained to use PLT used it with children, and 75% of these educators have used PLT in the classroom in the last two years. In 2004, most teachers used less than six activities per year in the classroom or on school grounds believing that the Florida Sunshine State Standards (SSS) and the Florida Comprehensive Assessment Test (FCAT) reduced their use of PLT. In response to this situation, the Florida PLT Steering Committee expanded the guide to using PLT to meet the

Sunshine State Standards and restructured the workshops to demonstrate how PLT activities can help students prepare for assessment tests (Project Learning Tree, 2004).

2.4 Evaluation of Environmental Education Programmes in terms of knowledge, attitude, and environmental learning outcomes

2.4.1 Introduction

As previously stated, this study examined not only students' environmental knowledge but also their attitudes and actions (that they may have or have not taken). According to Hungerford and Volk (2003, p.4), "despite the many efforts of the past 20 years, environmental education still has a largely inadequate, relatively inconsistent, and scattered presence in the curriculum." However, Hart and Nolan (1999, p.1) claim, "environmental education research is a more complex and controversial field than it was a decade ago." Since Posch's (1993) review, research in environmental education has expanded internationally and become more methodologically diverse and sophisticated. The majority of research studies published in the 1970's and 1980's were quantitative. These studies were concerned with the identification, prediction, and control of the variables that were believed to be the critical cognitive and affective determinants of responsible environmental behaviour (Hines, Hungerford, & Tomera, 1986/1987).

While past environmental education research has focused on environmental education programmes, little is currently known about how and why programmes are able to bring about certain learning outcomes (Rickinson, 2001, p. 274). Environmental education researchers appeared to see value in attempts at linking practical case studies with theoretical perspectives as a means of impacting both policy and practice (Hungerford & Simmons, 2003).

What makes educational practice is the set of values that it embodies, the intrinsic worth of the school activities themselves, the personal qualities that are enhanced, and the appropriate ways of proceeding given the context. One comes to Environmental Education, for example, with views about doing

research. These views embody certain values such as respect, caring, responsibility, and these values are open to critique and hence refinement. This kind of critically reflexive activity requires a research culture in teaching that is not there yet. (p. 5)

In this study, I attempted to gain an insight into how and why students choose to help the environment. I believed that this might improve my understanding of how to guide students in his critically reflexive activity to help them “get there”.

2.4.2 Methods for Investigating Students' Understanding

Duit, Treagust and Mansfield (1996) reviewed methods of students' conceptual understanding of science, which conformed to what White and Gunstone (1992) called "probing understanding" as a means to improve classroom teaching.

Methods for investigating students' understanding were identified as naturalistic settings, interviews, conceptual relationships, diagnostic test items, and computerized diagnosis. These methods can be used to investigate students' ideas on the nature of science. In the naturalistic setting, the researcher observed students and tried not to influence the situation significantly. In this study, in addition to surveying all the grade-4 and grade-5 students, I videotaped and made verbatim transcripts of interviews of several student pairs. As did Balacheff (1991), I used interviews with pairs of students to identify any tensions due to any differences in individual motivations and commitments of the students. According to Balacheff (1991) two-person protocols can provide the richest data. I learned this while interviewing two students at the same session. The data were rich because the number of plausible alternative solution paths was restricted and the social dynamics were not as complex as in larger groups (Duit, Treagust & Mansfield, 1996, p. 23). I saw that students changed their answers during an interview, possibly because they were thinking more deeply about the problem. This showed that students' answers were not necessarily permanent. Every interview could be regarded as an opportunity for students to reflect on, reconsider, and reconstruct their conceptions. (Duit, Treagust & Mansfield, 1996, p. 21).

It was my intention during the interviews to allow students to create ideas and concepts in order to make sense of their prior thoughts about the environment. This did actually occur.

2.4.3 Quantitative and Qualitative Methods

According to Brody and Koch (1994), environmental problems and issues are front-page materials and have the potential of making science instruction relevant and meaningful. The most obvious conclusion that emerges from quantitative studies of environmental knowledge, attitudes and behaviour, is a change towards more positive environmental attitudes among people of all ages after exposure to some form, almost any form, of environment-related or even in-class environmental education experiences whether short or longer term. Hart and Nolan (1999b) found a definite tendency towards qualitative forms of inquiry within the environmental education literature, as well as a tendency to mix qualitative methods with quantitative methods even when studies were described as being qualitative. These studies have yielded some interesting linkages between people, culture and environment as well as demonstrating the importance of childhood experiences, key mentors, and transformative programmes. Perhaps the most intriguing new area of qualitative inquiry involves the use of narrative. Trends that warrant close attention are manifest in action research, case study research, and descriptive research of various types which highlight curriculum issues, as well as context issues, and community awareness and action. This research is both quantitative and qualitative in nature, containing data from a formal survey and informal interviews as well as the use of narratives.

There are generally accepted basic methods of gathering, analysing and interpreting qualitative data. Qualitative data can be collected from interviews or from observations using artefacts, documents, and records from the past and visual, personal experiences. Analyses can be based on data that are managed and computerised. Denzin and Lincoln (1998a) state

Qualitative research is multi-method in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative

researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them. Qualitative research involves the studied use and collection of a variety of empirical materials--case study, personal experience, introspective, life story, interview, observational, historical, interactional, and visual texts--that describe routine and problematic moments and meanings in individuals' lives. (p. 3)

Keeping the quantitative and qualitative research collection methods in mind, I surveyed and interviewed students in their natural school setting in order to explain their answers on the written survey. I used the time-honoured procedure of data triangulation to enhance the creditability in interpretively evaluating the students' answers (Denzin, 1978). This is termed contextualized meaning. Greene (1998) states

Social reality is viewed as significantly socially constructed, based on a constant process of interpretation and reinterpretation of the intentional, meaningful behaviour of people--including researchers, and truth is ultimately a matter of socially and historically conditioned agreement. (p. 384)

According to Klein and Merritt (1994), there are many parallels between teaching strategies used in environmental education and the teaching approaches informed by constructivism. Four major components of constructivism are necessary for lessons that result in meaningful learning for students. These components are 1) introduction of a real-life problem by the students or teacher for the students to resolve; 2) student-centred instruction facilitated by the teacher; 3) productive group interaction during the learning process; and 4) authentic assessment and demonstration of student progress. Both philosophies (environmental education and constructivist methods) require students to take an active role in learning and building on factual knowledge to improve investigation and critical thinking skills. According to Chaille and Britain (1997), teachers should use open-ended questions to encourage problem-solving, perspective taking, and/or consideration of feelings. Open-ended questions

can be used as pre- and post-assessments of students' knowledge and skills (Chaille, 1997).

The assessment of student knowledge through interviews should provide a more comprehensive picture of student understanding of concepts and conceptual relationships than other, more frequently used assessment techniques, such as multiple-choice tests (Novak & Gowin, 1984). According to Ausubel, Novak and Hanesian (1978), the assessment of student knowledge in a given domain should provide information useful in the design of curricula and educational materials that address students' conceptual problems and misconceptions directly, and that introduce new and difficult concepts in ways that facilitate non-arbitrary (meaningful) linkage of those concepts to existing relevant knowledge in students' cognitive structures.

2.4.4 Survey Instruments

In my quest to find an instrument to measure quantitative data of the environmental knowledge, attitudes and behavioural intentions of elementary school students, I reviewed several surveys. It was informative and helpful for me to see the results of data from older students.

In Perth, Australia a survey was designed and tested (Lim, 1985). The study, which had five substantive concerns, described the state of the art of environmental knowledge, locus of control, behavioural intentions and attitudes of grade-10 students in metropolitan Perth. The data from this survey proved to be reliable for grade-10 students but the survey was too difficult and considered not applicable to the lives of younger students.

In Kilbert's (2000) study at the University of Florida, a survey was used. The data gathered were analysed to determine the relationships between the major components of environmental literacy--attitudes, behaviours and knowledge--in undergraduates. Kilbert examined differences in the students' scores on the components of environmental literacy by gender, class standing and age sub-populations. A version of the Modified Wisconsin Environmental Survey was administered. Kilbert's

results showed that knowledge had an insignificant relationship with behaviour and with perceived behavioural control, whereas knowledge had a weak correlation with attitude. The relationship between attitude and behaviour was moderate as were behaviour and perceived behavioural control and attitude and perceived behavioural control. Males did have a significantly higher knowledge component score, while females had a significantly higher attitude score and behavioural score. Freshmen had the lowest scores in environmental knowledge, literacy, attitude and behaviour. Interestingly, juniors scored the highest in every component. This finding could relate to this study in which I investigated whether or not grade-5 students knew more than grade-4 students. I hypothesized that grade-5 students did know more and had done more to help the environment, by virtue of the fact that they were older and had spent a year longer in a school where environmental education was part of the curriculum.

Bogan and Kromrey's (1996) study provided: (a) an indication of the impact of the previous decades' environmental educators' efforts on the knowledge and attitudes of students, (b) a guide for curriculum development, (c) a data-based indication of needs against which programme proposals could be measured, and (d) a baseline to serve researchers in the decades ahead. The Florida Environmental Literacy Survey was used to determine the environmental literacy of high school students, i.e. knowing ecology, being attitudinally predisposed to the environment, valuing responsible environmental behaviours, participating in responsible environmental behaviours, and knowing political action strategies. Students averaged a score of only 37% in their knowledge of ecology; held a positive attitude towards the environment; knew environmentally responsible behaviours; and some participated in environmental behaviours. However, students demonstrated limited knowledge of political action strategies when asked to respond to an open-ended question about civic action. In past years, our school's gifted programme, kindergarten through grade-6, concentrated on teaching environmental problem-solving and civic action.

Roper Starch Worldwide (1994) (Appendix B-17) used a very comprehensive survey to gain an understanding of environmental knowledge, behaviour and attitudes among students in general across the United States but with an emphasis on students from disadvantaged neighbourhoods. The findings make it apparent that young

people care about the natural environment. Students from disadvantaged areas were significantly less likely than students from non-disadvantaged areas to engage in activities relating to litter and recycling. However, concern about environmental matters did exist but it was not a leading concern. A wide set of other concerns including AIDS, kidnapping, guns and the economy weighed heavily on students' minds, often shaping their perceptions of environmental issues and problems. The data suggested the importance of the school in environmental education and the need for new opportunities for involvement for disadvantaged youth. The survey suggested that levels of factual knowledge could vary between the genders depending upon the environmental topic that is in question. Girls from disadvantaged areas exhibited higher levels of concern than did boys on most issues, a trend often seen in the data. These findings related to my study of students from non-disadvantaged areas, as in the Roper study; I would expect that both boys and girls would be engaged in activities pertaining to litter and recycling.

The Children's Environmental Attitude and Knowledge Scale (CHEAKS) (Leeming, Dwyer & Bracken, 1995) was based on the structure and content of an adult scale developed by Maloney, Ward and Braucht (1975) to measure ecological attitudes and knowledge. The CHEAKS scale was adapted for children using easy readability and includes items that relate to major attitudinal components, including commitment (verbal and actual), behaviour, and affect. The questionnaire was administered to 1219 elementary school students in Tennessee in grades 1 to 7. Forty-two teachers were involved in the Tennessee field-testing study. I chose to use this survey in my study in Florida because of its high reliability in Tennessee for grades 4-7 which ranged from .90 to .91 on the attitude questions and .72 to .76 on the knowledge questions.

2.4.5 Evidence available on learners and learning

Claims have been made that environmental education theory and research overlook "the children who are the subjects of environmental education" (Payne, taken from Rickinson, 2001 p. 207). The research and evidence base on learners and learning is developing and changing, as new foci emerge, bringing with them different methodological and conceptual approaches. These findings make a case for studies

focused more explicitly on learning and the role that learners play within this process. According to Rickinson, there have been many more studies focused on investigating the characteristics of school students' environmental education than there have been exploring the process or outcomes of environmental learning. This research which focused on students' environmental knowledge, attitudes and behaviour was designed to incorporate a more active view of learners as they were surveyed and interviewed, and walked around the school campus taking photos in addition to pencil and paper surveys.

2.4.6 Research about environmental knowledge

Gambro and Switsky's study (1996) analysed data from 1,870 US high school students in 1987 and 1989 from the Longitudinal Study of American Youth. The analysis revealed disappointing levels of knowledge. The items covered environmental issues such as acid rain, the greenhouse effect, and future sources of energy and measured how well students could recall specific facts and concepts as well as use higher order cognitive processing. The average student could not correctly answer four of the seven items on the scale, and only one third of the high school seniors correctly answered five or more of the items. Most 12th grade students could not apply their knowledge to determine the consequences or potential solutions for those environmental issues. The authors reported a "36% discrepancy between students' knowing that burning fossil fuel causes pollution and understanding the consequences of exploiting that energy source" (p. 31). Similarly, the authors concluded that, "most high school seniors ...lack the necessary understanding to go beyond the common recognition of an issue and use their knowledge to grasp the consequences of environmental problems or offer solutions for those problems" (p. 31). Therefore, environmental education should be taught in the school system beginning at the elementary school. Teachers have the opportunity to use students' concerns as a source of motivation and can take advantage of what students know about environmental issues and develop isolated pieces of information into concepts that can be used for critical thinking (Gambro & Switzky, 1996). This information is important for my study because elementary school students are concerned about the environment and teachers, sometimes, do not foster environmental problem-solving in the classroom nor do they promote civic action.

In another study, Clark (1996) found no significant relationship between gender and environmental knowledge levels with one-year group in one Australian school. My study surveyed all the students, both boys and girls in grade-4 and grade-5 over a two-year period in our school, providing a comparison and with a larger sample than in the Clark study.

Connell, Fien, Sykes and Yencken (1998) found factual knowledge amongst 5,688 Australian students to be lower for certain key environmental concepts such as intergenerational equity and precautionary principle, as compared with other concepts like renewable resources and ecology. The study indicated marked variation in factual environmental knowledge between these two locations, Melbourne and Brisbane. Students were found to perform better on knowledge recall questions compared to questions that required the application of concepts and evaluation of alternative explanations or solutions. This study also found that "female students had stronger conceptual knowledge than male students, correctly defined more than five out of the ten concepts significantly more often" (p. 43). Non-government organizations and schools were regarded as the most reliable source of information, with the media being rated as only of moderate reliability.

The relationship between environmental knowledge and environmental attitudes and behaviour proved to be very weak although there was a true relationship between environmental attitude, willingness to make personal sacrifices, and environmentally responsible behaviour (with the stronger connection between responsible behaviour and willingness to make sacrifices) as reported by Kuhlemeier, Bergh and Lagerweij, (1999). In this Dutch study, the underlying idea was that students who know a lot about the environment have a positive attitude towards it and are likely to behave in an environmentally responsible manner" (p. 4).

Chan's (1998) study among Hong Kong youth claimed to have found encouraging levels of factual environmental knowledge. Students were more aware of wildlife and air pollution issues than world population and Hong Kong's local pollution problems due to construction waste.

In a US study, the factual knowledge of students in Washington State was found to differ depending on the topic (Cardeiro & Sayler, 1994). Students performed well on questions dealing with tropical rainforest destruction and the effects of clear cutting, but did poorly on questions about animal populations and endangered wildlife species. In this study, the 11-year-olds had significantly higher knowledge than the 12-year-olds, attributed to 'curricular differences', not their chronological age; but there was no significant relationship between the students' gender and environmental knowledge.

Membela, Nogueiras and Suarez (1994) found that levels of students' factual knowledge were low. The researchers reported that students' factual knowledge was better developed in relation to larger animals, especially pets and mammals, than in relation to smaller non-domestic animals and plants.

The notion of misconceptions was widely reported in the context of studies on secondary school students' ideas about global environmental issues. Boyes and Stanisstreet (1996) found that students in the UK had a poor understanding of the differences between the causes of global warming and the causes of ozone layer depletion, stating that many global environmental problems were invisible and rather abstract and so children's learning cannot be directly experiential. Some children's thinking is uni-dimensional; they intuitively associate one phenomenon with one cause, so consequently they may be reluctant to assent to other causes.

According to Palmer (1995), learners as young as six years frequently possessed blurred or inaccurate understanding of processes and events in the world around them such as believing that during recycling the very same can or bottle is used again for the same purpose for which it was originally intended. An analysis of the sources of knowledge and misconceptions about recycling suggested that children's ideas about waste are derived from home, school and television. The data also revealed a lack of personal involvement by UK six-year-olds in the recycling process. The younger children (4-year-olds) displayed a greater degree of uncertainty or lack of knowledge (i.e. incomplete answers) than the 6-year-olds whose responses were characterised more by 'confusion and established misconceptions' (p. 41) than a straight lack of knowledge.

In a later study, Palmer and Suggate (1996) attempted to establish what young children knew about two distant environments, i.e. tropical rain forests and polar lands, and to identify some of the common misconceptions relating to them. The researchers identified many strengths in young people's understanding of environmental issues and that "many children of a very young age, i.e. six, are quite capable of sophisticated thinking and reasoning and constitute active thinkers in the realm of environmental issues" (p. 328). Certain phenomena were better understood as students got older. Considerable confusion and scientifically inaccurate conceptions characterized primary school students' thinking about distant environments and various local and global issues, though. Not surprisingly, it appeared that six-year-olds were more likely than their four-year-old counterparts to refer to long-term effects of polar warming and deforestation, rather than only short-term effects.

Six-year-olds' ideas about the process of melting showed misunderstandings; 15% thought that snow would first change into ice before melting into water, 10% thought that snow would change into grass or ground, and 9% thought that snow just 'went away' (p. 317). In relation to polar warming, the older children were better able to correctly describe the process of snow melting and producing water that would enter the sea. Children know a good deal about distant environments and related scientific concepts when they enter school, but some of their knowledge is inaccurate. As children mature between the ages of four and seven, they are able to take a longer-term view of issues and consequences and to make meaningful links between causes and effects of problems.

Mogensen's (2001) Danish study indicated that when educators determined curriculum content, they paid little attention to environmental education, a subject not compulsory in Danish schools, although environmental topics were supposed to be integrated into all subjects. When identifying and prioritising environmental problems, the 845 primary and lower secondary school children provided responses that most frequently mentioned the problem of pollution. Few students noted reasons related to societal conditions of production and political decision-making processes as the causes of environmental problems. Nevertheless, the authors'

findings showed that EE seemed to have a positive influence of students' belief in their own action possibilities.

Korhonen and Lappalainen's (2004) research noted that the effect of education on environmental concern is significant, but when the effects of degradation can be felt and seen in daily life there is an increase in this awareness. In this study, the researchers examined the environmental awareness of children and adolescents in the Ranomafana region of Madagascar and compared the environmental awareness of children who lived under different ecological conditions. "The results of the study show that children in rural areas of Madagascar are measurably aware of environmental issues and can relate them to human activities. Children's environmental concern and demand for action was stronger in deforested areas" (p. 195).

2.4.7 Research about environmental concerns, attitudes and behaviours

A number of studies have investigated the kinds of environmental phenomena that concern young people although these environmental concerns have represented just one small part of a much larger research focus under investigation. Consequently, there is not a particularly strong base of evidence about students' environmental concerns. Nevertheless, research shows young people rate certain environmental issues as more serious than others. What can be said is fairly descriptive and is not based on strongly coherent themes emerging between several individual studies. In terms of young people's conceptions at the global level, there seems to be concern among Australian (Connell *et al.*, 1998), Singaporean (Ivy *et al.*, 1998), and UK. (Morris with Schagen, 1996) students with ozone depletion over and above other issues such as global warming/greenhouse effect, deforestation, and air and water pollution. These findings contrast with the findings of studies in Europe (Filho, 1996) and the US (Riechart & Peterson, 1998) which respectively suggest that pollution and acid rain, and water pollution and air pollution are seen as more serious than ozone depletion and (especially in the US study) global warming. According to Rickinson (2003), "A feature common to almost all of the studies is that they did not seek specifically to investigate *why* their respondents perceived certain issues as more serious than others" (p. 248).

In Prelle and Solomon's (1996) investigation of 14-year-old school students in Germany and England the authors observed that the most emotionally charged responses were associated with threats to wildlife, while issues such as hole in the ozone layer and cutting down the rainforest tended to be characterized by factual-type information, often of an incorrect nature.

According to Connell *et al.*'s (1998) study, young people appear to hold generally positive environmental attitudes. The researchers found in their questionnaire survey that protecting the environment was the most frequently selected item from a list of several societal goals for Australia. Connell *et al.*'s (1999) findings from a qualitative study of environmental attitudes of young people across their final two years of secondary school in the two Australian cities of Melbourne and Brisbane provided an in-depth picture of young people's environmental knowledge, attitudes and actions, including strongly conflicting expressions of hope for social and environmental change coupled with a deep sense of pessimism, frustration and action paralysis. "The young people were concerned primarily with personal levels of meaning--personal relationships, careers, academic success and enjoyment--and a desire to make sense of their lives and their place in the world" (p. 98).

Chan (1996) reported that students in Hong Kong were more likely to agree with statements of a pro-environmental nature than to be indifferent or agree with anti-environmental sentiments. Chan concluded, "the student's over-optimism towards technological development and the perceived importance of the benefits of modern consumer goods were the major factors that contradicted concern for the environment" (p. 303).

Based on a three-year qualitative study, which took place in four middle schools located in the Detroit metropolitan area, Wals (1994) found that relatively little attention had been paid to the way in which young people come to make sense of their own environment through their everyday interactions within their life world. "In order for nature to play a role in education, environmental educators will have to be sensitive to the different experiences and perceptions that the learner brings to the classroom" (p. 191).

Barron's (1995) work with a class of Australian primary school children complemented that by Wals. Based on interviews focusing on Dr. Seuss' 1972 book *The Lorax*, Barron found that

Most girls in the study (unlike the boys) took up 'light green discourses' in relation to logging. In relation to technology, most of the boys and the girls (took) up a 'scientific fix' for all discourses. Barron argued that rather than being confused or unable to make up their mind, this could be read as the children taking up multiple subjectivities in relation to contradictory discourses. (p. 116)

Young people's environmental attitudes seemed to be influenced by several factors including their gender, socio-economic grouping, age, academic ability and orientation. Morris and Schagen's (1996) work found no statistically significant relationship between students' ability and their level of environmental concern, but did find a significant positive relationship between students' self-reported enjoyment of school subjects and their environmental concern.

Young people reported some involvement in environmentally responsible behaviours; 55% of the 5,688 young people in Connell *et al.*'s (1998, p. 43) study stated that they had taken deliberate actions to improve the environment, but 40% said they had not. Kuhlemeier *et al.* (1999, p.8) found that the behaviour of about a quarter of their 9000 respondents could be described as (extremely) environmentally friendly, and another 50% were in the category where environmentally friendly behaviour was exhibited more often than environmentally unfriendly behaviour. Many things still need to be improved in the environmentally responsible behaviours of large groups of students.

Certain pro-environmental behaviours appeared to be more prevalent than others. Environmental conservation practices such as turning off lights and reusing printed paper were more common among Singaporean students than environmentally friendly consumption activities such as selecting products with 'green' labels and avoiding ones with lots of packaging (Ivy *et al.*, 1998).

Environmental conservation and consumption practices were reported more frequently by Australian students than were behaviours involving information gathering, political and community activities, and financial donations (Clarke, 1996; Connell *et al.*, 1998). UK. students were reportedly more likely to turn off lights and electrical appliances, than they were to either wear extra clothing instead of turning up the heating, or to apply energy considerations to purchases made (Morris with Schagen, 1996, p. 11). Students from disadvantaged areas in the US were more likely to report that they and their families made efforts to save energy and water than to cut down on the amount of trash and garbage or reduce use of pesticides and fertilizers (Roper Starch Worldwide, 1994). According to Rickinson (2001), there was some evidence to suggest that the nature and degree of young people's environmental behaviours is influenced by factors such as socio-economic grouping, schooling, gender and also other people (p. 262).

Eagles and Demare (1999) reported that camping did not affect attitudes of grade-6 students, after a weeklong Sunship Earth programme at a residential camp in Canada. This was in agreement with Keen's (1991) findings that participation in the Sunship Earth programme (developed by the Institute of Earth Education) did not result in more positive environmental attitudes for 578 grade-5 and grade-6 students in the Australian Capital Territory. The authors felt that it might be due to the fact that students entered the programme with a moderate level of environmental experience.

Chawla (1998) asserted that environmental sensitivity, which is associated with particular kinds of significant life experiences, is an important variable in environmental awareness and in the predisposition to take responsible environmental action. Chawla and Hart (1995) argued that the roots of environmental concern might lie in young children's initial fusion of their own feelings with their sensations of the world, thus forming the basis for a sense of the world as a living being to which they are attached.

Bonnett and Williams' (1998) findings in the UK indicated that while the attitudes of children towards nature and the environment were generally very positive, they could involve a number of limitations, dichotomies and ambivalence, which their education should help them to address. Shortcomings of the current National Curriculum (UK)

policy of delivering environmental education through traditional subjects were outlined and provided the context for reporting the results of a pilot study into Year 5/6 school children's attitudes towards nature and the environment. Bonnett and Williams (1998) questioned and summarized central issues for environmental education: What degree of intervention should teachers undertake in the formation of a child's outlook? Should children simply be given relevant information and then be left to form their own attitudes? Should they be helped to clarify their own ideas and values through discussion, etc? Should there be a deliberate attempt to guide them towards a particular set of fundamental values and behaviours, in which case, what are they, how are they justified and what do they imply for the curriculum as a whole and the school ethos? Also, the media can be highly selective in the presentation of environmental issues. A cause for concern was the unusual finding that children's assessment of the severity of environmental problems tended to increase with the distance away problems are perceived to be. (Students are worried about problems far away, more than they are worried about local problems).

The large majority of primary school students who were interviewed in groups in Littledyke's study (2004) in the UK showed considerable interest and concern about environmental issues related to their experience and understanding, drawn both from school and influences outside of the school. Most showed limitations and contradictions in their understanding of the issues, though. The children's understanding of science was mainly limited to their experience of the subject at school and few showed any understanding of the impact of science on society or the environment.

Knowledge, understanding and/or concern, and locus of control significantly correlated with grade level in Dimopoulos and Pantis' (2003) study in Zakynthos, Greece, and a significant positive correlation between knowledge and attitudes was demonstrated. Knowledge scores were low about sea turtle conservation but attitude scores were high.

A pilot study in Slovenia (Beatty, 1991) carried out to elucidate existing levels of moral reasoning in environmental dilemmas (in analogy to Kohlberg) found age-related differences, and differences between boys and girls. The results favoured

girls because they gave less one-sided concrete justifications, more answers on higher levels, and answers connecting both sides of the issue. This finding was a part of a larger international project, called Environmental and School Initiatives Project initiated in 1986 with nine cooperating countries, by the Centre of Educational Research and Innovation at the Organization for Economical Cooperation and Development.

Corral-Verdugo's (1993) Arizona research was focused on distinguishing environmental fact and opinion. The control group received an explanation of the distinctions between environmental facts and opinions, whereas the experimental group received the explanation as well as specific examples. The experimental group scored significantly higher than the control group on distinguishing environmental facts and opinions; gender was not related to performance.

2.4.8 Research on environmental learning outcomes and programmes

A small number of studies has tried to report data on characteristics of both in-school and out-of-school programmes and their impacts in terms of changes in students' environmental knowledge, attitudes and/or behaviours. Much of the time, however, long-term durability is not assessed although educational interventions can change learner's environmental knowledge, attitudes and actions, at least in the short term. Certain aspects of environmental education programmes appear to facilitate positive outcomes; for example, educational interventions can affect young people's environmental knowledge, attitudes and behaviour in different ways (Rickinson, 2001).

Bogner's (1998) study was designed to examine one-day and five-day versions of a long-established outdoor ecology programme in a German national park. The survey of 700, 12-year-old (grade-5) students from 24 secondary schools showed that both programmes fostered cognitive levels and the five-day programme explicitly provoked favourable shifts in individual behaviour, a parameter that is generally seen as a complex and long-term process.

The results from Dettmann-Easler and Pease's (1999) research in the upper US Midwest indicated that students had significantly more positive attitudes towards wildlife after residential programmes than they did after an in-class wildlife programme and that these changes were retained at least three months after the programme. The authors felt it is logical to assume if a child has strong positive attitudes towards wildlife, then he or she might also have positive attitudes towards protecting and enhancing wildlife through habitat protection, pollution control, and so forth.

Uzzell, Rutland and Whistance's (1995) investigation into the effects of a 4-day experiential environmental education course at a UK field study centre found that children were less concerned about problems at a local level than they were about problems at a global level, a similar finding to that of Bonnett and Williams (1998). Once children returned home to the inner city, there was a significant decrease in concern. If children are to be encouraged to take action at the local level in respect of environmental issues and problems, then clearly they have got to see that there is a need for action at the local level (p. 179).

Emmons' (1997) qualitative case study of two small groups of female high school students in a Belizean environmental education programme appeared to be very positive. The author agreed with Chawla (1988) that studies within natural settings are important if environmental educators are to understand how outdoor experiences formatively contribute to the development of environmental attitudes, sensitivity and concerns.

According to Rickinson (2001), the research evidence indicated that targeted classroom-based programmes could also be effective in altering students' environmental attitudes, knowledge and actions. An example of such programmes is that by Leeming *et al.* (1997) who reported that children who had taken part of The Caretaker Classroom Programme (initiated by a Tennessee city's newspaper) showed a significantly greater change in environmental attitude from pre-test to post-test than did those children who did not participate. Significant changes were not reflected in the area of environmental knowledge, possibly because the Caretaker teachers might not have presented any special curriculum materials associated with the various

activities. "The Caretaker children at all grade levels influenced the environmental behaviours of their parents." (p. 41)

In addition to attitudes and knowledge, Ramsey's (1993) work adds the instructional effects of Issue Investigation and Action Training (IIAT) on grade-8 students.

The findings indicate that issue investigation and action training tends to foster independent overt environmental behaviour, group locus of control, environmental action knowledge, and perceived knowledge about, and skill in the use of environmental action skills. The super-ordinate goal of responsible citizenship behaviour can be approached via formal environmental instruction. (p. 34)

Because I compared boys and girls as subgroups in my study, I also researched students' progress according to their gender. Overall, females have done much better than males in reading and writing, but have generally, though not always, lagged behind in science and mathematics. Concern exists that this gap in science and mathematics may give female students less access to high paying jobs, although there are no data to compare this disadvantage with the possible disadvantage faced by males because of their lower reading and writing achievement. Science and mathematics have become particularly important. Jobs in our technological society increasingly require workers to use complex mathematics skills and scientific knowledge to solve problems (*The Nation's Report Card: Mathematics 2000*) (NCES, National Centre for Education Statistics Institute of Education Sciences, 2005). Although there is a common perception that males consistently out-perform females in mathematics, NAEP mathematics scores have not shown this. In mathematics, the gap between average scale scores for males and females has been quite small and fluctuated only slightly between 1990 and 2003.

The Campus Ecology Research Project (CERP) is an innovative environmental education teaching model developed at the University of Wisconsin as an educational response to the global environmental crisis and the powerlessness and despair that this daunting problem has engendered among university students. The CERP model provides students with small scale and local problem-solving situations

whereby they develop the knowledge, skills and motivation necessary to become environmentally literate and responsible citizens (Einstein, 1995).

A Hawaiian study (Volk, 2003) Investigating and Evaluating Environmental Issues and Actions (IEEIA) was in place for five years in a combined grade-5 and grade-6 classroom in one of the four public elementary schools on the island of Molokai, Hawaii. Students formed partnerships with a variety of community agencies and initiated and undertook such adult actions as meeting with elected officials to discuss legislation to be introduced and then providing testimony to the state legislature regarding the proposed legislation (p. 23). IEEIA is a skill development programme designed to help learners take an in-depth look at environmental issues in their community, to make data-based decisions about those issues, and to participate in issue resolution.

In Mason and Santi's (1998) study of grade-5 students in a rural area of Padova (northern Italy), the results showed that classroom discussions, the core of the proposed learning activity, led the children, although at different levels, to the integration of new scientific knowledge in to their conceptual ecology, based on the personal revision of pre-instructional conceptions.

2.5 Summary of Research

Environmental education has unfortunately not found an established niche in the US schooling process. Consequently, environmental education still has a largely inadequate, relatively inconsistent, and scattered presence in the curriculum. Nevertheless, educators are utilizing the National Research Council National Science Education Standards of 1994 to give credibility and support for incorporating science (including environmental) concepts in multiple disciplines. However, this is not enough. Subject areas, including the humanities and the social sciences need to address issues related to environmental and sustainable development. Such a goal is consistent with that of The Florida Legislature which has mandated that the public educational system, from kindergarten through the university, act as the primary delivery system to create environmentally literate citizens.

Although the general population of Floridians is concerned with environmental issues, there is a low level of information and understanding about the environment, even at the most basic level. Environmental action programmes can and should be a part of environmental education programmes in Florida. The students in this study participated in certain curricula for environmental education but there was no formal programme guideline.

While past environmental education research has focused on environmental education programmes, little is currently known about how and why programmes were able to bring about certain learning outcomes (Rickinson, 2001, p. 274). Much of the research was underpinned by a passive view of students. In my study, in addition to a survey of all grade-4 and grade-5 students, I attempted to gain insight into how and why students choose to help the environment. The learners were active agents (rather than passive subjects) with their own perceptions, experiences and influence.

In my quest to find an instrument to measure quantitative data of the environmental knowledge, attitudes and behavioural intentions of elementary school students, I reviewed several surveys. I chose the *Children's Environmental Attitude and Knowledge Scale* (CHEAKS) (Leeming, Dwyer & Bracken 1995) because of its high reliability for a similar age group to my students. Further, the survey covered the environmental issues I wanted to assess. I investigated learners and learning through the voice of the students. I sought to understand how learners themselves made sense of environmental education.

I investigated the research about students' environmental knowledge.

The research informed me that

- Students were found to perform better on knowledge recall questions compared to questions that required the application of concepts and evaluation of alternative explanations or solutions.
- Students scored significantly higher environmental knowledge for 11-year-olds as opposed to 12-year-olds. Researchers attributed this to 'curricular differences', not their chronological age.

- Levels of students' factual knowledge were low. Factual knowledge was better developed in relation to larger animals, especially pets and mammals, than in relation to smaller non-domestic animals and plants.
- The research gave emphasis to the fact that the problem was not simply one of knowledge but also of conceptualisation. Some children's thinking was uni-dimensional and children intuitively associate one phenomenon with one cause; they may be reluctant to assent to other causes.
- Young learners frequently possessed blurred or inaccurate understanding of processes and events in the world around them.
- Many children of a very young age were capable of sophisticated thinking and reasoning and constituted active thinkers in the realm of environmental issues.
- Children were confused about environmental processes with younger students exhibiting more misunderstandings.
- EE seemed to have a positive influence of students' belief in their own action possibilities.
- The effect of education on environmental concern was significant, but when the effects of degradation could be felt and seen in daily life there was an increase in this awareness.

I investigated the research about environmental concerns, attitudes and behaviours.

The research informed me that

- A feature common to almost all of the studies is that they did not seek specifically to investigate *why* their respondents perceived certain issues as more serious than others.
- Most emotionally charged responses were associated with threats to wildlife, while issues such as a hole in the ozone layer and cutting down the rainforest tended to be characterised by factual-type information, often of an incorrect nature.
- Protecting the environment was the most frequently selected item from a list of several societal goals for Australia.

- Environmental conservation and consumption practices were reported more frequently by Australian students than were behaviours involving information gathering, political and community activities, and financial donations.
- At times, strongly conflicting expressions of hope for social and environmental change was coupled with a deep sense of pessimism, frustration and action paralysis.
- Relatively little attention had been paid to the way that young people come to make sense of their own environment through their everyday interactions within their life world.
- Young people's environmental attitudes seemed to be influenced by several factors, including their gender, socio-economic grouping, age, academic ability and orientation.
- A significant positive relationship was found between students' self-reported enjoyment of school subjects and their environmental concern.
- Young people were concerned primarily with personal levels of meaning: personal relationships, careers, academic success and enjoyment, and a desire to make sense of their lives and their place in the world. Concern for the environment was generally of less concern.
- The roots of environmental concern may lie in young children's initial fusion of their own feelings with their sensations of the world, thus forming the basis for a sense of the world as a living being to which they are attached.
- While the attitudes of children towards nature and the environment were generally very positive, students could have a number of limitations, dichotomies and ambivalences that their education should help them to address.
- A cause for concern was the finding that children's assessment of the severity of environmental problems tended to increase with the distance away they are perceived to be, that is, local environmental concerns were perceived to be less important.
- Primary school students showed considerable interest and concern about environmental issues related to their experience and understanding, drawn from school and influences outside of the school. Most showed limitations and contradictions in their understanding of the issues.

- Moral reasoning in environmental dilemmas was found to be both age- and gender-related. The results favoured girls because they gave less one-sided concrete justifications, more answers on higher levels, and answers connecting both sides of the issue.

I investigated research on environmental learning outcomes and programmes.

The research informed me that

- Educational interventions can change learners' environmental knowledge, attitudes and actions, at least in the short term.
- A five-day outdoor ecology programme in a German national park explicitly provoked favourable shifts in individual behaviour, a parameter that is generally seen as a complex and long-term process.
- Research indicated that students had significantly more positive attitudes towards wildlife after residential programmes than they did after an in-class wildlife programme and that these changes were retained at least three months after the programme.
- If children are to be encouraged to take action at the local level in respect of environmental issues and problems, they must see that there is a need for action at the local level.
- Studies within natural settings are important if environmental educators are to understand how outdoor experiences formatively contribute to the development of environmental attitudes, sensitivity and concerns.
- Targeted classroom-based programmes can be effective in altering students' environmental attitudes, knowledge and actions.
- Issue Investigation and Action Training tended to foster independent overt environmental behaviour, group locus of control, environmental action knowledge, and perceived knowledge about, and skill in the use of environmental action skills. The super-ordinate goal of responsible citizenship behaviour can be approached via formal environmental instruction.
- Skill development programmes helped learners take an in-depth look at environmental issues in their community, make database decisions about those issues, and participate in issue resolution.

- Classroom discussions led the children to the integration of new scientific knowledge into their conceptual ecology, based on the personal revision of pre-instructional conceptions.

To conclude, based on the findings of environmental education studies reviewed in this chapter, it was considered to be of interest to find out what would be the outcome when a similar investigation was conducted in a South Florida elementary school. I investigated what students reported about environmental education in the school and in their lives. While this chapter has been focused on the theoretical framework that guided this study, the following chapter contains an elaboration of the methodological framework implemented in the different stages of the study.

CHAPTER 3

RESEARCH METHODS

3.1 Overview of Chapter 3

In Chapter 3, I discussed the research methods used in this study, overview of research design and methods (Section 3.2), and the sample (Section 3.3). I included data sources from the quantitative data from Childrens' Environmental Attitude and Knowledge Scale instrument and qualitative data from students' interviews (Section 3.4). I discussed data collection procedures, recording procedures, and analysis (Section 3.5). I discussed ethical considerations (Section 3.6) and limitations of the study (Section 3.7). A summary (Section 3.8) concluded the chapter.

3.2 Overview of Research Design and Methods Used in this Study

The main focus of the data collection involved the administration of a survey and student interviews. As the study gradually developed, however, another research question emerged as a result of my reflections. Multiple research methods were used to deepen the researcher's understanding of students' responses (Aldridge, 1999) (Denzin & Lincoln, 1998a).

During this study I learned about environmental education initiatives used by some teachers in the school and that there was no standard environmental education in place in the school. I gained insight into the meaning perspectives of others about environmental education.

This study drew on elements of the constructivist paradigm (Driver & Scott, 1996). There are many parallels between teaching strategies used in environmental education and teaching approaches informed by constructivism which resulted in meaningful learning for students, both philosophies (environmental education and constructivist methods) required students to take an active role in learning and building on factual knowledge to improve investigation and critical thinking skills.

According to Treagust, Duit and Fraser (1996),

Students hold pre-instructional conceptions in many fields that are substantially different from the scientific and mathematical concepts taught in school (p. 2). Many students and teachers are naïve realists in that they view science and mathematics knowledge as a faithful copy of the “world outside” and not as tentative human construction.

3.2.1 Quasi-Experimental Design

This researcher utilised a quasi-experimental design involving the use of convenience sampling – in which there was no random assignment of students into groups. The classes in the school were the intact, pre-existing groups among whom comparisons are possible (Punch, 1998). Because the researcher was comparing pre-formed groups where there was no randomisation and control, this design cannot make strong cause/effect statements. This *ex post facto* (also called "causal comparative") design with no overt treatment was an attempt to see if a grouping, over which the researcher had no prior control, seemed to make a difference on some outcomes. (Dereshiwsky, 1998). This is sometimes called a status survey, a normative survey or a descriptive survey. The students who were interviewed were from one particular elementary school in South Florida. The research questions helped form the design of this study. According to Punch (1998), quoting Denzin and Lincoln (1994), “there is the general idea of design as situating the researcher in the empirical world, and connecting research questions to data” (p. 66).

3.2.2 Multiple Methods

Multiple methods, including quantitative and qualitative research, were used. Data collection of different sources and kinds of information, including a formal survey, videotaped recordings of interviews in the classroom, answers to open-ended questions written by students, interview comments, and photos taken by students were evidence. These different data sources helped the researcher piece together the information collected to provide a more complete picture. Using both quantitative

and qualitative research helped me examine the student's perspective, the individual's point of view. According to Denzin (1978), the use of multiple methods, or triangulation effects an attempt to secure an in-depth understanding of the phenomenon in question (p. 3).

3.3 The Sample

3.3.1 Student Selection

The criteria used for student selection was determined by my teaching situation and time constraints. Because I was the teacher/researcher in one public school in Miami-Dade County, Florida, I selected students who were in the school to be in the study. Since I had first pilot-tested the written CHEAKS instrument with gifted grade-3 students, who were reading above grade level, in my classes, and found that they understood the questions, I felt that most grade-4 and grade-5 students would understand the written instrument. I obtained permission from the school administration and the students' parents for the students to be part of the study. The study used convenience sampling, also called deliberate sampling: "It means sampling in a deliberate way, with some purpose or focus in mind" (Punch, 1998, p. 193). The sampling, which was relevant to my conceptual frame and research questions, produced believable descriptions and explanations that were true to real life. The sampling plan was feasible in terms of time, money, access to people and my own employment as a teacher within the school.

3.3.1.1 Student sample for the quantitative research

All the students in both grade-4 and grade-5 in the years 2002 and 2003 in the elementary school in which I taught were the sample for the written instrument. The school was in an upper middle class suburban neighbourhood in Miami-Dade County in South Florida. The classes were self-contained, and homogeneous in reading level. In February 2003, there were 1072 students in the school, 188 were given free lunch and 39 were given reduced price lunch, 21 students were Asian, 101 were black, 375 were Hispanic, 3 were American Indian, 8 were multi-ethnic, and 564 were white.

The mean scale scores for grade-4 and grade-5 students (who were part of this study) for the Reading section of the Florida Comprehensive Assessment Test were 321 and 305, respectively, which was higher than the average of 285 and 299, respectively, in the State of Florida. Most students were reading at or above grade level. At the beginning of each school year, students were placed in homeroom classes depending on their reading level. That meant the classes were more or less homogeneously grouped by reading levels. The gifted students (many of whom were reading two years above grade level) were in a separate homeroom class in the grade level. The Florida Department of Education, Administrative Rule 6A-6.03019 Special Instructional Programs for Students Who Are Gifted states:

- (1) Gifted. One who has superior intellectual development and is capable of high performance.
- (2) Criteria for eligibility. A student is eligible for special instructional programs for the gifted if the student meets the criteria under paragraph (2)(a) or (b) of this rule.
 - (a) The student demonstrates:
 1. Need for a special program.
 2. A majority of characteristics of gifted students according to a standard scale or checklist, and
 3. Superior intellectual development as measured by an intelligence quotient of two (2) standard deviations or more above the mean on an individually administered standardized test of intelligence.
 - (b) The student is a member of an under-represented group and meets the criteria specified in an approved school district plan for increasing the participation of under-represented groups in programs for gifted students.
 1. For the purpose of this rule, under-represented groups are defined as groups:
 - a. Who are limited English proficient, or
 - b. Who are from a low socio-economic status family.

(Florida Department of Education, 2006)

The survey was administered to every student in every grade-4 and grade-5 class in the school. This totalled six grade-4 classes and five grade-5 classes (each self contained with approximately 33 students) in year one and also in year two of the study. Most of the students who were in grade-4 in year one of the study, took the survey again when they were in grade-5, in year two of the study. In addition, two grade-6 classes were also surveyed in year two of the study. Most of the gifted students in grade-6 in the middle school, in year two of the study, had taken the survey in grade-5 in the elementary school in year one of the study. The numbers of

students, teachers and principals involved in the study for the two-year duration are presented in Table 1.

Table 3.1 Numbers of students, teachers and principals involved in the study

Grade	2002			2003		
	Students	Teachers	Principal	Students	Teachers	Principal
4	180	6	1	181	6	1
5	125	5		197	5	
6				57	2	1

3.3.1.2 Student sample for the qualitative research – interview

After formal testing, using the CHEAKS instrument in whole class settings, I set up student-student interviews with a cross sample of students (whose parents and teachers gave permission) to find out about their environmental attitudes. Students were chosen by their availability and teacher recommendation. Fourteen were available during class time, eight were available during lunchtime and six were available during an after school program. A total of 28 students were interviewed and recorded on video during the months of May and June 2002. Each interview took at least one half hour in length. Nine students were from grade-4 (four were male and five were female) and 19 were from grade-5 (11 were male and nine were female). I chose to transcribe the comments from two grade-4 gifted girls and two grade-4 gifted boys for several reasons. One reason was that these particular sets of students completed their interviews and had time to take photos around the campus. Another reason was that these particular interviews included students' rich explanations and elaborate answers.

3.4 Data Sources

3.4.1 Quantitative Data CHEAKS Instrument

CHEAKS (*Children's Environmental Attitude and Knowledge Scale*) was used to measure environmental knowledge, attitudes and behaviour based on two subscales, Attitude and Knowledge (see Appendix A-1). I read through the instrument and considered it was appropriate for use with the students at my school. I emailed Dr.

Leeming, who gave me permission to use it (see Appendix C-2). CHEAKS was given two different years to many of the same students. A year in school passed between test dates. In addition to CHEAKS, some students were asked open-ended written questions about their environmental education. The answers from the students gave the interviewer an overview of some of the environmental issues that these students had learned in school.

The CHEAKS instrument consisted of two sub-scales, Attitude and Knowledge. The Attitude sub-scale comprised 36 items that measured students' attitudes towards environmental issues: 12 items reflected verbal commitment, 12 measured actual commitment, and 12 assessed affect. The organization of the items within the three subscales and the content sub-domain is presented in Table 3.2. These attitudinal items were sampled systematically from six content-dependent sub-domains, i.e. two items from each sub-domain: animals, energy, pollution, recycling, water, and general issues as shown in Table 3.2. The 36 items included in the attitude scale were presented in a 5-point Likert-type response format (i.e. very true, mostly true, not sure, mostly false, or very false).

The student was asked to mark in pencil on an answer sheet. The scoring was as follows: A=5 points, B=4 points, C=3 points, D=2 points, and E=1 point. The most environmentally friendly answer was A; the least environmentally friendly answer was E, except for questions #2, 4, 6, 13, 22, 24, 30, 31and 32 that had the reverse responses (See Appendix A-1). The organisation between the attitude items and the six sub-domains are shown in Table 3.4.

Table 3.2. Examples of Items from CHEAKS instrument--Attitude sub-scale

Verbal--Commitment

Animals	I would be willing to stop buying some products to save animal's lives.
Energy	I would not be willing to save energy by using less air conditioning.
Water	To save water, I would be willing to use less water when I bathe.
General	I would not give \$15 of my own money to help the environment.
Pollution	I would be willing to ride the bus to more places in order to reduce air pollution.
Recycling	I would not be willing to separate my family's trash for recycling.

Table 3.2 (continued)

Actual--Commitment

Pollution	I have not written someone about a pollution problem.
General	I have talked with my parents about how to help with environmental problems.
Water	I turn off the water in the sink while I brush my teeth to conserve water.
Energy	To save energy, I turn off lights at home when they are not in use.
Animals	I have asked my parents not to buy products made from animal fur.
Recycling	I have asked my family to recycle some of the things we use.

Affect--Feelings

General	I am frightened to think people don't care about the environment.
Pollution	I get angry about the damage pollution does to the environment.
Recycling	It makes me happy when people recycle used bottles, cans, and paper.
Animals	I get angry when I think about companies testing products on animals.
Energy	It makes me happy to see people trying to save energy.
Water	I am not worried about running out of water.

Note: Items were answered by selecting

- a. very true b. mostly true c. not sure d. mostly false e. very false
 5 points 4 points 3 points 2 points 1 point

The CHEAKS Knowledge sub-scale comprised 30 items that also systematically sample the six content-dependent sub-domains, i.e. five items from each sub-domain: animals, energy, pollution, recycling, water, and general issues as shown in Table 3.3. In addition, this researcher added two items at the end of the instrument that were not scored. The organization between the first 30 knowledge items and the six sub-domains is shown in Table 3.5.

Table 3.3 Examples of Items from CHEAKS instrument--Knowledge sub-scale

Animals Most elephants are killed every year to provide people with:

- a. trophies.
- b. ivory.
- c. meat.
- d. oil.
- e. skin.

Energy Burning coal for energy is a problem because it:

- a. releases carbon dioxide and other pollutants into the air.
- b. decreases needed acid rain.
- c. reduces the amount of ozone in the stratosphere.
- d. is too expensive.
- e. pollutes the water in aquifers.

Table 3.3 (continued)

General Ecology assumes that man is what part of nature?

- a. special.
- b. related to all other parts.
- c. not important.
- d. the best part.
- e. the first part.

Water Phosphates are harmful in sea water because they:

- a. cause cancer in fish.
- b. stop reproduction in fish.
- c. make fish nervous.
- d. make the water cloudy.
- e. suffocate fish by increasing algae.

Recycling Compared to other paper, recycled paper:

- a. takes more water to make.
- b. takes less energy to make.
- c. is less expensive to buy.
- d. is harder to write on.
- e. produces more pollutants.

Pollution The most pollution of our water sources is caused by:

- a. dams on rivers.
 - b. chemical runoff from farms.
 - c. methane gas.
 - d. leaks in the sewers.
 - e. human and animal wastes
-

Table 3.4 Attitude Item Numbers on CHEAKS instrument with Sub-domains

Sub-domain	Verbal Commitment	Actual Commitment	Affect
			Question #
Animals	1, 7	17, 23	28, 34
Energy	2, 8	16, 22	29, 35
Water	3, 9	15, 21	30, 36
General	4, 10	14, 20	25, 31
Pollution	5, 11	13, 19	26, 32
Recycling	6, 12	18, 24	27, 33
Total items = 36			

Table 3.5 Knowledge Item Numbers on CHEAKS instrument with Sub-domains

Sub-domain	Knowledge Question #	Total # Questions
Animals	37, 47, 52, 59, 64	5
Energy	39, 48, 53, 60, 65	5
Water	40, 46, 57, 58, 63	5
General	39, 43, 49, 54, 66	5
Pollution	42, 44, 50, 55, 61	5
Recycling	41, 45, 51, 56, 62	5

Total items = 30 (not including the last 2 items added by this researcher)

3.4.1.1. Reliability for CHEAKS instrument

Previous Work with CHEAKS in Tennessee

Leeming et al. (1995) stated that all but one of the studies they reviewed employed a project-developed questionnaire to measure attitude and/or knowledge. Previous to this survey, no single scale was widely used to measure children's attitudes towards, and knowledge of, a broad range of environmental issues.

I noted that in Memphis, Tennessee, 21 of the 42 teachers involved in the field-testing study provided their classes with instructional and experimental activities of an environmental orientation during that school year. In Leeming et al.'s study, younger students (grades 1-3) had better improvement in attitudes on the CHEAKS than did students in grades 4-7 from the first to the second administration of the survey (8 months later). CHEAKS was more stable for the older children in the pilot study (grades 4-7) than the younger children (grades 1-3) and more stable for the Attitude scale than the Knowledge scale. Developmentally, younger children are less stable in their judgements than older children. The scale may be useful for children who are at the end of their grade-1 year and older.

In Tennessee, children in grades 1-3 attained mean Knowledge subscale scores that indicated approximately 25% of the items were answered correctly. Children in grades 4-7 found the Knowledge scale somewhat less challenging and averaged approximately 44% correct responses.

My work with CHEAKS in Miami

In looking for comprehensive environmental surveys to give the students in my school I decided to use CHEAKS because of its reliability and also because it did cover a range of environmental issues, which I felt should be in the elementary school curriculum. I found CHEAKS to be a valuable teaching and research tool. I used CHEAKS for grade-4 -5 and -6 students during this study.

In my study in Miami, the same exact CHEAKS instrument was used for the same grade level for two consecutive years 2002 and 2003. The students matriculated from one grade level to the next. The same Sunshine State Standards (SSS) were used to guide the curriculum, which was taught at each grade level building on the student knowledge from the last grade level.

In my administrations of CHEAKS in Miami in 2002 in grade-4 regular (n=140), my students scored a mean of 8.74 questions correct out of 30 Knowledge questions which is an average of 29% correct. In 2002 in grade-4 gifted (n=26), the students scored a mean of 13.19 questions correct out of 30 Knowledge questions which is an average of 44%. The next year, in 2003, in grade-4 regular (n=53), the students scored a mean of 8.1 questions correct out of 30 Knowledge questions, which is 27%. In 2003 in grade-4 gifted (n=53), the students scored a mean of 13.49 questions correct out of 30 Knowledge questions, which is an average of 45%. I guess the information on the Knowledge section was not taught from the first year to the next or if it was, the student did not learn it.

The most common internal consistency measure is Cronbach's alpha, which is usually interpreted as the mean of all possible split-half coefficients. As shown in Table 3.6, all scales had acceptable reliabilities (>0.60) (Punch, 1998, p. 99). Eta² values also showed that all scales, except Actual Commitment, are able to differentiate students' perceptions from different groups/classes.

Table 3.6 Internal Consistency Reliability (Cronbach Alpha Coefficient) and ANOVA Results for CHEAKS instrument from this study in Miami (n=301)

Scale	Number of Items	Alpha Reliability	Mean	S.D.	Eta ²
Verbal Commitment	12	.73	2.40	.61	.10***
Actual Commitment	12	.67	2.72	.68	.05
Affective	12	.83	2.19	.75	.09**
Knowledge (cognitive)	30	.62	9.79	3.88	.31***

p<0.01 *p<0.001

3.4.1.2 Content validity for CHEAKS instrument

Since this was the first time this survey was ever given in South Florida, as far as I could ascertain, I could only use the answers of the students in this school to provide content validity. Content validity is most often addressed in academic testing, where test items need to reflect the knowledge actually required for a given topic area. Since I was a teacher in the school for 20 years, I can verify what I had been teaching. I did cover the content of this survey. The Sunshine State Standards (SSS) mandate what students are expected to learn in each grade level. The school follows the SSS. The items on the CHEAKS instrument are part of the standards that each child should have been taught by grade-5.

The following are the misconceptions of the students who were interviewed. The Sunshine State Standard in Science covering this content follows in italics.

1. Animals

Students thought that species become extinct just because people hunt for the animal. (Dodo bird was mentioned). Many students did not know that the cause of the animal becoming extinct, most times, is that the habitat where they live is destroyed.

How Living Things Interact with Their Environment

- *knows the kinds of organisms that lived in the past and compares them to existing species.*
- *knows characteristics that allow members within a species to survive and reproduce.*
- *understands patterns of interdependency in ecological systems.*

2. Energy

Most students thought that lights use the most energy in an average house in the United States. The correct answer is the hot water heater. Most students who were immigrants from Israel knew the correct answer.

Energy

- *knows that there are a variety of sources for electricity (for example, hydroelectric, geothermal, windmills).*
- *knows that most objects that emit light also emit heat.*
- *knows ways that energy can be transformed (for example, electricity to light, light to heat, mechanical to heat).*
- *extends and refines use of a variety of tools to measure the gain or loss of energy.*
- *understands the reasons for energy conservation.*
- *knows the risk factors associated with the use of nonrenewable energy sources (for example, economic factors and health factors).*
- *understands the processes that created fossil fuels and why they are nonrenewable.*

3. General

Many of the students interviewed in this school stated they thought that ecology assumes that man is the best part of nature. This is an egocentric idea. The correct answer is man is related to all other parts.

How Living Things Interact with Their Environment

- *knows characteristics that allow members within a species to survive and reproduce.*
- *understands patterns of interdependency in ecological systems.*
- *understands that what benefits one organism may be harmful to other organisms.*
- *understands that changes in an ecological system usually affect the whole system.*

4. Pollution

Many students had no idea that the most pollution of our water sources is caused by chemical runoff from farms. They were not aware that phosphates stop the water flow by making the plants grow in canals and streams. This is especially true in central and south Florida. In contrast, the students that went to Sea Base years ago had the opportunity to see the dead coral reefs possibly caused by chemical runoff. Students also didn't know that (older) leaded

gasoline (which has now been virtually eliminated in our economy) from cars caused lead emissions in our air.

Processes that Shape the Earth

- *understands the stages of the rock cycle.*
- *knows the properties of different types of soil.*
- *understands how the water cycle is influenced by temperature and land features.*
- *understands how processes of weathering and erosion constantly change the surface of the Earth.*
- *knows ways in which people can conserve natural resources.*
- *knows ways misuse of natural resources affects the quality of life for all species.*

5. Water

Again, phosphates were unknown to most students even though Florida has phosphate mining on the west coast. Students were unaware of the causes of acid rain. This could be because acid rain is not very prevalent in Florida although sinkholes are caused by an acid solution dissolving the limestone rock. Some students were aware of this.

Processes that Shape the Earth

- *understands the stages of the rock cycle.*
- *knows the properties of different types of soil.*
- *understands how the water cycle is influenced by temperature and land features.*
- *understands how processes of weathering and erosion constantly change the surface of the Earth.*
- *knows ways in which people can conserve natural resources.*
- *knows ways misuse of natural resources affects the quality of life for all species.*

6. Recycling

Most students had no concept of how paper is made and that recycled paper takes less energy to make than making new paper.

Energy

- *understands the reasons for energy conservation. (Florida Department of Education, 2005.)*

3.4.2 Qualitative Data

3.4.2.1 Student-Student Videoed Interviews

In order to provide qualitative data to enhance the validity of my findings, I arranged for students to interview each other to investigate their thoughts while they were answering the survey questions. I asked the teachers which of their students they would suggest should be interviewed about their environmental knowledge, feelings and actions. Because time was limited during the school day, I also asked the teachers at the after-school YMCA programme to suggest students who could come to be interviewed after school hours.

Subsequently, I set up interview times for the students who had their teachers' permission to leave their classroom. Teachers excused students from class and after school during the YMCA time. Some students chose to come to interview each other during their lunchtime, which was also my lunchtime. Because I had to arrange the interview times around my teaching schedule the interviews took quite a few weeks to complete. I interviewed the students in pairs allowing them to choose their own partners so that they felt comfortable and were relaxed. I was in the classroom to oversee that the videotaping was not interrupted. When students asked me questions during the interviews, I answered them immediately. I was acting as interviewer and teacher. I felt it was important to give feedback to the students at these 'teachable moments' so the students would learn and remember. Most interviews were over one hour in length (see Appendix C-7).

Twenty-eight of the students were interviewed and recorded on video in May and June 2002 in my classroom. Students were chosen by their availability and teacher recommendation. Nine were grade-4 students (four were male and five were female) and 19 were in grade-5 (11 were male and nine were female). I chose to transcribe the comments from two grade-4 gifted girls and two grade-4 gifted boys for several reasons. One reason was that these particular sets of students completed their interviews and had time to take photos around the campus. Another reason was that the interviews included students' rich explanations and elaborate answers.

An additional reason why I chose to transcribe the interviews of grade-4 students was because all grade-4 students in the State of Florida had been involved in the study of Florida and Florida history in both science and social studies during that school year. Many environmental initiatives are available in South Florida, some of which were used as resources in our school. The grade-4 students had heard speakers who came to their classrooms from the Officer Snook Water Pollution Programme and Friends of the Everglades. They had been to the North Miami Beach Water Fest to see a live performance by Earth Man and his band and watched him on television every school day in the month of April in class. I wondered whether these initiatives had inspired students to take action to help the environment.

3.4.2.2 Qualitative Data--Photo Essay

When the students finished interviewing each other, I made our school digital camera available for some of the students to use if time permitted. I arranged for permission with their teachers and administration for them to walk around the school campus and take photos. My instructions to them were to take photos of things they saw in the school environment that they thought were both positive (good things) and negative (things they thought should be changed). Then they came back and discussed what they saw (see Appendix C-8). Certain environmental concerns were noted by most of the students who walked around the campus with the camera. (See Section 4.3.5 for researcher's reflections of photos.)

3.4.2.3 Data Source--Parents

Because I became curious about parents' environmental attitudes and actions, I asked 50 parents at our Family Science Night if they would fill out an environmental survey and turn it in to me at the end of the night. However, only 13 of those parents turned it in to me. Some of the parents who did turn in the survey became involved with their child's environmental studies and started an email dialogue with me that informed me of any of their social actions.

3.4.2.4 Data Source--Community Action by Student

At the end of the school year, in fact, the day after the grade-5 graduation, student “E” came to my classroom and asked me if he could tell me about his meeting with the governor of our state. He told me his story. I noted it. This is a part of the qualitative information (see Appendix D-7).

3.5 Data Collection Procedures/Recording Procedures/Analysis Procedures

3.5.1 Quantitative Data Collection – Year One

In 2002, I received approval to conduct this research from my public school and county public school administration (see Appendix C-3). Then I spoke with each grade-4 and grade-5 teacher and sent each teacher a letter to explain the study.

I sent home and received back parents’ permission forms for their children to be a part of this study (see Appendix C-4). Before I used the instrument, I received parent approval and tested CHEAKS instrument with 10 gifted grade-3 students to see if they could read the items silently and understand them. They were able to understand and answer the items without difficulty. One third-grade student wrote reflections about the science class (see Appendix C-5).

During the first year of this study, in April and May of 2002, I disseminated the CHEAKS to all grade-4 and grade-5 teachers in the school and asked them to administer the instrument to their students ($n=301$). The time of the year was propitious. It was springtime. The students had just learned about, and had celebrated Earth Day. The grade-4 students had gone to Water Fest. The speaker from Friends of the Everglades had been in every grade-4 class to speak with the students and show videos about the precious resources of South Florida. The oak trees on the school grounds were dropping their acorns and the squirrels were gathering and enjoying their feast.

The gathering of data in each of the classes was not without difficulties, though. At first, the teachers agreed to administer the instrument to their students, but in reality,

a few found it too time-consuming. In those cases, I came in to their classrooms on my planning time to administer the instrument while the teacher took a break. I already knew some of the students because I had taught them in prior years. I introduced myself to all the students and explained my purpose for giving the survey; that I wanted to investigate students' knowledge of environmental issues, attitudes towards the environment and behavioural intentions towards the environment. I explained to the students that they would not be graded on this. The students were all quite attentive, read the survey silently, and answered the questions. I personally collected the CHEAKS papers from each class.

3.5.2 Qualitative Data Collection – Year One

The students who were selected by convenience sampling conducted videotaped interviews asking each other the items from the instrument and the reasons for their answers. The students came from classes where the teacher selected them or they volunteered to come during their lunchtime and were accepted for the interview. The interview was standardized (Punch, 1998, p. 175) across different respondents from both grade-4 and grade-5 students, with gifted and regular students, and with boys and girls. Because the students were able to choose one other student from their class with whom they wanted to partner, they felt at ease, even while the video camera was running. In many cases, the students set up the video camera themselves and conducted their own interview sessions after receiving instructions from me, the researcher.

The interviews were structured with the students asking a series of pre-established questions taken directly from the CHEAKS instrument. The respondents received the same questions in the same order. Flexibility and variation were minimized. I, as the facilitator, tried to play a neutral role and have the students ask each other the questions. But when the students asked me for clarification or direction, I gave it. Because both interviewers were students, the respondents were not in a subordinate position to the interviewer. They did not feel intimidated. Many students asked to be interviewed when they found out about the study. This might have been because they liked having the opportunity to express their ideas at length in a school setting. The interview situation helped students produce meanings for themselves and clarify

concepts. Students addressed issues related to the research concerns (see Appendix C-6).

As it is important for the qualitative researcher to be able to convey the full picture, I tried to provide a 'thick description' of what the students said (Punch, 1998, p. 192). According to Lincoln and Guba (1985), the research report needed to provide sufficient information about the context of the research so that a reader can judge the transferability or generalise its findings.

3.5.3 Recording Procedures – Year One

I spent the first summer coding and inserting the raw data on my computer. I realised that a few of the students had not finished answering the questions on the CHEAKS instrument. This might have been because they were English speakers of other languages and not proficient readers of English. The data were then analysed (see Chapter 4 Section 4.2). The instrument was administered again the following year.

3.5.4 Data Collection – Year Two

The following year, in April and May of 2003, I chose to administer all of the tests myself to grade-4 and grade-5 students ($n=378$). I read the body of the items to the students and they silently read the responses and individually chose the answer to mark on their answer sheet. I answered any questions the students asked me about a vocabulary word by giving a synonym or definition. I gave the students enough time to answer each question, went through the questions sequentially, and made sure every student answered on their answer sheet. I could tell this by walking around the room and watching them mark in the answers. Then I read the next item. For the 2003 administration of CHEAKS, the students finished answering all the items because I read them orally to grade-4 and grade-5 students. I expected students to do better because I improved the way they could learn by reading the items out loud. I also expected that they would do better because they had taken the survey the prior year.

This second year 2003, I also asked the students to write a paragraph or two about what they knew or had done to improve the environment. Students, who were all English Speakers of Other Languages in one grade-4 class, wrote about how they helped the environment by recycling, saving energy and water. In addition, the teacher wrote about her environmental experiences (see Appendix C-8).

Because many of the previous year's students matriculated to the neighbouring middle school, I also arranged, with the assistant principal of the middle school and with the head of their science department, for the copies of CHEAKS to be given to grade-6 students ($n=57$). I compared one science class of gifted students (most of whom had been in our elementary school gifted programme) with one science class of regular students (which was a heterogeneous mixture from other elementary schools). After several weeks and my initiating many phone calls, I picked up the completed surveys from the science teacher.

The strategy in both years was to collect and use both quantitative and qualitative data in order to compare grade-4 and grade-5 students in gifted/regular classes, and girls/boys from one year to the next. Many of the grade-4 students of 2002, responded to the instrument again in 2003 when they were grade-5 students. Some gifted grade-5 students and some regular grade-5 students who responded to the instrument in 2002, answered the questions on CHEAKS instrument again as grade-6 students in 2003.

3.5.5 Analysis Procedures/Types of Tests I Used

3.5.5.1 Data Analysis

I compared the results across different variables: students in grade-4/grade-5, students in gifted classes/students in regular classes in grade-4-5 and -6, and boys/girls.

After formal testing, using the CHEAKS instrument in whole class settings, I set up student-student interviews with a cross sample of students (whose parents and teachers gave permission) to find out about their environmental attitudes. The data

provided answers and clarification to the research questions involving students' attitudes towards environmental issues.

In order to develop an understanding of the environment that related to their lives, some of the students who were interviewed then walked around the school campus discussing and taking digital photos of what they saw as good or bad things in the school environment. The data from this photo record was compared to the student's answers on both the formal test and the interview. This triangulation aided in showing validity of the results (Matheson, 1988). These results were compared to the results of the total group.

Editing, segmenting and summarising helped to reduce the data during the data analysis. Coding, making memos (Punch, 1998, p. 206), finding themes, clusters and patterns also aided in this effort. Conceptualising and explaining the data reduced them without significant loss of information. The quantitative data presented in this study were displayed in tables, charts and graphs which were used to organise, compress and assemble the information that I collected.

Conclusions were drawn from the first part of the study and clarified and sharpened during the study. For me, writing this research was an analytical task and was interpretive and personal. This research increased my understanding of what children believed and how those beliefs developed. As Keen (1991) noted, there is little point in imparting knowledge if attitudes are not also changed.

3.5.5.2 Types of Tests Used

T-tests were used to investigate the differences of means between two matched groups. In this analysis t-test with independent sample was used. Within the fields of quantitative design and data analysis are the comparison-between-groups with the t-test and analysis of variance as its main statistical features (Punch, 1998, p. 69). I also used dependent t-test with the same students.

3.6 Ethical Considerations

3.6.1 Sampling

The sampling plan was ethical in terms of informed consent, potential benefits and the relationship with informants (Punch, 1998, p. 194). The informed consent came from the administration, the teachers, the parents and the students. The students benefited from the study not only by learning what they were asked in the instrument, but also by thinking about what part environmental education does and should play in their daily lives. The plan was ethical and the relationship with the informants was good. They were able to express themselves, remember and retrieve experiences, and make comparisons and contrasts without being judged.

3.6.2 Permission, Facilities and Resources

I asked and obtained permission to use the CHEAKS from its originator, Dr. Leeming. As I was employed as a full time teacher for the Miami-Dade County Schools, I obtained permission to conduct the study from the Chairperson, Research Review Committee, Miami-Dade County Public Schools, Office of Evaluation and Research, 1500 Biscayne Boulevard, Suite 225, Miami, Florida 33132 (see Appendix C-3). Then, each and every student in grade-4 and grade-5 was given a parent letter to take home to explain the research (see Appendix C-4). Only students with parent permission participated in the interviews. The students were able to withdraw from the research at any time without explanation. The students' mean results were compared so that each individual student remained anonymous. Teachers agreed to administer the CHEAKS Survey to their students or have me administer it. Teachers gave permission for students to leave their class in order to be interviewed.

3.6.2.1 Data Storage/Author

The original data in my classroom will be retained at Curtin University for at least five years. The students were kept anonymous and I ensured appropriate security for information including what was held in the computing systems. I am the author of

the research where all the following conditions are met: conception and design, analysis and interpretation of data, drafting the article and revising it critically.

3.7 Limitations of the Study

3.7.1 The Language

The CHEAKS instrument had to be read to a few of the students even though the readability level was for grade-4. Some students spoke English as a Second Language (ESOL), were English Language Learners (ELL, which is the new US Department of Education term). They might not have completely understood the concepts, even though the ESOL teacher explained the concepts to the students in their native language.

3.7.2 Time as a Factor

Another limitation was time. The classroom teachers who agreed to be involved in the study had to find time in their schedule to administer CHEAKS instrument and may have rushed some students who could not finish in the 30 minutes required to complete it. Time was also a factor in interviewing students. Some students came to be interviewed on videotape during their lunchtime or after school. The interviews allowed students to expand on the issues. Consequently some interviews took well over an hour.

3.7.3 The Sample Group as a Factor

Another limitation was the nature and size of the sample group. The sample group was limited to all the students in grade-4 and grade-5 attending this elementary school and some students in grade-6 in the middle school next door. The 28 students who were interviewed were those students who were available. Furthermore, the homeroom class was the unit of analysis. I did not compare individual students in grade-4 in 2002 and grade-5 in 2003.

3.7.4 The Subject Matter as a Factor

The subject matter focus was a limitation in that many students may not have been exposed to any instruction on environmental issues. A significant limitation was that many of the questions might have been difficult for a few ESOL students to understand, although their teacher may have explained the questions to them.

3.7.5 The Researcher as a Teacher

One of the limitations of the study was the fact that the person collecting the data (me) was not anonymous. I am a teacher in the school and the students know me. Consequently, students may have answered the questions in a way that they felt would please the teacher. The students were told that the research would not affect their performance and grades, though. This concept relieved their stress.

3.7.6 A Different Procedure was Used Year 2

In administering survey year 2, I read the questions to the students in all the classes to make sure every student had an equal opportunity to hear the questions and answer all 68 of them. This reading of the questionnaire may have influenced the outcomes of students' responses in the second year, but overall, students' responses across years were not statistically different.

3.8 Summary of Chapter 3

In Chapter 3, I discussed the research methods used in this study, overview of research design and methods, and the sample. I included data sources from the quantitative data from Childrens' Environmental Attitude and Knowledge Scale instrument and qualitative data from students' interviews. I discussed data collection procedures, recording procedures, and analysis. I discussed ethical considerations and limitations of the study.

The next chapter, Chapter 4, reports the results of the study including the quantitative and qualitative findings.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Overview of Chapter 4

In this chapter, I discussed the CHEAKS instrument in terms of its reliability and I present the results of the study in response to the six research questions. This study compared two different school grades in two consecutive school years, 2002 and 2003. I compared the findings, both quantitative (Section 4.2) and qualitative (Section 4.3) and summarized the responses on both the attitude and knowledge parts of the CHEAKS instrument based on the sub-domains (animals, energy, water, general, pollution, and recycling). I also presented reflections of the qualitative findings with possible reasons for them (Section 4.3), other findings including vocabulary that was not understood by the students, and students' misconceptions (Section 4.3.3). A summary (Section 4.4) concluded the chapter.

4.2 Quantitative Data

4.2.1 Response to Research Questions with Quantitative Data

For all mean scales comparisons on the Attitude section of the test, the higher the number score in Verbal Commitment, Actual Commitment and Affective (feelings), the more commitment the student had to the environment. Questions were answered by selecting very true (5 points), mostly true (4 points), not sure (3 points), mostly false (2 points), very false (1 point). The higher the Knowledge score the more the student knew about the environment. Each Knowledge question had one correct response.

4.2.1.1 Research Question 1:

How do students in grade-4 and grade-5 compare in their

- a. verbal commitment towards the environment
- b. actual commitment towards the environment
- c. feelings towards the environment
- d. knowledge of the environment?

This comparison was made in two consecutive school years 2002 and 2003. An independent t-test (Gay, 1981) was used to investigate the differences of means between grade-4 and grade-5 students. Evident in Table 4.1 is that whereas in the year 2002, there are no statistically significant differences in the grade-4 and grade-5 students' mean scores on CHEAKS' Verbal Commitment and Knowledge subscales, the grade-4 students' Actual Commitment and Affective mean scores are statistically significantly higher than those of the grade-5 students. Moreover, in all cases in Table 4.1 and Figure 4.1, the means of the grade-4 students are numerically slightly higher than those of the grade-5 students on the CHEAKS' four subscales.

Table 4.1 Mean scale comparisons between grade-4 (n = 166) and grade-5 (n=135) on the *Children's Environmental Attitude and Knowledge Scale* (2002)

Scale	Grade-4 (n=166)		Grade-5 (n=135)		t
	Mean	S.D.	Mean	S.D.	
Verbal Commitment	3.64	0.55	3.55	0.68	1.39
Actual Commitment	3.38	0.61	3.16	0.73	2.95*
Affective	3.90	0.69	3.70	0.81	2.33*
Knowledge	9.44	4.07	10.23	3.60	1.77

*p<0.05

12 items on Verbal Commitment maximum score=60, minimum score=12

12 items on Actual Commitment maximum score=60, minimum score=12

12 items on Affective maximum score=60, minimum score=12

The CHEAKS Knowledge sub-scale comprised 30 items with a maximum of 30 points.

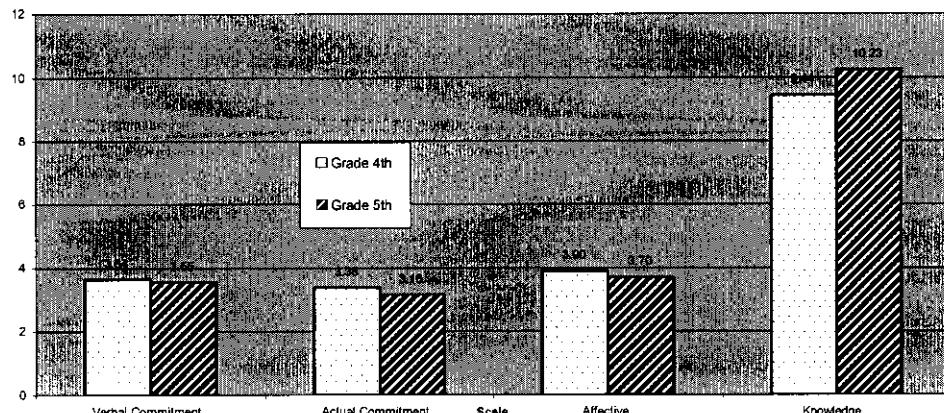


Figure 4.1 Mean scale comparisons between grade-4 (n=166) and grade-5 (n=135) on CHEAKS (2002).

Similarly, in respect of Table 4.2 data, in the year 2003, while there is no statistically significant difference in the grades-4-and-5-students' Environmental Knowledge mean scores, the grade-4 students' Verbal Commitment, Actual Commitment and Affective mean scores are statistically significantly higher than those of the grade-5 students. The data in Figure 4.2 are consistent with these findings.

Table 4.2 Mean Scales Comparisons between Grade-4 (n=181) & Grade-5 Students (n=197) on the *Children's Environmental Attitude and Knowledge Scale* (2003)

Scale	Grade-4 ((n=181)		Grade-5 (n=197)		t
	Mean	S.D.	Mean	S.D.	
Verbal Commitment	3.52	0.45	3.28	0.47	4.92***
Actual Commitment	3.47	0.56	3.28	0.60	3.07**
Affective	3.45	0.56	3.30	0.57	2.62**
Knowledge (cognitive)	10.25	3.71	10.40	4.01	0.37

***p<0.000, **p<0.01

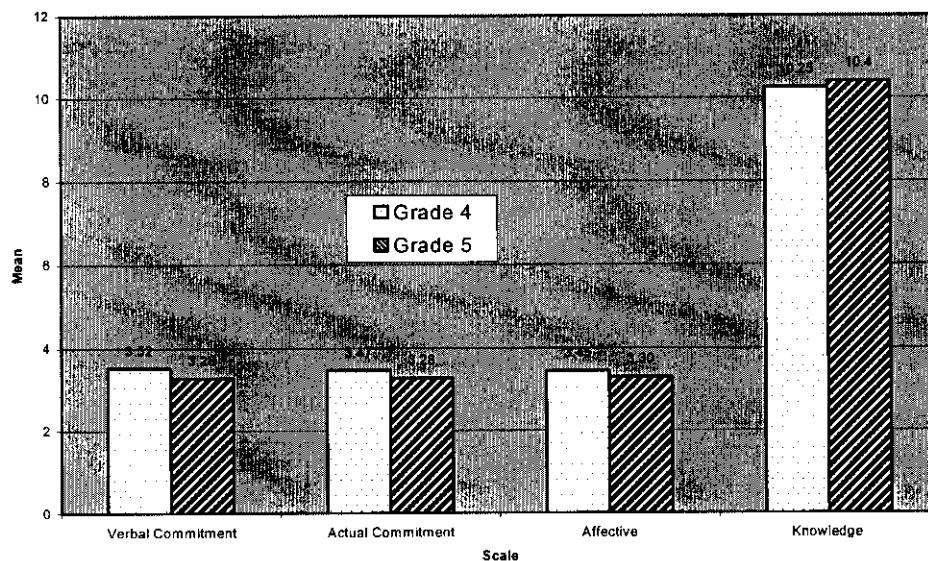


Figure 4.2 Mean scale comparisons between grade-4 (n=181) and grade-5 (n=197) on the *Children's Environmental Attitude and Knowledge Scale* (2003).

Kuhlemeier, Bergh and Lagerweij (1999) stated that "students who know a lot about the environment have a positive attitude toward it and are likely to behave in an environmentally responsible manner" (p. 4). Morris and Schagen (1996) found a significant positive relationship between students' self-reported enjoyment of school subjects and their environmental concern. Knowledge, understanding and/or concern,

and locus of control significantly correlated with grade level in Dimopoulos and Pantis' (2003) study in Zakynthos, Greece.

4.2.1.2 Research Question 2:

How do students in grade-4 regular and grade-4 gifted compare in their

- a. verbal commitment towards the environment
- b. actual commitment towards the environment
- c. feelings towards the environment
- d. knowledge of the environment?

Evident in Table 4.3 are the findings that there is no significant difference in the Actual Commitment mean scores of the grade-4 regular and grade-4 gifted students. Conversely, the grade-4 gifted students' Knowledge of the environment mean score is statistically significantly higher than that of the grade-4 regular students. These findings are further underlined graphically in Figure 4.3

Table 4.3 Mean scale comparisons between grade-4 regular (n=140) and grade-4 gifted (n=26) on the *Children's Environmental Attitude and Knowledge Scale* (2002)

Scale	Grade-4 Regular (n=140)		Grade-4 Gifted (n=26)		t
	Mean	S.D.	Mean	S.D.	
Verbal Commitment	3.58	0.53	3.98	0.55	3.53**
Actual Commitment	3.35	0.59	3.54	0.69	1.44
Affective	3.85	0.68	3.18	0.69	2.19*
Knowledge (cognitive)	8.74	3.88	13.19	2.88	6.81***

*p< 0.00

The findings, related to gifted students' knowledge scores, are supported by the teachers of the gifted students. These teachers incorporated an environmental curriculum as enrichment to the regular science and social studies program in this school.

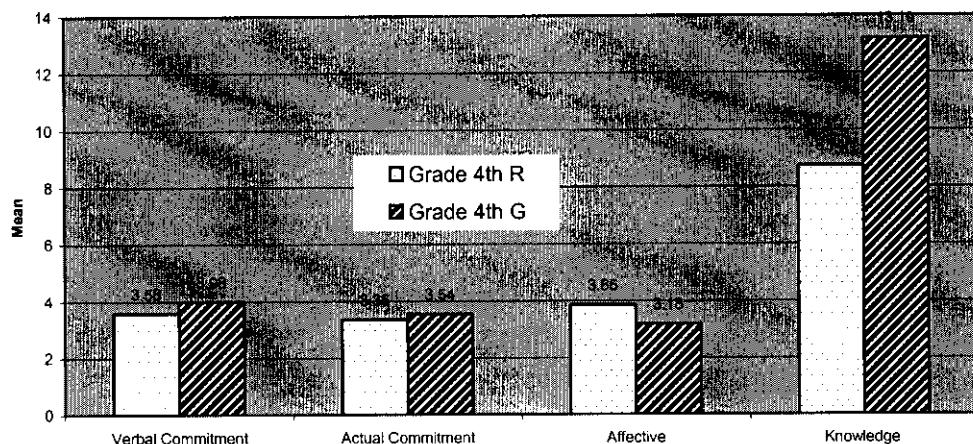


Figure 4.3 Mean scale comparisons between grade-4 regular ($n=140$) and grade-4 gifted ($n=26$) on the *Children's Environmental Attitude and Knowledge Scale* (2002)

Comparing independent t-test results in the year 2003 between grade-4 regular students ($n=128$) and grade-4 gifted students ($n=53$), there were no statistically significant differences between the two groups in terms of Verbal Commitment and Actual Commitment. On scores on the Affective (feelings) scale, grade-4 gifted students were less committed to the environment than their regular student peers ($p<0.05$). Grade-4 gifted students had more Knowledge than did their peers in the regular classes and these differences were statistically significant ($p<0.001$) (see Table 4.4 and Figure 4.4).

Table 4.4 Mean scales comparisons between grade-4 regular ($n=128$) and grade-4 gifted students ($n=53$) on the *Children's Environmental Attitude and Knowledge Scale* (2003)

Scale	Grade-4 Regular ($n=128$)		Grade-4 Gifted ($n=53$)		t
	Mean	S.D.	Mean	S.D.	
Verbal Commitment	3.53	0.44	3.48	0.47	0.66
Actual Commitment	3.49	0.55	3.40	0.59	0.98
Affective	3.52	0.55	3.30	0.56	2.36*
Knowledge	8.10	3.17	13.49	2.83	9.56***

* $p<0.000$, * $p<0.05$

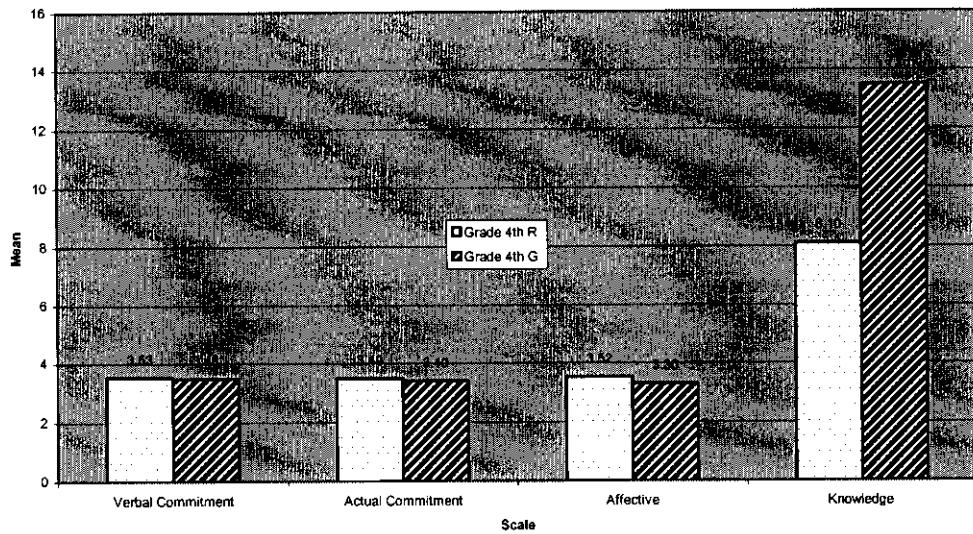


Figure 4.4 Mean scale comparisons between grade-4 regular (n=128) and grade-4 gifted (n=53) on the *Children's Environmental Attitude and Knowledge Scale* (2003).

These results are in agreement with previous findings. Just because a student has knowledge of the environment, does not mean he/she will take action to improve it. A variety of variables are hypothesized to be associated with responsible environmental behaviour (Hungerford & Volk, 1990). Instruction in community investigations and citizenship participation show a positive impact on attitudes, socio-political knowledge, environmental knowledge, cognitive skill development, and both responsible environmental behaviour and several determinants of responsible environmental behaviour (Volk, 2001).

4.2.1.3 Research Question 3:

How do students in grades-5 regular and grade-5 gifted compare in their

- verbal commitment towards the environment
- actual commitment towards the environment
- feelings towards the environment
- knowledge of the environment?

Comparing independent t-test results in year 2002 between grade-5 regular students ($n=105$) and grade-5 gifted students ($n=30$), grade-5 gifted students were statistically less committed to the environment in terms of scores on the Verbal Commitment ($p<0.05$), and Affective (feelings) scales ($p<0.01$). There were no statistically significant differences on Actual Commitment. Gifted students had more knowledge than did their peers in the regular classes and these were statistically significant ($p<0.05$) (see Table 4.5 and Figure 4.5).

Table 4.5 Mean scale comparisons between grade-5 regular ($n=105$) and grade-5 gifted ($n=30$) on the *Children's Environmental Attitude and Knowledge Scale* (2002)

Scale	Grade-5 Regular ($n=105$)		Grade-5 Gifted ($n=30$)		<i>t</i>
	Mean	S.D.	Mean	S.D.	
Verbal Commitment	3.61	0.66	3.32	0.71	2.03*
Actual Commitment	3.19	0.74	3.04	0.68	0.95
Affective	3.80	0.80	3.37	0.75	2.70**
Knowledge (cognitive)	9.81	3.32	11.70	4.18	2.28*

* $p<0.05$, ** $p<0.01$

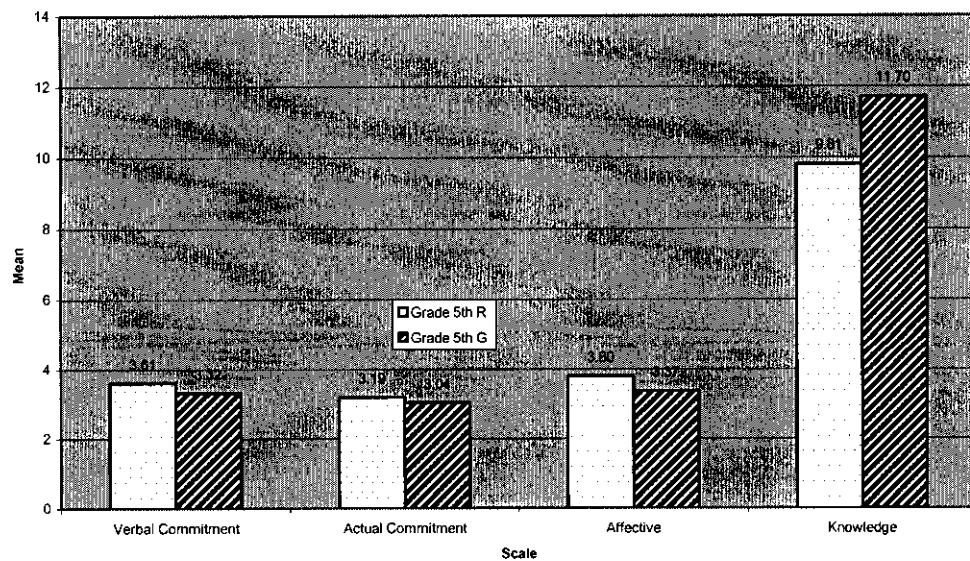


Figure 4.5 Mean scale comparisons between grade-5 regular ($n=105$) and grade-5 gifted ($n=30$) on the *Children's Environmental Attitude and Knowledge Scale* (2002).

I expected that these gifted students, who had superior intellectual development and were capable of high performance (Florida Department of Education, 2006) would be committed to the environment. But these findings show that they were not. The instructional services for gifted students was different from regular instruction in such areas as: content, including broad based interdisciplinary curriculum, process, including higher level thinking skills, product, including variety and complexity, and learning environment, including flexibility.

Comparing independent t-test results in the year 2003 between grade-5 regular ($n=159$) and grade-5 gifted students ($n=38$), no statistically significant differences were found on any of the four scales (see Table 4.6 and Figure 4.6).

Table 4.6 Mean scale comparisons between grade-5 regular students ($n=159$) and grade-5 gifted students ($n=38$) on the *Children's Environmental Attitude and Knowledge Scale* (2003)

Scale	Grade-5 Regular ($n=159$)		Grade-5 Gifted ($n=38$)		t
	Mean	S.D.	Mean	S.D.	
Verbal Commitment	3.30	0.48	3.19	0.46	1.32
Actual Commitment	3.26	0.60	3.35	0.63	0.78
Affective	3.33	0.55	3.17	0.66	1.39
Knowledge (cognitive)	10.31	3.72	10.79	5.08	0.55

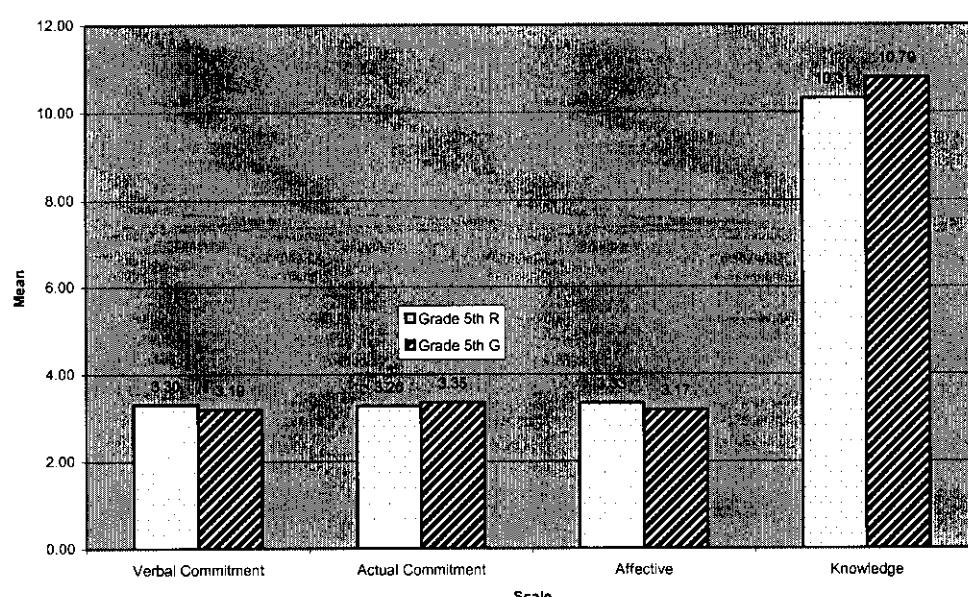


Figure 4.6 Mean scale comparisons between grade-5 regular ($n=159$) and grade-5 gifted ($n=38$)

4.2.1.4 Research Question 4:

How do students in grade-6 regular and grade-6 gifted compare in their

- a. verbal commitment towards the environment
- b. actual commitment towards the environment
- c. feelings towards the environment
- d. knowledge of the environment?

Comparing test results in the year 2003 between grade-6 regular students ($n=29$) and grade-6 gifted students ($n=28$), no statistically significant differences were found (see Table 4.7 and Figure 4.7).

Table 4.7 Mean scale comparisons between grade-6 regular ($N=29$) and grade-6 gifted ($N=28$) on the *Children's Environmental Attitude and Knowledge Scale* (2003)

Scale	Grade-6 Regular (n=29)		Grade-6 Gifted (n=28)		t
	Mean	S.D.	Mean	S.D.	
Verbal Commitment	3.28	0.52	3.20	0.60	0.59
Actual Commitment	3.66	0.52	3.92	0.72	1.55
Affective	3.26	0.69	3.07	0.79	1.51
Knowledge (cognitive)	9.28	3.73	9.71	5.95	0.34

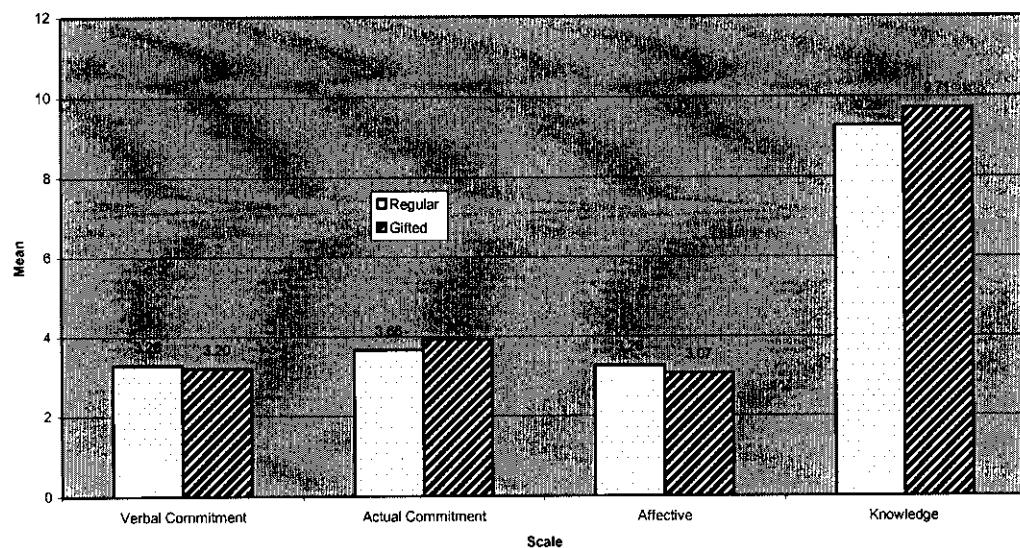


Figure 4.7 Mean scale comparisons between grade-6 regular ($n=29$) and grade-6 gifted ($n=28$) on the *Children's Environmental Attitude and Knowledge Scale* (2002).

4.2.1.5 Research Question 5:

How do boys in grades-4 and -5 compare with girls in grades-4 and -5

- a. verbal commitment towards the environment
- b. actual commitment towards the environment
- c. feelings towards the environment
- d. knowledge of the environment?

Comparing independent t-test results in the year 2002 between all boys in grade-4 and grade-5 (n=157), and all girls in grade-4 and grade-5 (n=144), a statistically significant difference was found in Verbal Commitment ($p<0.05$) with girls being more committed verbally to the environment. There were no statistically significant differences between boys and girls involved in this study on the scales Actual Commitment, Affective (feelings) and Knowledge (see Table 4.8 and Figure 4.8).

Table 4.8 Mean scales comparisons between boys in grade-4 and grade-5 (n=157) and girls in grade-4 and grade-5 (n=144) on the *Children's Environmental Attitude and Knowledge Scale* (2002)

Scale	Boys (n=159)		Girls (n=144)		t
	Mean	S.D.	Mean	S.D.	
Verbal Commitment	3.53	0.62	3.67	0.60	1.97*
Actual Commitment	3.26	0.68	3.30	0.68	0.55
Affective	3.76	0.76	3.87	0.74	1.31
Knowledge (cognitive)	9.50	3.99	10.11	3.74	1.36

$p<0.05$

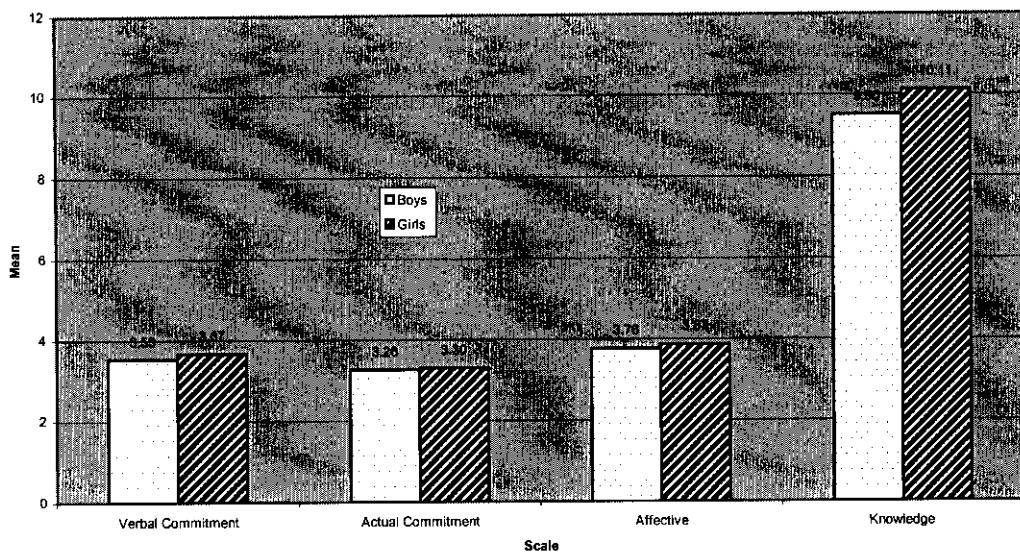


Figure 4.8 Mean scale comparisons between boys in grade-4 and grade-5 (n=157) and girls in grade-4 and grade-5 (n=144) on the *Children's Environmental Attitude and Knowledge Scale* (2002).

These findings are in agreement with prior research. Results in Beatty's (1991) moral reasoning study relating to environmental dilemmas, favoured girls because they gave less one-sided concrete justifications, more answers on higher levels, and answers connecting both sides of the issue. Roper Starch Worldwide's (1994) study suggested that girls from disadvantaged areas exhibited higher levels of concern than did boys on most issues support my findings.

Comparing independent t-test results in the year 2003 between all boys in grade-4 and grade-5 (n=190), and all girls in grade-4 and grade-5 (n=188), a statistically significant difference was found in Verbal Commitment in favour of the girls ($p<0.01$). Although girls' scores were higher on the Actual Commitment Scale and Affective (feelings) Scale, these differences were not statistically significant. The scores on the Knowledge scale for boys and girls were almost identical (see Table 4.9 and Figure 4.9).

Table 4.9 Mean scale comparisons between boys grade-4 and grade-5 (n = 190) and girls grade-4 and grade-5 (n=188) on the *Children's Environmental Attitude and Knowledge Scale* (2003)

Scale	Boys in Grade -4 & -5 (n=190)		Girls in Grade -4 & -5 (n=188)		t
	Mean	S.D.	Mean	S.D.	
Verbal Commitment	3.34	0.49	3.45	0.46	2.23**
Actual Commitment	3.32	0.63	3.42	0.55	1.70
Affective	3.34	0.58	3.41	0.55	1.20
Knowledge (cognitive)	10.32	4.15	10.34	3.57	0.05

*p<0.05

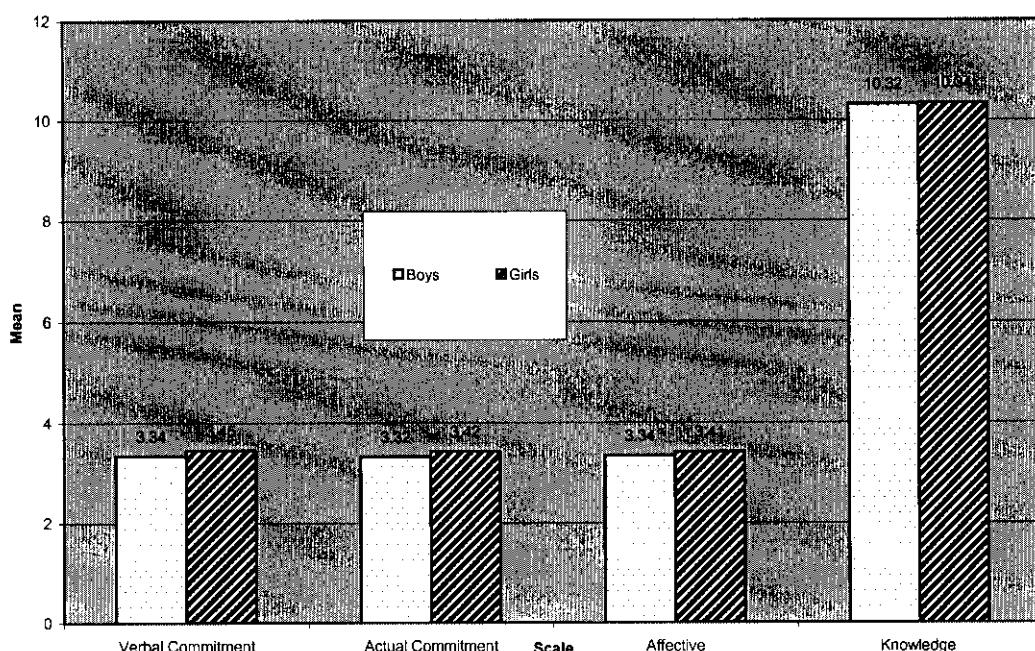


Figure 4.9 Mean scale comparisons between boys grade-4 and grade-5 (n=190) and girls grade-4 and grade-5 (n=188) on the *Children's Environmental Attitude and Knowledge Scale* (2003).

4.2.1.6 Research Question 6:

What is the correlation between students' verbal commitment, actual commitment, environmental attitudes and their knowledge of the environment?

By calculating simple correlation, multiple correlation and standardized beta coefficients for each of the years when data were collected, response to this research question was made.

Table 4.10 Correlation between knowledge scores and each of the other three scales on the *Children's Environmental Attitude and Knowledge Scale* (2002) (n=301)

Attitudinal Scale	Simple Correlation	Beta Coefficient
Verbal Commitment	-0.07	0.05
Actual Commitment	-0.07	0.06
Affective	-0.19**	-0.26**
Multiple Correlation	0.20	

**p<0.01

There were no statistically significant associations between student scores in the Verbal Commitment and Actual Commitment scales. There is a negative, statistically significant but weak relationship between the students' Knowledge scores and their Affective scores (Table 4.10). The implications for this, in reality, are that even though students know environmental information and facts, they may not feel or perform actions that show they are environmentally committed. The prior research indicated that issue investigation and action training tended to foster independent overt environmental behaviour, group locus of control, environmental action knowledge, and perceived knowledge about, and skill in the use of environmental action skills. (Environmental Education and Training Partnership, 2001).

Table 4.11 Correlation between Knowledge scores and each of the other three scales on the *Children's Environmental Attitude and Knowledge Scale*, (2003) (n=378 for grade-4 and grade-5)

Attitudinal Scale	Strength of the Association with Knowledge Score 2003	
	Simple Correlation	Beta Coefficient
Verbal Commitment	-0.04	0.04
Actual Commitment	-0.11*	-0.07
Affective	-0.12*	-0.10
Multiple Correlation	0.14	

*p<0.05

For the 2003 students, there is no relationship between their Verbal Commitment scores and their Knowledge scores. However, there is a negative, statistically

significant but weak relationship between the students' (a) Actual Commitment scores and (b) Affective scores and their Knowledge scores. (Table 4.11)

4.2.2 Summary of Quantitative Findings

1. Grade-4 students in this elementary school had a higher commitment to the environment than grade-5 students. (See Tables 4.1 and 4.2)

Possible reason: Florida history and ecology were a concentration in the curriculum for grade-4. The students were immersed in learning it for many months. In my study, I found the grade-4 students were presented more environmental information in school programme, such as Water Fest and Friends of the Everglades, compared to grade-5 students. One would expect students in grade-5, who have already learned about Florida, to have more knowledge, a better attitude and more commitment towards helping the environment than grade-4 students would. This was by virtue of their age and the fact that they spent a year longer in school. But it turned out that this was not the case in this study. The grade-5 students may have been less interested in academics and commitment to the environment because they were becoming more social with their peers. Or maybe in the school curriculum they needed constant reminders that the environment is fragile.

2. Gifted students had more knowledge than regular students. Only the gifted students in grade-4 had a high commitment to the environment. (See Table 4.3)

Possible reason: Gifted students are many times more avid readers than the regular student and may gain knowledge through that medium. They may have extended dialogue about environmental issues with their parents. Florida studies including the history of the state and its geography were a part of the grade-4 curriculum. Maybe only the history and geography of Florida were being taught and students were not learning environmental education in the regular classes. Ten years ago, students were immersed in the environment on field trips in the Florida Everglades and Florida Keys, but that was no longer the case for this particular group of students. During this study, I taught a science class for gifted grade-4 students and environmental education was the umbrella for all content. Students worked in cooperative groups

with hands-on lessons and community problems. Only one student though, took the issue investigation to action. The approach to the subject matter may be the reason for some students' commitment. Learning styles are an important issue. Anything different than the usual lecture method is going to give better results.

3. Comparing independent t-test results in year 2002 between grade-5 regular students ($n=105$) and grade-5 gifted students ($n=30$), grade-5 gifted students were statistically less committed to the environment in terms of scores on the Verbal Commitment. (See Table 4.5.)

Possible reason: It is likely that the grade-5 gifted students were not involved in community action and issue investigation. Gifted students, by nature, were usually very verbal and were bored by rote learning.

4. There is no difference in knowledge or commitment in grade-6 students. (See Table 4.7.)

Possible reason: Maybe the students were taught in the same way, in the middle school, in both gifted and regular classes with direct instruction rather than issue investigation and community action.

5. Girls are more verbally committed to the environment than boys. (See Tables 4.8 and 4.9.)

Possible reason: Girls may report being more verbally committed, whereas boys may not report it. Girls were supposedly more nurturing. They were also possibly more interested in pleasing adults. A possible reason for girls having lagged behind in science and mathematics may be that people had lower expectations for girls and they lacked role models in mathematics and science. As studies show,

Overall, females have done much better than males in reading and writing, but have generally, though not always, lagged behind in science and mathematics. On average, US boys outperformed girls in science in 2003, which was the case in 1995 as well. Concern exists that this gap in science

and mathematics may give them less access to high paying jobs. (National Centre for Education Statistics, 2005).

6. Having knowledge about the environment did not necessarily mean being committed to the environment nor did it mean the student took action to solve environmental problems. There were no statistically significant associations between student scores in the Verbal Commitment and Actual Commitment scales. The scores on the Affective scale were negatively statistically significant ($p<0.01$) with the knowledge scale in 2002 (see Table 4.10).

Possible reason: These students were not taught how to take action. Newspaper writer Leonard Pitts gave a plan of action for the general public: inform yourself, inform others, and demand news coverage (see Appendix D-1). Some people may sympathise with an issue but do not know how to go about doing anything to help. Writing letters and doing research on locating government officials to whom to write could be a valuable part of the curriculum.

Miami is a giant megalopolis with a huge school system and large government. Students are sometimes far removed from the workings of real civic decision-makers. Only one student in my school became a community activist. He was enabled by his knowledge of the local environment, his realisation that there was a problem, and his zeal to try to correct it (See Appendices D-2, D-3, D-4, D-5, D-6, D-7).

4.3 Qualitative Data Obtained from Interviews

4.3.1 Overview

Twenty-eight students were interviewed in pairs subsequent to their answering the questions on the CHEAKS instrument in the classrooms.

Table 4.12 Number of students interviewed in grade-4 and grade-5 (2002)

Grade-4		Grade-5		Combined
Boys	4	Boys	11	15
Girls	5	Girls	8	13
Total	9		19	28

Two pairs of interviews were transcribed verbatim; one pair was grade-4 gifted girls, another pair was grade-4 gifted boys (see Appendix C-6). In the discussion that follows, the grade-4 interviews are presented first, followed by a summary of the total group answers and quotes of a few grade-5 students. The two grade-4 student pairs that are reported are representative of the others who were interviewed. These students not only answered the questions, but also expanded on why they answered the way they did. Qualitative interviews of students took place both during and after school hours. After the interviews, the pairs of students went around campus. The students took digital photos of what they believed needed improvement in the environment (see Appendix C-8).

4.3.2 Response to the Research Questions with Qualitative Data from Interviews

The interviews focused on the sub-domains: animals, energy, water, general, pollution, and recycling as described in Chapter 3 (see Tables 3.3 and 3.4 questions on CHEAKS). Each interview included statements from the CHEAKS instrument (see Section 3.8.2). The 28 interviewed students' responses to the four subscales were tabulated and are presented in Table 4.13 for Verbal Commitment, Table 4.14 for Actual Commitment, Table 4.15 for Affective and Table 4.16 for Knowledge. The question numbers are from the CHEAKS instrument. The categories are presented in the same order in Tables 4.13 to 4.16 so the questions presented in the tables are not always in the same numerical order as the text. A comparison of the mean data of these 28 students for Verbal commitment, Actual Commitment and the Affective domain are made with grade-4 and grade-5 students in 2002 (see Table 4.17).

Table 4.13 Summary of students' verbal commitments towards the environment on the CHEAKS Attitude sub-scale (n-28)

Question #/ Category	Choice					Mean
	Very True 5 points	Mostly True 4 points	Not Sure 3 points	Mostly False 2 points	Very False 1 point	
1. Animals	7	11	8	1	1	3.90
2. Energy	3	7	6	6	6	2.71
3. Water	15	6	5	0	2	4.14
4. General ¹	0	3	4	5	16	4.22
5. Pollution	4	6	8	4	5	3.11
6. Recycling ¹	2	2	5	2	17	4.08
Total Mean						3.68

Note ¹. Reversed items

Total of 6 Verbal Commitment questions

Example #1. I would be willing to stop buying some products to save animal's lives.
 a. very true b. mostly true c. not sure d. mostly false f. very false

Table 4.14 Summary of students' Actual Commitments (actions) towards the environment on the CHEAKS Attitude subscale (n-28)

Question #/ Category	Choice					Mean
	Very True 5 points	Mostly True 4 points	Not Sure 3 points	Mostly False 2 points	Very False 1 point	
17. Animals	16	4	0	1	7	3.75
16. Energy	16	7	1	2	2	4.18
15. Water	19	2	2	2	3	4.14
14. General	9	7	4	2	6	3.40
13. Pollution ¹	17	5	2	3	1	3.21
18. Recycling	15	6	2	0	5	3.97
Total Mean						3.94

Note ¹. Reversed items

Total of 6 Actual Commitment questions

Example #17. I have asked my parents not to buy products made from animal fur
 a. very true b. mostly true c. not sure d. mostly false e. very false

Table 4.15 Summary of 28 grade-4 and grade-5 students' feelings (Affect) towards the environment on the CHEAKS Attitude sub-scale (n-28)

Question #/ Category	Choice					Mean
	Very True 5 points	Mostly True 4 points	Not Sure 3 points	Mostly False 2 points	Very False 1 point	
28. Animals	16	4	0	1	7	3.75
29. Energy	15	7	4	1	1	4.21
30. Water ¹	4	5	2	2	15	4.40
25. General	9	8	3	5	3	3.54
26. Pollution	12	11	1	3	1	4.07
27. Recycling	17	6	3	3	0	4.21
Total Mean						4.03

Note¹. Reversed items

Total of 6 Affect questions

Example #28. I get angry when I think about companies testing products on animals.

- a. very true b. mostly true c. not sure d. mostly false e. very false

Table 4.16 Summary of students' Knowledge about the environment on the CHEAKS Attitude sub-scale (n-28)

Question #/ Category	# Students answered correctly (out of 28 students)
37.Animals	15
38.Energy	22
40.Water	9
39.General	7
42.Pollution	12
41.Recycling	12

Total of 6 Knowledge questions

Example #37. Most elephants are killed every year to provide people with:

- a. trophies b. ivory c. meat d. oil e. skin

As shown in Table 4.17, the Verbal Commitment (3.86) of the 28 grade-4 and grade-5 students who were videotaped was higher than the mean score for all the other grade-4 and grade-5 students. The Actual Commitment (3.94) of the 28 grade-4 and grade-5 students who were videotaped was also higher than the mean score for all the other grade-4 and grade-5 students. The Affective (feelings) score (4.03) of the 28 grade-4 and grade-5 students who were videotaped was higher than the mean score for all the other grade-4 and grade-5 students. The mean Knowledge score for the 6 samples of the 30 questions was 2.75. This shows that almost half of the questions

were answered correctly. Most of the 28 students who were videotaped knew the correct answer “a” to the question in the ‘energy’ category.

Example #38. Burning coal for energy is a problem because it:

- a. releases carbon dioxide and other pollutants into the air.
- b. decreases needed acid rain.
- c. reduces the amount of ozone in the stratosphere.
- d. is too expensive.
- e. pollutes the water in aquifers

Table 4.17 Mean scale comparisons between quantitative data from CHEAKS for all grade-4 and grade-5 students in the school and those students who were interviewed on video (2002)

Scale	Grade-4 (n=190)		Grade-5 (n=188)		Students Interviewed (n=28)
	Mean	S.D.	Mean	S.D.	
Verbal Commitment	3.64	0.55	3.55	0.68	3.86
Actual Commitment	3.38	0.61	3.16	0.73	3.94
Affective	3.90	0.69	3.70	0.81	4.03
Knowledge (cognitive)	9.44	4.07	10.23	3.60	

*p<0.05

4.3.2.1 What are Students’ Verbal Commitments (Attitudes) Towards the Environment from Interviews? (These answers are based on two grade-4 student pairs who are representative of the others who were interviewed.)

Question #1

Animals: I would be willing to stop buying some products to save animal’s lives.

Both grade-4 sets of girls and boys stated that they love animals and would be willing to stop buying some products to save animals’ lives. All four said they would not buy fur coats.

You know when they use certain things like sunscreens and it says they test it on animals. That can be really bad because you don’t know what it can do to the animals. So that’s why I would stop buying some sunscreen they tested on animals or eye products or something like that.

Out of 28 students interviewed, 18 stated they would stop buying some products to save animal's lives. Most said that animals were important to them and they would not do anything to hurt animals, especially buy fur coats. One grade-5 boy said "I put very false because I would still use leather in cars. I like to ride in a luxurious car with leather seats."

Question #2

Energy: I would **not** be willing to save energy by using less air conditioning.

Both sets of grade-4 girls and boys said they would not be willing to stop using air conditioning because of the heat in South Florida. The girls said they need air conditioning because they have asthma. The boys said they would be willing to turn off the lights to save energy, though.

That's mostly true because down here in Miami, it can get pretty hot. I would die, but if it 'was' ('were' is correct English) a normal day, (student seems to change his idea after reconsidering what he had answered on the survey). I would turn off the air conditioning or use less that day, if it was about 79 degrees. But, if it was about 90 degrees I would not pay any attention about saving energy, if I was close to dehydration at that point. (Student is concerned about his own comfort.)

Out of 28 students interviewed, 12 stated they would **not** be willing to stop using air conditioning. One grade-5 boy said, "We need air-conditioning in Miami or we would not be able to survive."

Question #3

Water: To save water, I would be willing to use less water when I bathe.

Both grade-4 girls said they would be willing to use less water when they bathe. One grade-4 boy stated he answered very true because of an additional reason.

Yes, very true because I hate taking showers. Whether it's a good shower or a bad shower, I hate taking showers. So that's not a fact of whether I want to save water or not, it's just that I hate taking showers.

Out of 28 students interviewed, 21 students said they would be willing to use less water when they bathe. The two who said very false were grade-5 boys who stated they love to take long showers to relax.

Question #4

General: I would **not** give \$15 of my own money to help the environment.

Both grade-4 boys and girls said they would give \$15 to help the environment. The boys discussed their financial states.

I would give \$15 of my own money, even though that is pushing it money wise. I would still give it because I know how important it is to save the coral reefs, (this child spends a lot of time on weekends in the ocean snorkelling off the shore), endangered species like the Florida Panther, and other animals. Also, I would give money to preserve animals (endangered species), like the dodo bird, which was hunted out and became extinct.

Out of 28 students interviewed, 21 students said they would give \$15 to help the environment. One grade-5 boy who said ‘mostly true’ said, “I would prefer to give that \$15 for the homeless.” On the other hand, one grade-5 girl said, “I would take it out of my bank account.” One grade-5 boy said, “I would give more than that if I could.” One grade-5 boy stated, “I discussed the environment with my mother after taking the survey. I feel (humans are) responsible for many environmental problems.” One other grade-5 boy, who had gone to Camp Manatee in Dade County stated, “We learned about how the Everglades got polluted. We took field trips to Gumbo Limbo Park in the Everglades. This experience left a positive impression on him.”

Question #5

Pollution: I would be willing to ride the bus to more places in order to reduce air pollution.

One grade-4 girl said she was not sure, but then put very true. The other girl said she would ride the bus, but does not do it now. One grade-4 boy said he already rides the

bus, but only to school. The other boy said that there were no bus routes close to his house.

Out of 28 students interviewed, only 10 would be willing to ride the bus to more places. One grade-5 boy stated,

I would have to go with ‘very true’ if it saves air pollution. The air is what gives us oxygen and helps us breathe in our oxygen from the trees, but if it were being polluted we would have trouble breathing. So I would be willing to ride a bus to stop air pollution. (The student has the misconception that oxygen is only produced from trees. In fact, the ocean produces much of our atmospheric oxygen.)

The other grade-5 boy who was his partner for the interview stated, “I had answered very false, but now that I think about the greenhouse effect, where the atmosphere contains carbon dioxide and contains heat, I would answer very true.”

Question #6

Recycling: I would **not** be willing to separate my family’s trash for recycling.

These grade-4 students do recycle in their community and have bins for pickup outside their homes. Therefore they recycle at home.

I put ‘very false’, like sometimes people just throw it away or something. Sometimes people just throw it on the ground instead of even throwing it away, and that would take sometimes like a million years, 500 years or even 30 days, and that’s a long time sometimes, I mean a month. (The student knows that different things take different times to biodegrade. Officer Snook Programme taught this to the students last year.) And then I mean, like (Student’s partner intervenes, ‘And so you’re saying that you would want to separate your garbage.’) Yeah, I would separate it.

Out of 28 students interviewed, only four would **not** be willing to separate their family’s trash for recycling. Of those four, one grade-5 boy stated,

I said ‘very true’ because we used to separate our trash for recycling but we have not done it any more. I don’t really know why. I’ve asked my mom and she just said we get too busy. But I don’t know how that happened. I’ve asked my mom to start recycling, but she never has.

The other grade-5 boy who was his partner for the interview stated, “I answered very true because in my neighbourhood, they don’t have a recycling programme. So I can’t recycle at home.”

4.3.2.2 What are Students’ Actual Commitments (Actions) Towards the Environment from Interviews?

Question #13

Pollution: I have **not** written someone about a pollution problem.

One grade-4 girl said all the students in her grade-2 class wrote to Kid Heroes and adopted a whale. The other girl had not written letters. One boy claimed that this survey helped him realise he needed to take action on local environmental problems. The other boy said he had mentioned pollution in his letter writing.

When I had answered this survey, I had not written to anyone about pollution.

But this is a month later after the survey, and I have (written). In my community there was a problem with dredging (the sand from under the ocean) and the fish were killed. And I have written to an environmental land use attorney. (This student took action since the survey was given a month ago.)

Out of 28 students interviewed, 22 had not written to someone about a pollution problem. One grade-5 boy stated, “I don’t write to those environmental people. They are the authorities, they should be writing to us.”

Question #14

General: I have talked with my parents about how to help with environmental problems.

The two girls have talked with their parents about environmental problems. One grade-4 boy said currently he has been asking his parents how to get involved and has become involved since he took this survey a few weeks ago. One boy said he recently gave up talking to his parents about environmental problems because it hasn't been effective. "Again, when I did this (survey) there was not a problem, and I had answered 'no'. But yes, currently, I have been asking my parents how to get involved and I have been getting involved."

Out of 28 students interviewed, 16 had talked with their parents about environmental problems. Of the six who answered very false, one grade-5 boy stated, "I never talk to them about environmental problems. I just talk to them about what to do the next day."

Question #15

Water: I turn off the water in the sink while I brush my teeth to conserve water.

Two girls and one boy do turn off the water while they brush their teeth. One boy brushes quickly, stating:

I put 'very true' because actually I do (turn off the water while brushing). I think it is very important. As I said before, there could be five family members in the house. And if each family member doesn't turn off the water when they are brushing their teeth, they could use up five gallons of water each. That is really bad. So after I found all of that information out, I definitely started to turn off the water when I brush my teeth.

Out of 28 students interviewed, 21 do turn off the water in the sink while they brush their teeth. Of the three that said 'very false', one grade-5 girl admitted, "Sometimes I forget."

Question #16

Energy: To save energy, I turn off lights at home when they are not in use.

All of the grade-4 students say they do turn off the lights at home when they are not in use.

I put ‘very true’ because I do that already. People don’t think about saving energy as much as they think about saving water, and animals and stuff. So people don’t turn off the lights because people don’t think about saving energy. No one really does. But then when I read the survey and figured out that energy is so important to this world and to us and to all the living creatures, yeah, I turn off the lights when they’re not in use. Definitely.

Out of 28 students interviewed, 23 said they would turn off the lights. One grade-5 boy stated, “I would turn off the lights when not in use and I would use a dimmer when I did use the light. A dimmer would lower the amount of light that you use you would save a lot more energy.” One grade-5 girl of the 28 interviewed, who was born and schooled in Israel before coming to this school stated, “In Israel, we were taught to save energy. I know that air-conditioning costs a lot more than lights. We keep the thermostat higher at home and save fuel.”

Question #17

Animals: I have asked my parents not to buy products made from animal fur.

Three of the four students said their parents would not buy furs so they do not have to discuss it. One boy said he has discussed it and his mom did not buy a fur coat...she borrowed it! One grade-4 girl said,

I would not have to ask my parents, because my parents love animals. But she might look at it, and I’d say ‘Mom don’t buy that’ but she said ‘Don’t worry, I’m not.’ But if somebody else were looking at it (animal products) like my friends, I would say ‘Why are you buying that? It’s made from animal fur. Don’t you love animals? And they say ‘Like yeah, but it’s really pretty.’ Like in the movie called *Life Size*. This lady was wearing a big furry jacket and one person came up to her and she said, “You should **love** animals, not wear them.” That’s a really good message that people all over the world should know. (The movie had a positive environmental affect on this student.)

Out of 28 students interviewed, 20 stated they have asked their parents not to buy products made from animal fur. One grade-5 girl stated, “I really don’t like any furs.

I like to save animals.” On the other hand, one grade-5 boy stated, “I said very false because I like to have leather seats in my car and ride in luxury.”

Question #18

Recycling: I have asked my family to recycle some of the things we use.

Both grade-4 boys said their families recycle. Both grade-4 girls said there is no need to ask their parents to recycle. They do it already.

I don’t really have to ask them. I mean my mom knows already what the causes are if you don’t recycle and stuff. (Student means ‘effects’ of not recycling, not ‘causes’.) It’s very bad for the trees and animals. I don’t really ask her. But when my grandparents came from England (to visit us), they weren’t recycling that much, so I asked them and I talked to them about it. So, yeah.

Out of 28 students interviewed, 21 have asked their parents to recycle some things.

4.3.2.3 What are Students’ Feelings (Affect) Towards the Environment from Interviews?

Question #25

General: I am frightened to think people don’t care about the environment.

The two grade-4 girls put ‘very true’ because they did not take the word ‘frightened’ literally. The boys, on the other hand said they didn’t like the word ‘frightened’ and said they were not really frightened, but went into a discussion about fossil fuel (stating some misconceptions).

I’m not really frightened. As you said, I’m not jumping out of my seat. What I am scared about is that eventually, we are going to run out of fossil fuels and we are going to have to maybe use friction with our own body power work to make electricity, or maybe worse, maybe discard all electrical items and forget about using electricity. And that would not have been so hard if we had not adapted and depended on electricity for so long. (Student has misconception about energy. Energy can neither be created nor destroyed but

can be changed from one form to another.) That's what really scares me, but mostly I'm angry."

The other grade-4 boy stated,

What you are telling me is that there is no other way to make energy without fossil fuels. But have you ever thought of solar energy that could power electricity? (The other boy answered.) Yeah, but that's expensive, to build a lot of solar panels. (First boy then says) How is that expensive? It's like having a mint to make as much money as you want. (Student is trying to make an analogy to renewable solar energy being never-ending.) Metal is fossil fuel. (This is a misconception. Fossil fuels were once living things, not a metal which is non-living.) We're using up resources that will never come back, either way. We're using up more than were formed.

Out of 28 students interviewed, 17 said they were frightened to think people don't care about the environment. One of the 3 who said 'very false' was a grade-5 boy who stated, "It's their choice. Why should we choose for them?" I don't think this student understood the implication that if people don't care about the environment, they will not protect it.

Question #26

Pollution: I get angry about the damage pollution does to the environment.

Two grade-4 girls answered very true. On stated:

Well, I put 'very true', because when things damage the environment it hurts me because sometimes it can hurt the animals, too (Her partner says, "and other things".) Yeah, because people throw glass bottles on the ground, animals can step on it. (This is a very literal, simplistic view coming from this student.) Sometimes I cry because, I mean, I love animals and I don't want to see them get hurt. And when they pollute it hurts the plants (Student does not address the fact that air, water and soils can be affected which, in turn, affect plants and animals.)

Out of 28 students interviewed, 23 said they do get angry about the damage pollution does to the environment. Only one grade-5 boy said ‘very false’ meaning he does not get worried about damage from pollution.

Question #27

Recycling: It makes me happy when people recycle used bottles, cans, and paper.

Both girls put very true. One boy said he didn’t like how the question was worded. The other boy said he would be happy if a whole community recycled, not just one or two people.

I put very true because it makes me really happy when people recycle because knowing the causes (student means ‘effects’) of when people don’t recycle, those are really bad causes (student means ‘effects’). And then in the future, if something bad happens to our world, as I said in previous questions, we’ll be saying ‘I should have recycled this and I should have recycled that.’ (This student’s view is that people need to plan for the future.) Because people, like children, are the future. And when they don’t recycle and stuff and they don’t know anything about conserving water, or saving animals, that’s really bad. So, I’m very happy when people recycle.

Out of 28 students interviewed, 23 said it did make them happy when people recycle. One grade-5 boy stated, “A lot of things we use are reused. This helps the environment.”

Question #28

Animals: I get angry when I think about companies testing products on animals.

All four students said they get angry when they think about companies testing products on animals. One boy said he wished they could clone the animals so they could test them. (Misconception is that he felt the cloned animal deserved fewer rights than the parent.)

People know me, that I love animals. Once we watched a movie in science class. They were doing all these experiments on bats. And the bat came back and it had a switch in its head. And people would switch it and stuff and he

would go all crazy. And I think it's really bad when people do this to animals because let's say eye drops, and they test them in the animal's eye. That can burn the animal's eye or it can blind the animal. (Student shows empathy). And I think it's really bad. (Partner says, 'and then the animal won't be able to see and then they get run over by a car or something.') (Student has misconception that laboratory animals are let loose after testing).

Out of 28 students interviewed, 22 said they do get angry when they think about companies testing products on animals. One grade-5 boy stated, "I get angry because some of the products harm animals." One grade-5 girl said, "Animals are like people, too."

Question #29

Energy: It makes me happy to see people trying to save energy.

The girls said 'very true'. The boys said it would take a lot of people to get them excited about this.

One person who would be very amazing would be me. When I was very little and we were getting ready to go to school, I would have the TV on and the lights on and I would leave them on by accident. (Student calls it by accident when it was not.) I didn't know the causes (Student means effects). My mom would tell me. 'In the morning, you have to help me by turning off these lights and the TV.' She wanted me to turn off the lights, and stuff, not to save energy but so she could be on time. But I realized when I read the survey that if you don't turn them off then using up energy is just as bad as using up water. So I was surprised. (Student's mother may have wanted lights and TV off to save electricity and costs.)

Out of 28 students interviewed, 25 said it does make them happy to see people trying to save energy.

Question #30

Water: I am **not** worried about running out of water.

The two grade-4 girls said they are worried about running out of water. One grade-4 boy said he is not worried and stated that because 70% of the earth is water, we should be able to filter it and use it to drink, no matter what the cost. The other boy told him that desalination was expensive.

I do worry, a lot, so I put ‘very false’ because I love the environment and I think it’s very important that people try to save water. Then in the future, we might have a drought. And people will think back, and learn (from) their mistakes. And I think that people should just think ahead and see what could happen in the future, and then they could try and think back and they would say, ‘I’m going to turn off the water when I brush my teeth’.

Out of 28 students interviewed, only 9 said they were not worried about running out of water. One grade-5 boy who answered that he was not worried said,

Evaporation and condensation will always let the water fall on plants.” Another grade-5 boy, in opposition to what his partner in the interview said, stated, “Yes, I’m worried. There are limits (to our water use) now. Lake Okeechobee is low.” (This grade-5 student did not know that our drinking water in South Florida does not come from Lake Okeechobee. It comes from underground and is pumped up from the Biscayne Aquifer that is running low due to the amount of water taken from it because so many people live in South Florida.)

4.3.2.4 What is Students’ Knowledge about the Environment from Interviews?

The CHEAKS Knowledge sub-scale comprised 30 items that also systematically sample the six content-dependent sub-domains, i.e. five items from each sub-domain: animals, energy, pollution, recycling, water, and general issues. In this section, one item is presented from each content subdomain with the number of students selecting responses.

Question #37

Animals: Most elephants are killed every year to provide people with:

- a. trophies 0
- b. ivory 15
- c. meat 5
- d. oil 3
- e. skin 5

One grade-4 boy knew that elephants were killed for their tusks. One other grade-4 boy stated, "I put 'skin' because I don't know a lot of people who eat elephant meat." Interviewer explained that the right answer was 'ivory'. Then the student stated, "What is ivory?" The student interviewer said "Ivory is from elephant's tusks. Did you know about elephant's tusks and that now it is illegal internationally to buy or sell ivory?" Student said, "Oh, yeah. What about the shofar? You know, in my synagogue, they blow the shofar on the New Year." Interviewer explained that a shofar is a ram's (sheep's) horn and that it is not illegal to buy or sell a ram's horn.

Out of 28 students interviewed, 15 knew that most elephants are killed every year to provide people with ivory.

Question #38

Energy: Burning coal for energy is a problem because it:

- a. releases carbon dioxide and other pollutants into the air 22
- b. decreases needed acid rain 1
- c. reduces the amount of ozone in the stratosphere 3
- d. is too expensive 0
- e. pollutes the water in aquifers 2

All four grade-4 students knew that burning coal releases carbon dioxide and other pollutants into the air.

Horrible, horrible pollution. Yes, I wish we could see the big hole in the ozone. Wouldn't that be neat, a hole in the sky?" (Student has a misconception of what ozone is and how it protects the earth from ultra violet (UV) rays.)

Out of 28 students interviewed, 22 knew that burning coal for energy releases carbon dioxide and other pollutants into the air. One grade-5 boy stated incorrectly, "It produces ozone." His partner in the interview, a grade-5 girl said, "It releases carbon dioxide."

Question #39

General: Ecology assumes that man is what part of nature?

- | | |
|-------------------------------|---|
| a. special | 6 |
| b. related to all other parts | 7 |
| c. not important | 2 |
| d. the best part | 6 |
| e. the first part | 4 |

Only one grade-4 girl knew that man is related to all other parts of nature. One grade-4 boy stated, "I think man is special. Because we are the smartest animal, and we build homes and rule the world." (The student did not make the connection that man is related to all other parts of nature.)

Out of 28 students interviewed, only 7 students knew that man is related to all other parts of nature. Three students did not provide an answer.

Question #40

Water: Phosphates are harmful in sea water because they:

- | | |
|---------------------------------------|---|
| a. cause cancer in fish | 5 |
| b. stop reproduction in fish | 6 |
| c. make fish nervous | 3 |
| d. make the water cloudy | 5 |
| e. suffocate fish by increasing algae | 9 |

None of the grade-4 students knew that phosphates suffocate fish by increasing algae. This is significant because phosphates are used to fertilize crops in Florida and end up in the waterways and ocean. According to one grade-4 student, "I have a fish tank and phosphates are bad for fish. And phosphates kill algae." (Student has a

misconception. Phosphates don't kill algae. Phosphates actually do the opposite by increasing algae growth in streams and rivers.

Out of 28 students interviewed, only nine knew that phosphates suffocate fish by increasing algae. One grade-5 girl stated, "Phosphates cause fish kills." (She may have been referring to the recent Red Tide off the west coast of Florida, which killed fish. Scientists hypothesize that pollution is aggravating Red Tide.)

Question #41

Recycling: Compared to other paper, recycled paper:

- | | |
|------------------------------|----|
| a. takes more water to make | 1 |
| b. takes less energy to make | 12 |
| c. is less expensive to buy | 8 |
| d. is harder to write on | 2 |
| e. produces more pollutants | 5 |

Neither of the grade-4 boys knew that recycled paper takes less energy to make. One grade-4 boy incorrectly stated,

I put C 'is less expensive to buy.' The other grade-4 boy said, "I put the same thing. I don't know the answer." (Interviewer asks, "Do you know how to make paper?") "No". (Interviewer explains the cutting of trees, sending them downstream or using transportation to send them to the paper mill, where it takes energy for cutting them smaller, slicing them, pressing out the water and turning them into paper.) Then the student realised the correct answer and stated, "I guess it takes less energy to make recycled paper."

Out of 28 students interviewed, only 12 knew that recycled paper takes less energy to make. The students did not know about the paper making process so were not aware why we need to save paper, recycle it and buy recycled paper.

Question #42

Pollution: Most pollution of our water sources is caused by:

- | | |
|-------------------------------|----|
| a. dams on rivers | 1 |
| b. chemical runoff from farms | 12 |
| c. methane gas | 8 |
| d. leaks in the sewers | 2 |
| e. human and animal wastes | 5 |

The two grade-4 boys did know that the pollution of our water is caused by chemical runoff from farms. The grade-4 girls did not know this when they took the survey. After being instructed a few weeks later, using an aerial map taken with infrared cameras, they realised that the colour red on the map denoted the heat rising from the crops around Lake Okeechobee and that the fertilizers were a huge problem for the waterways. One grade-4 girl said, “I put C ‘methane gas’.” “I did, too.” “But after seeing the aerial map with red (showing sugar cane crops giving off heat) around Lake Okeechobee, I think the most pollution is from chemical runoff from farms.” Out of 28 students interviewed, only 12 knew that the most pollution of our water sources is caused by chemical runoff from farms.

4.3.3 Researcher’s Reflections on Qualitative Findings from Interviews

Vocabulary

- Some of the vocabulary was unknown to the students when discussed in depth during the interview.
- Some of the students missed the true meanings of the questions.
- The boys did not like the words ‘frightened’ or ‘angry’ to describe their feelings about environmental problems.

Concepts/Knowledge

- An interview yielded much more in-depth information about what the students felt, have done and know about the environment than did the survey instrument.

- The survey instrument was a starting point for further discussion of environmental issues.
- The girls who were interviewed seemed to generalise about the questions on the survey and their global meaning and implications.
- The boys seemed to be very concerned about money expenditures.
- The girls stated directly that they were concerned about the future. The boys implied it.
- The boys went off on tangents and talked about inventions they hope to see that will help reduce the use of fossil fuel.
- One boy's misconception may have severe implications. He felt that if an animal is cloned, the cloned offspring has fewer rights than the parent.

Attitudes

- Both the boys and the girls bounced the ideas off each other in the interviews and usually responded with an elaboration of why they answered the way they did.
- The girls talked in a somewhat quiet voice and answered each question methodically.
- The boys went off on tangents, and did not always stay on the topic. The boys were creative during the interview.
- The boys play-acted their answers a great deal of the time.
- The boys started out controlled and orderly, but as the interview progressed, they put their hands on each other and grew unruly.
- When one boy told his partner that elephants were killed for their tusks, the partner said, "It decomposes and turns to fertilizer". I feel this student was trying to justify the killing somehow.
- Students' feelings can be changed, if they have the opportunity to discuss the issues. The best scenario is with peers who are positive role models.

Future Directions

- Phosphates are a problem for South Florida's waters. This information should be a part of the grade-4 curriculum.

- The students do recycle but do not know how those products are re-used or re-claimed, especially recycled paper. This should also be part of the curriculum.
- Current maps and authentic materials from satellites and sources such as EPA, NOAA should be used in the classroom. Technology is a natural part of students' lives in today's world.
- The survey acted as a catalyst to motivate certain children into issue investigation and civic action.
- The survey involved the parents (giving permission) and becoming aware that their children were learning about environmental education (See Appendix C-4).
- Only a handful of parents from 1100 students were interested enough to fill out an environmental survey at Family Science Night in the school. Teachers found it difficult because of time constraints and scheduling for their students to come to be interviewed.
- The opportunity for students to excel in environmental education is stifled by the focus on standardised testing.
- After responding to the CHEAKS instrument, some students felt compelled to take action to save the environment.

4.3.4 Researcher's Findings about Vocabulary on CHEAKS instrument and Students' Misconceptions from Interviews

Some of the vocabulary was new. Students' answers on the CHEAKS instrument during interview questions showed that "Phosphates, perpetual energy source, high octane gas, and precycling" were terms about which the students just guessed.

The following misconceptions in the sub-domains of the CHEAKS questionnaire were evident in students' discussion:

1. Animals

Students thought that species become extinct just because people hunt for the animal. (Dodo bird was mentioned). Many students did not know that the cause

of the animal becoming extinct, most times, is that the habitat where they live is destroyed.

2. Energy

Most students thought that lights use the most energy in an average house in the United States. The correct answer is the hot water heater. Most students who were immigrants from Israel knew the correct answer.

3. General

Many of the students interviewed in this school stated they thought that ecology assumes that man is the best part of nature. This is an egocentric idea. The correct answer is man is related to all other parts.

4. Pollution

Many students had no idea that the most pollution of our water sources is caused by chemical runoff from farms. They were not aware that phosphates stop the water flow by making the plants grow in canals and streams. This is especially true in central and south Florida. In contrast, the students who went to Sea Base years ago had the opportunity to see the dead coral reefs possibly caused by chemical runoff. Students also didn't know that (older) leaded gasoline (which has now been virtually eliminated in our economy) from cars caused lead emissions in our air.

5. Water

Again, phosphates were unknown to most students even though Florida has phosphate mining on the west coast. Students were unaware of the causes of acid rain. This could be because acid rain is not very prevalent in Florida although sinkholes are caused by an acid solution dissolving the limestone rock. Some students were aware of this.

6. Recycling

Most students had no concept of how paper is made and that recycled paper takes less energy to make than making new paper.

Many of the knowledge misconceptions pertained to pollution. Many times renewable energy sources are not discussed in classrooms, nor are ways to reduce pollution in our air, water and land.

4.3.5 Researcher's Reflections on Photos the Students took around the Campus

Certain things were noted by both sets of students (see Appendix C-7).

1. litter on the ground
2. garbage piled high in dumpster
3. erosion of land around classrooms
4. oak trees and gumbo limbo trees cut down
5. water leaking from sink and sprinkler
6. animals in danger (frogs in storm drain and turtles in chlorinated pond)

Only the girls noted that the grass was being cut too short. They also noted the sapling trees were dying because the weed eater (machine with monofilament whip) was destroying the bark around the tree bottom. The girls noted that the air conditioning units were giving off a lot of heat outside the building.

4.4. Summary of the Chapter

The CHEAKS instrument was discussed by presenting the results of the study in response to the six research questions. The general purpose of this research was to find out what elementary students in one school knew about the environment, what were their attitudes towards helping the environment and what had they actually done to help the environment. In this chapter, the quantitative and qualitative findings were presented. The students' responses on both the attitude and knowledge parts of the CHEAKS instrument based on the six sub domains of Animals, Energy, Water, General, Pollution, and Recycling, were summarized. The researcher presented reflections on the qualitative findings from interviews. This included noting the vocabulary that was not understood by the students as well as some of their misconceptions.

CHAPTER 5

MAIN FINDINGS, IMPLICATIONS AND RECOMMENDATIONS

5.1 Overview of Chapter 5

A major part of Chapter 5 includes a summary of main findings obtained through the study that have been discussed in Chapter 4 (Section 5.2). A discussion of implications of the study (Section 5.3) and recommendations and the possibilities for future research concluded the study (Section 5.4).

5.2 Main Findings

5.2.1 Findings for Research Question 1:

The students in grade-4 had higher commitment than the students in grade-5 in both years of the study. The grade-5 students may have been less interested in academics and commitment to the environment because they were becoming more social with their peers. Maybe they need constant reminders that the environment is fragile. Involvement in issue investigation and action training may improve both their affective feelings and actual commitment to the environment.

5.2.2 Findings for Research Question 2:

The gifted students had more knowledge in both years. In 2002 the gifted group had higher attitude scores and were more committed in verbal, actual and affect than in 2003. While they know a lot about the environment, they had some misconceptions and although environmental issues affected them, they had not done much to assist this cause. The survey gave them reason to think about their actions.

5.2.3 Findings for Research Question 3:

The gifted grade-5 students had more knowledge but were less committed to environmental issues in 2002. In 2003 there was no difference between regular and gifted grade-5 students in affect or knowledge.

5.2.4 Findings for Research Question 4:

In 2003 (the only year grade-6 students were surveyed) there was no difference between regular students and gifted students in terms of attitude and knowledge of the environment.

5.2.5 Findings for Research Question 5:

The scores on the Knowledge scale for boys and girls were almost identical. The girls were verbally more committed than the boys in both years of the study. This was very surprising to me since environmental studies are usually presented in science classes and boys have done better in science classes throughout the years.

5.2.6 Findings for Research Question 6:

It was statistically significant that students' perceptions of Affective scales negatively influenced students' cognitive (Knowledge) scores. Those students with higher knowledge scores were less committed to the environment. This is in agreement with other research findings. Environmental behaviour, unfortunately, does not bear out the validity of linear models for changing behaviour. Numerous researchers have investigated a variety of variables hypothesized to be associated with responsible environmental behaviour (Hungerford & Volk, 1990). Just because the students know facts is not enough to promote students' positive environmental actions.

5.2.7 Findings for Emergent Research Question 7:

What has been the influence of the administration of CHEAKS in grade-4 and grade-5 in this school?

Before I administered CHEAKS, I had no idea what most of the students in the school had done to help the environment. After surveying many students and interviewing students, I came to realize that this survey had made some of them more aware of certain environmental issues. However, I was surprised that only a few of these students did take action on the environmental problems they mentioned.

Many of these grade-4 students held misconceptions about certain environmental concepts. In addition, there seemed to be a gap in their knowledge and some of the environmental concepts were not understood. Students became more knowledgeable about environmental vocabulary and asked about things they did not understand after taking the CHEAKS instrument. The classroom teachers began asking me questions about the environment and asking me to explain concepts that they did not understand that were on the instrument. The classroom teachers told me candidly that their students were asking higher order thinking skill questions about items they had seen on the instrument and that the students said they wanted to do more for the school environment. Instead of administering CHEAKS instrument for just one year to grade-4 and grade-5 students, as I had initially planned, the positive feedback from teachers and students made me realize that this was an “Ah, ha!” experience for many students. I chose to extend my study into the second year.

5.3 Implications

5.3.1 Implications of the study in terms of the findings

5.3.1.1 Implications for Findings for Research Question 1

How do students in grade-4 and grade-5 compare?

The students in grade-4 had higher commitment than the students in grade-5 in both years of the study. Because grade-5 students are becoming more social with their

peers, involvement in issue investigation and action training in the classroom may improve both their affective feelings and actual commitment to the environment. Educators must be aware of the emotional nature of the students in grade-4 and grade-5. Working in cooperative groups for issue investigation and having outdoor field trips to reinforce the fragile nature of the environment may prove to be very successful.

5.3.1.2 Implications for Findings for Research Question 2

How do students in grade-4 regular and grade-4 gifted compare?

The gifted students had more knowledge in both years. The survey gave them reason to think about their actions. I believe that the CHEAKS instrument should be used each year and the teacher should discuss the students' answers before the civic issues are investigated with all of the classes, both regular and gifted.

5.3.1.3 Implications for Findings for Research Question 3

How do students in grade-5 regular and grade-5 gifted compare?

The gifted grade-5 students had more knowledge but were less committed to environmental issues. The students should be involved with environmental problem solving and see their actions make real-life changes in their locality. Just knowing about the environmental problems is not enough. Think locally; act globally.

5.3.1.4 Implications for Findings for Research Question 4

How do students in grade-6 regular and grade-6 gifted compare?

In 2003 (the only year grade-6 students were surveyed) there was no difference between regular students and gifted students in terms of attitude and knowledge of the environment. The middle school should be a laboratory of incubating ideas and help enable students to be involved in environmental issues.

5.3.1.5 Implications for Findings for Research Question 5

How do boys in grade-4 and grade-5 compare with girls in grade-4 and grade-5?

The scores on the Knowledge scale for boys and girls were almost identical. The girls were verbally more committed. Both boys and girls should work together to find answers to environmental problems. This may help increase the number of students who choose careers in math and science. It may also help students, who will become voters, understand many of the world issues.

5.3.1.6 Implications for Findings for Research Question 6

What is the correlation between students' verbal commitment, actual commitment, environmental attitudes and their knowledge of the environment?

Those students with higher knowledge scores were less committed to the environment. This is in agreement with other research findings. Both parents and teachers should encourage positive environmental behaviour, which is based on many factors. This should start in the early years of a person's life.

5.3.1.7 Implications for Findings for Emergent Research Question 7

What has been the influence of the administration of CHEAKS instrument in grade-4 and grade-5 in this school?

Because students became more knowledgeable about environmental vocabulary and asked about things they did not understand after taking the CHEAKS instrument, the classroom teachers began asking me questions about the environment. I feel teachers need more environmental education to be able to clearly understand environmental concepts and be able to explain them to their students. Teachers should also be trained in issue investigation and how to be involved in community action.

5.3.2 Implications for the Researcher

From a personal standpoint, this study has made it possible for the researcher (me) to visit all grade-4 and grade-5 classrooms in this suburban elementary school. Through working with the classroom teachers and students, I gained insights into what students know, feel and do about environmental issues. An important meta-analysis of the behaviour research literature in Environmental Education (Hines, et al., 1986)

assessed variables in association with responsible environmental behaviour. This study has added to this research base.

5.3.3 Implications for Policy Makers, School Administrators and School Principals

For policy makers, this study also has significance in that the research provided evidence of environmental knowledge, attitudes and actions of elementary school students. This study was the first of its kind in Miami-Dade County Public Schools. The results will be available for others to see, research and assess. The survey instrument, CHEAKS was validated and was reliable for students in Miami. Because this study involved a school that scored higher than the average in the county academically, the misconceptions of students were particularly significant. The interviews that were the qualitative portion of the study uncovered some educational misconceptions that should be addressed when designing curriculum. Findings from South Florida Water Management District research, with teachers and the general public, were similar to my findings with elementary school children (See Chapter 2.3.8 South Florida Water Management).

5.3.4 Implications for Teachers

The CHEAKS instrument acted as a catalyst to motivate some students, teachers and parents to participate in civic action to solve environmental problems. Teachers may want to administer this instrument to their students. Also, teachers may want to interview their own students to see about other misconceptions.

Environmental education provides a good system for developing critical thinking skills. It provides topics and problems that cut across the school curriculum. Environmental education can enhance the integration of knowledge. Environmental education provides real problems that can be studied or simulated and provides topics and problems that can be adjusted to the developmental levels of students. Environmental education, issue investigation and community action take knowledge to a higher level.

5.4 Recommendations

In the future, the written CHEAKS instrument may be translated into other languages or some pictures may be added to improve meaning before administering it to students who speak English as a second language. More research could be done to compare grade-4 girls and grade-5 boys in this school to see if the educational delivery system may be improved. Research could be done to investigate why students perceive certain issues as more serious than others.

Younger students might be surveyed in the future to find out what curriculum would be needed to clear up students' misconceptions at an earlier age. Further research would be beneficial into what environmental programmes the teachers have been trained and what are teachers' environmental knowledge and attitudes. Research following this study that covers a larger number of students, schools and districts in Florida is recommended.

In Tennessee, on the Attitude scale, both the older and younger children generally had positive attitudes towards the environment. The attitudes of the younger children improved the most. This is significant for educators to know in designing curriculum for environmental education starting in Kindergarten and grade-1 in schools. This is in agreement with Palmer's (1995) findings that young students need to be taught environmental concepts in order to avoid creating misconceptions. These misconceptions may be difficult to overcome in the future in student's minds.

In the future, the CHEAKS instrument could provide a common standard against which the effectiveness of various environmental education interventions could be judged and compared. This may be done not only in this elementary school, but also in other schools across the county. This would help facilitate the systematic development of more effective interventions to promote pro-environmental attitudes and behaviours.

Interested parties in the Officer Snook Programme and also the South Florida Water Management District have asked to see the results of this study. They, and others, may choose to use the survey and the results to conduct their future studies.

Throughout the United States, various environmental education models and curricula have been developed to bring about behaviour change. Two such examples are the Investigation and Evaluation of Environmental Issues and Actions (IEEIA) curriculum and the Community Based Environmental Education (CBEE) model. (Hungerford, et al., 2003). My recommendation is to use these models to teach critical thinking through environmental education in the elementary school. Issue Investigation and Action Training tended to foster independent overt environmental behaviour, group locus of control, environmental action knowledge, and perceived knowledge about and skill in the use of environmental action skills (Environmental Education and Training Partnership, 2001).

Citizens will have to make choices and decisions based on a critical examination of information and opinions in order to develop workable solutions to current and anticipated environmental problems. Children must see that there is a need for action at the local level. Responsible citizenship behaviour can be approached by formal environmental instruction even in the elementary school.

5.4.1 Differentiate between formal and informal EE

In differentiating between formal and informal environmental education in public school, we must consider the outcomes of teaching and learning environmental education.

5.4.1.1 Formal environmental education

Formal environmental education involves planning and development, implementation of curriculum, and evaluation. This kind of instruction provides the learner with an “ownership “of issues and a feeling of “empowerment” to do something about them. According to Hungerford and Volk (1990) “An Articulated curriculum across grade levels is crucial...unless reinforcement and continued support is provided, (citizenship) behavior appears to erode over time (p. 106).”

5.4.1.2 Informal environmental education

Informal environmental education refers to programs and experiences outside the classroom, by institutions and organizations that include children's and natural history museums, science-technology centers, planetariums, zoos and aquaria, botanical gardens and arboreta, parks, nature centers and environmental education centers, and scientific research laboratories.

In the elementary school during the years of the study, some classes participated in certain field trips or informal programs. The programs included Earthman concerts at the City of North Miami Beach Water Fest for grade-4 students, and Marjory Stoneman Douglas Biscayne Nature Centre on Key Biscayne for grade-5 students. Chawla (1998) asserted that environmental sensitivity, which is associated with particular kinds of significant life experiences, is an important variable in environmental awareness and in the predisposition to take responsible environmental action.

5.5 What this Research Says about the Effectiveness – or Otherwise - of the Environmental Education Programme in my School

I undertook this thesis because I felt that one of the most important aspects of education is to help children prepare for their future. While I understand the necessity for children to know certain skills within certain disciplines, such as learning the parts of speech in reading and writing, or memorizing certain dates in history, no discipline may be more important than learning about the environment. Such aspects include teaching the young to respect our planet and take action to stop pollution, for example, and to help promote the survival of the human species and other living things. Yet surprisingly, and most regrettably, my research showed that there is little attention given to teach children a respect for and understanding of our environment.

While I am personally not a flag waving Green Peace activist, I am committed to do everything possible to see that environmental studies become as important a component of a child's basic education as reading, writing and arithmetic. Having observed the curriculum first-hand at two elementary schools at which I have taught

over the last 22 years, regrettably I have seen little academic attention paid to this potentially life-transforming topic, environmental education.

The US National Science and Geography Standards address the need for environmental education. The State of Florida mandates that the public educational system act as the primary delivery system to create environmentally literate citizens. The Florida Office of Environmental Education was charged with the responsibilities (in part) to: (a) assess environmental education needs in all school districts, (b) assist with environmental education comprehensive plans, and (c) evaluate the success of student and in-service training. Many private organizations offer curriculum and materials to teachers to help teach environmental education. Many museums and field trips are available for students, also.

Nevertheless, environmental education was not taught in every classroom in the school in my study and was left to the discretion of the teacher. Many times this important subject was put on the “back burner”, so to speak, because of the lack of time after teaching reading, writing and mathematics, which was a school priority. As Chawla and Hart (1995) argued, the roots of environmental concern might lie in young children's initial fusion of their own feelings with their sensations of the world, thus forming the basis for a sense of the world as a living being to which they are attached.

The findings indicate that issue investigation and action training tends to foster independent overt environmental behaviour, group locus of control, environmental action knowledge, and perceived knowledge about, and skill in the use of environmental action skills. I feel this process should start in the elementary school.

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APPENDICES

A--from Chapter 1--Introduction

- A-1 Children's Environmental Attitude and Knowledge Scale
- A-2 Criteria for Gifted Eligibility in the Gifted Program in Miami-Dade County Public Schools (M-DCPS) 2002-2003
- A-3 Environmental Education taught to gifted students in our school
- A-4 Photo of our school ecosystem
- A-5 M-DCPS Student Enrolment as of Saturday, February 08, 2003
- A-6 FCAT Science Grade 5 Sample Test Questions
- A-7 Everglades Partnership
- A-8 Officer Snook Program
- A-9 Biscayne Nature Center
- A-10 Photo of Solar Energy Fair
- A-11 Personal Teaching Experiences

B-from Chapter 2--Research

- B-1 Tbilisi Declaration 1977
- B-2 Assessment to be a major contributor to the Intergovernmental Panel on Climate Change (IPCC)
- B-3 UN Conference on Environment and Development (Rio de Janeiro) 1992
- B-4 UNESCO Education for Sustainable Development National Research Council
- B-5 National Science Education Standards (US), 1994
- B-6 Declaration of Thessaloniki, Greece 1997
- B-7 UN Kyoto Conference of the Parties, 1997
- B-8 Report from Assistant U.S. Secretary of State for Oceans, International Environmental and Scientific Affairs, 2002
- B-9 Asst Secretary Turner's Speech, Stockholm 2004
- B-10 NBC Nightly News June 8, 2005
- B-11 U.S. Global Change Research Program
- B-12 The National Environmental Education & Training Foundation (NEETF)
- B-13 Florida Statutes on Environmental Education
- B-14 Florida Department of Environmental Protection
- B-15 TV Channel 10 (local) News
- B-16 Project Learning Tree
- B-17 Roper Starch Worldwide (1994)

C from Chapter 3--Method

- C-1 Email from Professors at UF about an environmental survey
- C-2 Email from Dr. Leeming giving permission to use his survey
- C-3 Miami-Dade County Public Schools Research Review Form
- C-4 Permission Letter to Parents
- C-5 Third Grader's reflections about science class
- C-6 Videotaped and transcribed Interviews of Students
- C-7 Photos of our school campus taken by students
- C-8 Paragraphs from ESOL teacher and students

D from Chapter 4—Results

- D-1 Article By Leonard Pitts, Jr. from *Miami Herald* “On Darfur, here's your action list.”
- D-2 Student "E", in grade 4, Interviewed the Environmental Attorney for Golden Beach, Brenda Chalifour, Esq. 10-02
- D-3 Letter from Parent of Student “R” to the Governor of Florida 5-03
- D-4 Letter from Governor of Florida to parent of 4th grader
- D-5 News release from Governor of Florida to parent of 4th grader
- D-6 Letter from parent of student “E” to teacher after he met with the Governor
- D-7 Teacher’s Interview of student “E” after he spoke with Governor of Florida

Appendix A-1**Children's Environmental Attitudes and Knowledge Scale**

Name_____ Grade__ Girl__ Boy__ Age____

Homeroom Teacher_____ ESOL yes/no Date_____

Children's Environmental Attitudes and Knowledge Scale (CHEAKS)

Please circle what you would really do. (Verbal Commitment)

1. I would be willing to stop buying some products to save animal's lives.
 - a. very true
 - b. mostly true
 - c. not sure
 - d. mostly false
 - f. very false

2. I would **not** be willing to save energy by using less air conditioning.
 - a. very true
 - b. mostly true
 - c. not sure
 - d. mostly false
 - e. very false

3. To save water, I would be willing to use less water when I bathe.
 - a. very true
 - b. mostly true
 - c. not sure
 - d. mostly false
 - e. very false

4. I would **not** give \$15 of my own money to help the environment.
 - a. very true
 - b. mostly true
 - c. not sure
 - d. mostly false
 - e. very false

5. I would be willing to ride the bus to more places in order to reduce air pollution.
 - a. very true
 - b. mostly true
 - c. not sure
 - d. mostly false
 - e. very false

6. I would **not** be willing to separate my family's trash for recycling.
 - a. very true
 - b. mostly true
 - c. not sure
 - d. mostly false
 - e. very false

7. I would give \$15 of my own money to help protect wild animals.
 - a. very true
 - b. mostly true
 - c. not sure
 - d. mostly false
 - e. very false

1. To save energy, I would be willing to use dimmer (less bright) light bulbs.

- a. very true b. mostly true c. not sure d. mostly false e. very false
2. To save water, I would be willing to turnoff the water while I wash my hands
- a. very true b. mostly true c. not sure d. mostly false e. very false
10. I would go from house to house to pass out environmental information.
- a. very true b. mostly true c. not sure d. mostly false e. very false
11. I would be willing to write letters asking people to reduce pollution.
- a. very true b. mostly true c. not sure d. mostly false e. very false
12. I would be willing to go from house to house asking people to recycle.
- a. very true b. mostly true c. not sure d. mostly false e. very false
- Please circle what you really do. (Actual Commitment)**
13. I have **not** written someone about a pollution problem.
- a. very true b. mostly true c. not sure d. mostly false e. very false
14. I have talked with my parents about how to help with environmental problems.
- a. very true b. mostly true c. not sure d. mostly false e. very false
15. I turn off the water in the sink while I brush my teeth to conserve water.
- a. very true b. mostly true c. not sure d. mostly false e. very false
16. To save energy, I turn off lights at home when they are not in use.
- a. very true b. mostly true c. not sure d. mostly false e. very false
17. I have asked my parents not to buy products made from animal fur.
- a. very true b. mostly true c. not sure d. mostly false e. very false
18. I have asked my family to recycle some of the things we use.

a. very true b. mostly true c. not sure d. mostly false e. very false

19. I have asked others what I can do to help reduce pollution.

a. very true b. mostly true c. not sure d. mostly false e. very false

20. I often read stories that are mostly about the environment

a. very true b. mostly true c. not sure d. mostly false e. very false

21. I do **not** let a water faucet run when it is not necessary.

a. very true b. mostly true c. not sure d. mostly false e. very false

22. I leave the refrigerator door open while I decide what to get out.

a. very true b. mostly true c. not sure d. mostly false e. very false

23. I have put up a bird house near my home.

a. very true b. mostly true c. not sure d. mostly false e. very false

24. I do **not** separate things at home for recycling.

a. very true b. mostly true c. not sure d. mostly false e. very false

Please circle how you really feel. (Affect)

25. I am frightened to think people don't care about the environment.

a. very true b. mostly true c. not sure d. mostly false e. very false

26. I get angry about the damage pollution does to the environment.

a. very true b. mostly true c. not sure d. mostly false e. very false

27. It makes me happy when people recycle used bottles, cans, and paper.

a. very true b. mostly true c. not sure d. mostly false e. very false

28. I get angry when I think about companies testing products on animals.

a. very true b. mostly true c. not sure d. mostly false e. very false

29. It makes me happy to see people trying to save energy.
- a. very true b. mostly true c. not sure d. mostly false e. very false
30. I am **not** worried about running out of water.
- a. very true b. mostly true c. not sure d. mostly false e. very false
31. I do **not** worry about environmental problems.
- a. very true b. mostly true c. not sure d. mostly false e. very false
32. I am **not** frightened about the effects of pollution on my family.
- a. very true b. mostly true c. not sure d. mostly false e. very false
33. I get upset when I think of the things people throw away that could be recycled.
- a. very true b. mostly true c. not sure d. mostly false e. very false
34. It makes me sad to see houses being built where animals used to live.
- a. very true b. mostly true c. not sure d. mostly false e. very false
35. It frightens me to think how much energy is wasted.
- a. very true b. mostly true c. not sure d. mostly false e. very false
36. It upsets me when I see people use too much water.
- a. very true b. mostly true c. not sure d. mostly false e. very false
- Please circle what you think.** (Knowledge)
37. Most elephants are killed every year to provide people with:
- a. trophies.
b. ivory.
c. meat.
d. oil.
e. skin.

38. Burning coal for energy is a problem because it:

- a. releases carbon dioxide and other pollutants into the air.
- b. decreases needed acid rain.
- c. reduces the amount of ozone in the stratosphere.
- d. is too expensive.
- e. pollutes the water in aquifers.

39. Ecology assumes that man is what part of nature?

- a. special.
- b. related to all other parts.
- c. not important.
- d. the best part.
- e. the first part.

40. Phosphates are harmful in sea water because they:

- a. cause cancer in fish.
- b. stop reproduction in fish.
- c. make fish nervous.
- d. make the water cloudy.
- e. suffocate fish by increasing algae.

41. Compared to other paper, recycled paper:

- a. takes more water to make.
- b. takes less energy to make.
- c. is less expensive to buy.
- d. is harder to write on.
- e. produces more pollutants.

42. The most pollution of our water sources is caused by:

- a. dams on rivers.
 - b. chemical runoff from farms.
 - c. methane gas.
 - d. leaks in the sewers.
 - e. human and animal wastes.
43. Ecology is the study of the relationship between
- a. different species of animals.
 - b. plants and the atmosphere.
 - c. organisms and their environments.
 - d. man and other animals.
 - e. man and the environment.
44. The most common poisons found in water are:
- a. arsenic, silver nitrates.
 - b. hydrocarbons.
 - c. carbon monoxide.
 - d. sulfur, calcium.
 - e. nitrates, phosphates.
45. Where does most of the garbage go after it is dumped from the garbage trucks?
- a. to an aquifer where it is buried.
 - b. into an ocean.
 - c. recycled to make plastic.
 - d. to a landfill where it is buried.
 - e. to farmers to use as fertilizer.
46. Which is most responsible for creating acid rain?
- a. sulfur dioxide
 - b. carbon dioxide
 - c. ozone

- d. nitrogen
- e. ultraviolet radiation

47. Catching tuna in the ocean:

- a. is eliminating a main food source for whales
- b. protects baby sea turtles.
- c. also kills many dolphins.
- d. is now against the law.
- e. is necessary to keep the population size down.

48. Which is an example of a perpetual energy source?

- a. nuclear
- b. oil
- c. wood
- d. uranium
- e. solar

49. Which of the following is the most dangerous to the earth's environment?

- a. damming rivers
- b. overpopulation
- c. tornadoes
- d. household pets
- e. nuclear power plants

50. Most of the lead in our air is caused by:

- a. cars.
- b. industrial plants
- c. airplanes.
- d. burning refuse.

e. cigarettes.

51. Precycling means that:

- a, people buy things that can be used again.
- b. more people should ride bicycles
- c, small children should wear the clothes of their older brothers or sisters.
- d. items should be tested before we buy them.
- e. environmental changes are always taking place.

52. Animals alive today are most likely to become extinct because:

- a. natural selection kills weaker animals.
- b. where they live is getting too warm.
- c. they are unable to reproduce because of pollution.
- d. the habitat where they live is destroyed.
- e. their food supply is destroyed by acid rain.

53. Coal and petroleum are examples of:

- a. fossil fuels.
- b. renewable sources of energy.
- c. energy sources that are plentiful.
- d. alternative sources of energy.
- e. recycled resources.

54. Environmental problems are a threat to :

- a. mostly people in small countries.
- b. only people who live in cities.
- c. only wild animals and endangered species.
- d. mostly tropical plants and animals.
- e. all living things in the world.

55. Which of the following does **not** do much to reduce the pollution by automobiles:

- a. properly tuned engine.
- b. high octane gas.
- c. low lead gas.
- d. smog control devices.
- e. propane engines.

56. The main problem with landfills is that they :

- a. take up too much space.
- b. are ugly to look at and smell bad.
- c. attract rats and other pests.
- d. prevent farming of nearby land.
- e. do not produce enough methane.

57. Building a dam on a river can be harmful because it:

- a. makes the river muddy.
- b. can no longer be used to make electricity.
- c. increases level of pollution on the water.
- d. causes the river to flood.
- e. damages the river's natural ecosystem

58. Where is water under the ground found?

- a. in landfills.
- b. in ponds.
- c. in low pressure areas.
- d. in aquifers.
- e. in rivers.

59. Killing animals like wolves that eat others:

- a. is necessary and should be done.
 - b. may increase the number of other animals.
 - c. does not affect other animals in the area.
 - d. may decrease the number of other animals.
 - e. will help protect the environment.
60. An example of a nonrenewable resource is:
- a. petroleum.
 - b. trees.
 - c. ocean water.
 - d. sunlight.
 - e. animals raised for food.
61. Most air pollution in our big cities comes from:
- a. cars.
 - b. jet planes.
 - c. factories
 - d. big trucks
 - e. landfills
62. An item which can **not** be recycled and used again is :
- a. disposable diapers.
 - b. newspapers
 - c. aluminum cans
 - d. motor oil
 - e. plastic bottles
63. What is the main problem with the use of aquifers for a water supply?

- a. They recharge too quickly.
 - b. They are becoming used up.
 - c. They contain too much fresh water.
 - d. They contain too much salt water.
 - e. It is hard to get the water out.
64. A species that no longer exists is:
- a. protected.
 - b. endangered.
 - c. abundant.
 - d. extinct.
 - e. wild game.
65. Which uses the most energy in an average house in the United States?
- a. lights.
 - b. TV.
 - c. hot water heater.
 - d. telephone.
 - e. refrigerator.
66. Which of the following groups is most interested in environmental issues?
- a. Boy Scouts of America
 - b. The Sierra Club
 - c. Kiwanis
 - d. 4-H Club
 - e. The American Cancer Society
67. I have never taken a written environmental survey before.

a. true

b. false

68. I would like to learn more about the environment and how to protect our Planet Earth.

a. true

b. false

**Appendix A-2 Criteria for Gifted Program Eligibility in Miami-Dade
County Public Schools 2003-2003 Plan A and Plan B**

- Plan A: The classroom teacher referred the student. The student may have had to wait months to be tested by the school psychologist using the Weschler Intelligence Test for Children, Revised. If the student scored an I.Q. of 130 or greater on full scale, verbal or performance sections of the test student was admitted into the gifted program. The parent could also choose to have the student tested privately (usually at cost for hundreds of dollars to the parents). If the student had an I.Q. of 130 or greater, the student was admitted into the program.
- Plan B: "Automatic" A student who scored in the 98th or 99th percentile of a standardized achievement test (including the Florida Comprehensive Assessment Test, Stanford Achievement Test,) in either Math or Reading and be Limited English Proficient was eligible for the gifted program. Prior to January 20, 2002, Plan B included Hispanic, African American, Chinese, Russian, Portuguese speakers from South America, students with Middle Eastern backgrounds and other minority ethnic groups. As of January 20, 2002, the criteria for Plan B changed. Students were no longer assessed based on their race or ethnicity. However, if students were on free or reduced lunch status or were Limited English Proficient (including all students attending English for Speakers of other Languages [ESOL] Programs, who are in Levels I-IV, or Level V within two years of exiting ESOL they were considered for gifted programs.
- Plan B: "Matrix" If a student did not score in the 98th or 99th percentile on an achievement test, a Matrix is completed with the following information:

I.Q. score

Achievement score

Williams scale score (Creativity test) and survey filled out by the teacher

Teacher nomination form-(survey on characteristics of learning, motivation, creativity, and leadership filled out by teacher).

The students are tested in their home language. Each of these four areas are "scored" on a scale from "0 to 4" and tallied. A child must earn a total of at least 9 matrix points and an I.Q. of at least 112 to be eligible for gifted. At the time of staffing, a child's grades and conduct are also considered when determining placement [Muniz, 2002 #385].

Appendix A-3 Environmental Education taught to gifted students in our school Letter from Shelia Firestone, Teacher of Gifted Students

Hi Arlene,

I guess what you are asking me to do is create a trip down memory lane re ecology and environmental concerns. I hope that this list will trigger in you some ideas for yourself and students yet to arrive on the scene. Not so easy as there were so many projects. I'll start with some more recent obvious ones and work my way backward. A few stand at the front, such as the creation of the musical "Let's Plant a Garden" (which told the history of the coming of the HOE project which you helped to initiate, along with the FPS team's effort to beautify and bring about an awareness of the beauty of the schools' grounds and the affect of litter from the school on the park across the street. Getting the Miami Heat (basketball team) mascot "Bernie" to the cleanup day. Painting the tops of the litter bins like basketballs, to encourage the kids to pitch in. Clean up days, weighing trash (contests). Recyclable objects of art created from throw-aways.

Visits and camping in the Everglades and Sea Base. Day trips to Bear Cut. (Dade County sponsored environmental program).

Developing a history time line at Arch Creek Park for their opening and an awareness of the importance of Indian Mounds. (Weeding of exotic seed pods from the park). I've forgotten the variety of which they had a super abundance

Greynolds Park, (just involvement in animal adoption day at GP because they had a superabundance of cats being dropped in the park. Awareness of animal rights, needs and making a difference in the respect of helping to get attention for that project. Animal adoption day at Highland Oaks.

Camping in Greynolds Park (one summer).

At the top of my list is always is the Future Problem Solving (Community Problem Solving) techniques where teams of children attack a community problem using the FPS approach. (FPS steps from research and fact finding to brainstorming, statement of the main problem,, solution finding, implementation and presentation. I have seen so many groups and their presentations at the state finals. All made a difference in their communities and all of the students became better team players and more aware of how they could make a difference in implementing their own ideas into a particular project.

In the writing area, having the students write essays about essential issues, Journalizing Thoreau style at the park across the street, with proper permission forms, etc. and participating in projects for the Sierra Club, Miami Young Film makers Contest, using the theme of endangered animals. Our Animal Alphabet songs that taught about the problems at the Special Arts Festival. The film called "The Endangered Crusaders all were projects that developed after students researching the concept of doing service at the Special Arts Festivals in order to share the knowledge and understandings that we had gleaned through research. Creating puppet kits for the festival about specific animals. Getting a grant to distribute the films and kits to children at other schools, names just a few of the projects that I can remember initiating. Janice of course would have her own list. So I hope that this may be of help to you. I would be happy for you to quote me if it will be of use to you in presenting ideas. "Ideas are a gift to us from the universe. What we do with those ideas are our gift to mankind." My own personal quote after having the children generate things that they would like to be remembered for having represented in their search for meaning.

Love and light,

Sheila (Firestone, 2003)

Appendix A-4 Photo of our school ecosystem



Appendix A-5 M-DCPS Student Enrollment as of Saturday, February 08, 2003 Active Students (Detailed List): 363,845

Pre-K :	2,209	Grade 6:	29,473
Kindergarten	25,999	Grade 7:	30,105
Grade 1:	26,683	Grade 8:	29,849
Grade 2:	27,463	Grade 9:	35,650
Grade 3:	28,126	Grade 10	: 27,663
Grade 4:	28,342	Grade 11	: 22,697
Grade 5:	28,626	Grade 12	: 20,960

[Miami-Dade County Public Schools, 2003 #386]

Appendix A-6 FCAT Science Grade 5 Sample Test Questions 2003

Each living thing in a food chain plays a role in the flow of energy in an ecosystem. Below is a picture of a simple food chain. The rabbit eats carrots and the fox eats the rabbit. What is the primary role of the rabbit in this food chain?

- a. to form a habitat
- b. to find a space to live
- c. to be a source of water
- d. to be a source of energy

For a special dinner, Catherine's mom lit some candles in the living room for decoration. What two forms of energy does the fire from a burning candle release?

- a. light and heat
- b. sound and chemical
- c. magnetic and nuclear
- d. electrical and mechanical

Armadillos and coral snakes both live in Florida. When an armadillo is threatened, it can curl up. Its armored body looks like a ball. A coral snake curls its tail into a tight spiral and holds it up when an enemy is near. This attracts the enemy to its tail and protects its head. Although these animals are very different, what is one way in which they are similar?

- a. They spend a lot of time in the water.
- b. They have ways to protect themselves.
- c. They use their bodies to attack enemies.
- d. They have hard outer layers of skin for protection.

Jim was planting a garden and a friend suggested he put worms in his garden. Jim wanted to do an experiment to find out what worms do for gardens. Jim put soil, food, and worms in a clear jar. He placed a shoebox with holes cut in it on its side and put the jar in it. The lid was kept on the shoebox, except when Jim was making an observation. If Jim does his experiment correctly, what will he do each time he takes the lid off the shoebox?

- a. add more worms to the jar
- b. write down what he sees in the jar
- c. try to guess where the worms will be
- d. plan what he will do next in the experiment

After studying photosynthesis, Jesse drew the illustration of a tomato plant shown below. Which arrow represents the primary release of oxygen (O_2)? (Diagrams labeled)

Celia saw a goldfish at the pet store that was living in a tank by itself. She bought the fish, took it home, and put it in her aquarium with her other goldfish. What must the new goldfish do to survive in its new environment?

- a. It must camouflage itself in its new surroundings.
- b. It must compete with other goldfish for resources.
- c. It must allow other goldfish to use the limited resources first.
- d. It must build a home that is similar to the one in its previous habitat.

Cities have water purification programs to keep the drinking water free from bacteria and other pollutants. How does this help people living in these cities?

- a. It eliminates filters from factories.
- b. It produces large amounts of water.
- c. It helps people by cleaning the air they breathe.
- d. It helps people by purifying the water to make it safer to use.

Appendix A-7 Everglades Partnership

In summer of 1995, a plan was created to create a not-for-profit institute, the Everglades Partnership, to help promote and assist with consensus building and cooperation in ecosystem restoration in South Florida. The partnership calls for three program initiatives: a Science Forum and Integration program, an Information Sharing Initiative, and a Partnership Development Laboratory (to help build consensus and manage conflicts) and included the Miccosukee and Seminole tribal nations and the Office of the Governor of Florida.

On Dec 11, 2000 the Water Resources Development Act of 2000 (WRDA2000), was signed into law by the President of the United States. (Public Law No. 106-541, of the 106th Congress) Title VI, Section 601, of the Act, describes authorizations specific to the Comprehensive Everglades Restoration Plan.

WRDA 2000 Provides: Approval of the Comprehensive Everglades Restoration Plan (CERP) as a framework and guide for modifications to the Central and Southern Florida Project needed to restore the south Florida ecosystem and to provide for the other water-related needs of the region ((USACE), 2003).

Appendix A-8 Officer Snook Program

The questions that Elaine Sevin and I discussed for the future surveys of the Officer Snook Program were:

- In your home country, describe what you saw as pollution.
- Did you learn pollution education? Why do you think people pollute?
- What do you think will change people who pollute, to stop them from polluting? prison fines, education, because they get sick
- If your parent smokes, does he/she throw the cigarettes out on the street?
- Have you had environmental education? Officer Snook Water Pollution Program, Friends of the Everglades, Audubon Society, other
- Were you taught at home not to throw garbage or not to pollute?
- Do you recycle? What items do you mostly recycle at home? In school? Plastic, glass, cans, paper.
- How long does it take to degrade plastic, glass, cans, newspapers in the environment?
- What happens to the garbage taken to the landfills?
- What are storm drains?
- Why don't people do something to help the environment?

The Officer Snook Program has partnered with many agencies and organizations including the EPA, DEP, Florida Fish and Wildlife Conservation Commission, Wildlife Conservation Society, North Carolina's Cape Fear River Watch Program, Hillsborough County, Miami-Dade County's Department of Environmental Resources Management (DERM), the Florida Aquarium and the New York Aquarium. The Officer Snook Program has presented at various conferences such as The Third International Marine Debris Conference in Miami, Florida; the 1994 Florida Caribbean Cruise Association Conference in Barbados, the 1995 Gulf of Mexico Symposium in Corpus Christi, Texas, the 1997 National Science Teachers Association Conference in New Orleans, Louisiana, and numerous USCG "Train the Trainers" conferences throughout the United States.

The following is a list of resources available from Elaine Sevin (Jennifer's mom) who runs the Officer Snook Program. These resources were given free to our school and other schools who were interested.

- Officer Snook Water Pollution Program
- Officer Snook Water Pollution Program Materials
- Officer Snook and Friends coloring book Ages: 4-6 years
- Officer Snook Coloring and Activity Book Ages: 7-12 years
- Officer Snook Coloring And Activity Book - (Spanish)Ages: 7-12 years
- Officer Snook Coloring And Activity Book - (Creole) Ages: 7-12 years
- Officer Snook vs. The Pollution Monster comic book Ages: 12-14 years
- Officer Snook Hands On/Minds On Activity Book Ages: Teachers and Parents Guide To Understanding Water Pollution Ages: 15 and Up
- "It's Time To Stop The Wave Of Water Pollution" Officer Snook Poster
- "Water - Enjoy It, Protect It" Recreational Water User Brochure
- Officer Snook Book Cover, Officer Snook Multi Pull-Off Sticker, Officer Snook Square Sticker, Officer Snook Waterproof Round Sticker, Officer Snook T-shirt
- Officer Snook Soft Sculpture

Appendix A-9

Biscayne Nature Center

"Housed in a hot dog stand" An open letter from Theodora Long, Executive Director

In 1969, the Nature Center, housed in a hot dog stand, began as a summer camp for students in Crandon Park. Two years later, it became one of the first hands-on environmental Dade County School Programs. In 1985, after moving from various hot dog stands around the park, Marjory Stoneman Douglas, went before the Dade County School Board and declared the Nature Center needed a building of its own. At the young age of 95, Marjory scored a portable classroom building and planted the idea for a community facility in Crandon Park. In 1991, the State of Florida Department of Education awarded the Marjory Stoneman Douglas Biscayne Nature Center 1.8 million dollars to be matched for the construction her beloved Nature Center in Crandon Park.

A Message From Marjory Stoneman Douglas

"It is indeed a great honor to have the Marjory Stoneman Douglas/Biscayne Nature Center bear my name. The promise that the nature center brings to Dade County is exciting.

The north end of Key Biscayne, with its mangroves, sand dunes, fossilized rock reef, ocean, and uplands, offers a unique opportunity to study the wonders of nature. The relationship of one natural system to another is a microcosm of South Florida's coastal environment. In order to survive, its interdependence must not be obstructed by man. It is my hope that all who come to visit the nature center will leave with a better understanding and appreciation of this area.

<http://www.biscaynenaturecenter.org/>

Appendix A-10

Photo of Solar Energy Fair



Appendix A-11 Personal Teaching Experience

I seem to have been interested in Florida's ecology and environmental education for as long as I can remember. Fifteen years ago my students were figuring out their home energy consumption and doing projects to save energy and use solar power. One of my grade-2 students got the governor's energy award, which was signed by Governor Chiles and David La Hart who was head of the Florida Solar Energy Education Program near Cape Kennedy.

A few years ago, the South Florida Water Management District (SFWMD), in an effort to help educate students and spark their interest in environmental issues, had a poster contest of how students thought the Everglades would look in 20 years. 80 of my young students submitted entries for this contest. Some depicted a dry, barren area. One grade-3 student drew a lively scene with water flowing around plants and animals in a thriving ecosystem. Apparently the judges liked it and this little boy's picture was used to make thousands of book covers that were handed out statewide by SFWMD.

Three years ago, I visited a water pumping station at South Florida Water Management District where the water from Ft. Lauderdale goes in and out of the Everglades off of Griffin Road. I did see where the holding tanks for water run off are being built near road Interstate 75 since South Florida's drought scared everyone. No one knew of any survey for elementary schools. I did give my students The South Florida Water management District *Home Water Audit* to check their home water use and we discussed how much water their family is using with the dishwasher, washing machine, showers, tub baths and toilet flushes on the average each week.

I visited the International Game Fish Association (IGFA) and arranged to have three classes of gifted grade-3 students go to their facility to learn about ecology. As part of the trip, students were engaged in hands-on experiments to replicate how a walrus' fat helps her to keep warm. The grade-3 students saw a live giant-screen broadcast from the stellar seal research station in Alaska presented by the benthic sea explorer, Robert Ballard (who found the Titanic) and his team of Jason Project young scientists who answered some of the students' questions.

Appendix B-1**Tbilisi Declaration (1977)**

The world's first intergovernmental conference on environmental education was organized by the United Nations Education, Scientific, and Cultural Organization (UNESCO) in cooperation with the U.N. Environment Program (UNEP) and was convened in Tbilisi, Georgia (USSR) from October 14-26, 1977.

Delegates from 66 member states and observers from two nonmember states participated. Representatives and observers from eight U.N. agencies and programs also participated. Three other intergovernmental organizations and 20 international nongovernmental organizations also were represented. In all, 265 delegates and 65 representatives and observers took part in the conference.

The Tbilisi Declaration was adopted by acclamation at the close of the intergovernmental conference. The declaration noted the unanimous accord in the important role of environmental education in the preservation and improvement of the world's environment, as well as in the sound and balanced development of the world's communities.

The Role, Objectives, and Characteristics of Environmental Education

The Tbilisi Declaration together with two of the recommendations of the Conference constitutes the framework, principles, and guidelines for environmental education at all levels—local, national, regional, and international—and for all age groups both inside and outside the formal school system.

I. The Conference *recommends* the adoption of certain criteria that will help to guide efforts to develop environmental education at the national, regional, and global levels:

1. Whereas it is a fact that biological and physical features constitute the natural basis of the human environment, its ethical, social, cultural, and economic dimensions also play their part in determining/he lines of approach and the instruments whereby people may understand and better use natural resources in satisfying their needs.
2. Environmental education is the result of the reorientation and dovetailing of different disciplines and educational experiences which facilitate an integrated perception of the problems of the environment, enabling more rational actions capable of meeting social needs to be taken.
3. A basic aim of environmental education is to succeed in making individuals and communities understand the complex nature of the natural and the built environments resulting from the interaction of their biological, physical, social, economic, and cultural aspects, and acquire the knowledge, values, attitudes, and practical skills to participate in a responsible and effective way in anticipating and solving environmental problems, and in the management of the quality of the environment.
4. A further basic aim of environmental education is clearly to show the economic, political, and ecological interdependence of the modern world, in which decisions and actions by different countries can have international repercussions. Environmental education should, in this regard, help to develop a sense of responsibility and solidarity among countries and regions as the foundation for a new international order, which will guarantee the conservation and improvement of the environment.
5. Special attention should be paid to understanding the complex relations between socio-economic development and the improvement of the environment.
6. For this purpose, environmental education should provide the necessary knowledge for interpretation of the complex phenomena that shape the environment, encourage those ethical, economic, and esthetic values which, constituting the basis of self-discipline, will further the development of conduct compatible with the preservation and improvement of

the environment. It should also provide a wide range of practical skills required in the devising and application of effective solutions to environmental problems.

7. To carry out these tasks, environmental education should bring about a closer link between educational processes and real life, building its activities around the environmental problems that are faced by particular communities and focusing analysis on these by means of an interdisciplinary, comprehensive approach which will permit a proper understanding of environmental problems.

8. Environmental education should cater to all ages and socio-professional groups in the population. It should be addressed to (a) the general non-specialist public of young people and adults whose daily conduct has a decisive influence on the preservation and improvement of the environment; (b) to particular social groups whose professional activities affect the quality of the environment; and © to scientists and technicians whose specialized research and work will lay the foundations of knowledge on which education, training, and efficient management of the environment should be based.

9. To achieve the effective development of environmental education, full advantage must be taken of all public and private facilities available to society for the education of the population: the formal education system, different forms of non-formal education, and the mass media.

10. To make an effective contribution towards improving the environment, educational action must be linked with legislation, policies, measures of control, and the decisions that governments may adopt in relation to the human environment.

II. The Conference *endorses* the following goals, objectives, and guiding principles for environmental education:

The *goals* of environmental education are:

1. to foster clear awareness of, and concern about, economic, social, political, and ecological interdependence in urban and rural areas;
2. to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment;
3. to create new patterns of behavior of individuals, groups, and society as a whole towards the environment.

The categories of environmental education *objectives* are:

Awareness—to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems.

Knowledge—to help social groups and individuals gain a variety of experience in, and acquire a basic understanding of, the environment and its associated problems.

Attitudes—to help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.

Skills—to help social groups and individuals acquire the skills for identifying and solving environmental problems.

Participation—to provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems.

Guiding principles—environmental education should

1. consider the environment in its totality—natural and built, technological and social (economic, political, cultural-historical, ethical, esthetic);
2. be a continuous lifelong process, beginning at the preschool level and continuing through all formal and non-formal stages;
3. be interdisciplinary in its approach, drawing on the specific content of each discipline in making possible a holistic and balanced perspective;
4. examine major environmental issues from local, national, regional, and international points of view so that students receive insights into environmental conditions in other geographical areas;
5. focus on current and potential environmental situations while taking into account the historical perspective;
6. promote the value and necessity of local, national, and international cooperation in the prevention and solution of environmental problems;

7. explicitly consider environmental aspects in plans for development and growth;
8. enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences;
9. relate environmental sensitivity, knowledge, problem-solving skills, and values clarification to every age, but with special emphasis on environmental sensitivity to the learner's own community in early years;
10. help learners discover the symptoms and real causes of environmental problems;
11. emphasize the complexity of environmental problems and thus the need to develop critical thinking and problem-solving skills;
12. utilize diverse learning environments and a broad array of educational approaches to teaching, learning about and from the environment with due stress on practical activities and first-hand experience.

**Appendix B-2 Assessment to be a major contributor to the
Intergovernmental Panel on Climate Change (IPCC)**

Temperature Trends in the Lower Atmosphere:
Steps for Understanding and Reconciling Differences
Final Prospectus for Synthesis and Assessment Product 1.1 (2005)

A prospectus has been prepared according to the Guidelines for Producing Climate Change Science Program (CCSP) Synthesis and Assessment Products. The prospectus was reviewed and approved by the CCSP Interagency Committee. The document describes the focus of this synthesis and assessment product, and the process that will be used to prepare it. The document does not express any regulatory policies of the United States or any of its agencies, or make any findings of fact that could serve as predicates for regulatory action.

Independently produced data sets that describe the four-dimensional temperature structure from the surface through the lower stratosphere provide different temperature trends. These differences are seen in varying degrees in comparisons of separate *in situ* (surface and weather balloon) data sets, in comparisons of separate space-based data sets, and in comparisons of individual data sets drawn from the different observational platforms and different trend analysis teams.

This CCSP synthesis and assessment product will address the accuracy and consistency of these temperature records and outline steps necessary to reconcile differences between individual data sets. Understanding exactly how and why there are differences in temperature trends reported by several analysis teams using differing observation systems and analysis methods represents a necessary step in reducing the uncertainties that underlie current efforts focused on the detection and quantification of surface and tropospheric temperature trends. Consequently, this synthesis and assessment product promises to be of significant value to decision makers, and to the expert scientific and stakeholder communities. For example, we expect this assessment to be a major contributor to the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (due to be published in 2007). In addition, we expect the information generated will be used by the Global Climate Observing System Atmospheric Observation Panel to help identify effective ways to reduce observational uncertainty.

The period of performance for the review is expected to be approximately January to April 2005.

[US Climate Change Science Program, 2005]

Appendix B-3 The United Nations Conference on Environment and Development (1992 – Rio de Janeiro, Brazil).

The 1992 Earth Summit in Rio de Janeiro, Brazil declared “To be effective, sustainable development, education should deal with the dynamics of the physical, biological, social, economic and spiritual environment. [Sitarz, ed. 1993 in Wheeler p.37, 2000]

Agenda 21 was signed by 178 heads of State and is the international consensus on the interlocking issues facing humanity and the steps that must be taken by the global community to achieve a sustainable future. In particular, Agenda 21 sought the integration of development needs with those of ecologically sustainable management of the environment. The UN Commission on Sustainable Development (CSD) monitors progress on Agenda 21 [Paden, 2000 #23]. (1977, IUCN quoted in Paden in Wheeler p.19)

The United Nations Education, Scientific and Cultural Organization, UNESCO, was designated by the United Nations Commission on Sustainable Development as the taskmaster for Chapter 36 in Agenda 21, the chapter concerned with education. In the UNESCO work plan, the following issues were identified as critical for the world community to address:

- The rapid growth of the world’s population and its changing distribution
- The persistence of widespread poverty
- The growing pressures placed on the environment by the world-wide spread of industry and the use of new and more intensive forms of agriculture
- The continuing denial of democracy, violation of human rights and the rise of ethnic and religious conflicts and violence, gender inequity’ and
- The very notion of ‘development’ itself, what it has come to mean, and how it is measured.

Appendix B-4 UNESCO Education for Sustainable Development (1994)

New Role of Education -- Key to a Viable Future

Education in all its forms is essential to sustainable development. In many respects primary education makes a positive contribution to combating the problems of poverty, the degradation of the environment and the improvement of nutrition. Improved access to primary education for girls and women yields tangible benefits, including reductions in birth rates and improvements in health. Education is also an important factor in fostering social cohesion and democratic government.

Scientific education has a unique part to play in facilitating sustainable development because it can widen our capacities, especially in areas such as eco-technology and the development of renewable energy sources, and it can ensure the widespread availability of scientific information, which in turn is increasingly necessary for informed ethical decision-making.

Education not only provides the scientific and technical skills required, it also provides the motivation, justification, and social support for pursuing and applying them. Education increases the capacities of people to transform their visions of society into operational realities. It is for this reason that education is the primary agent of transformation towards sustainable development. It is also for this reason that society must be deeply concerned that much of the education presently on offer falls far short of what is required. Improving the quality and coverage of education and reorienting its goals to recognize the importance of sustainable development must be among society's highest priorities.

Education – Force of the Future

It is widely agreed that education is the most effective means that society possesses for confronting the challenges of the future. Indeed, education will shape the world of tomorrow. Progress increasingly depends upon the products of educated minds: upon research, invention, innovation and adaptation. Of course, educated minds and instincts are needed not only in laboratories and research institutes, but in every walk of life. Indeed, access to education is the sine qua non for effective participation in the life of the modern world at all levels. Education, to be certain, is not the whole answer to every problem. But education, in its broadest sense, must be a vital part of all efforts to imagine and create new relations among people and to foster greater respect for the needs of the environment.

Over time, education also powerfully affects cultures and societies, increasing their concern over unsustainable practices and their capacities to confront and master change. The potential of education is enormous. Not only it can inform people, but it can change them. It is not only a means for personal enlightenment, but also for cultural renewal.

Education serves society in a variety of ways. The goal of education is to make people wiser, more knowledgeable, better informed, ethical, responsible, critical and capable of continuing to learn. Were all people to possess such abilities and qualities, the world's problems would not be automatically solved, but the means and the will to address them would be at hand. Education also serves society by providing a critical reflection on the world, especially its failings and injustices, and by promoting greater consciousness and awareness, exploring new visions and concepts, and inventing new techniques and tools. Education is also the means for disseminating knowledge and developing skills, for bringing about desired changes in behaviors, values and lifestyles, and for promoting public support for the continuing and fundamental changes that will be required. Education is humanity's best hope and most effective means in the quest to achieve sustainable development.

Education as a Means

Education is considered as the essential foundation for sustainable development and as indispensable for advances in other spheres, such as sciences, technology, legislation and production. Education is no longer seen as an end in itself, but as a means

- to effect the changes in value systems, behavioral patterns and lifestyles necessary to achieve sustainable development, and ultimately democracy, security and peace.
- to disseminate the knowledge and skills necessary to foster sustainable production and consumption patterns and to improve the management of natural resources, agriculture, energy and industrial production.
- to ensure an informed populace, prepared to support changes in other sectors conducive to sustainability.

<http://www.unesco.org/education/esd/english/education/role.shtml>

Appendix B-5 National Science Education Standards and National Geography Standards (1994) The National Research Council

"The national science standards and the national geography standards readily show an acceptance of the need for students of all ages to understand the complexities of our global environment. For example, the National Research Council National Science Education Standards, published in 1994 by the National Academy of Sciences, suggest several standards that link to global change [Mortensen, 2000, p.21]

The eight categories of content standards are

- Unifying concepts and processes in science.
- Science as inquiry.
- Physical science.
- Life science.
- Earth and space science.
- Science and technology.
- Science in personal and social perspectives.
- History and nature of science.

The standard for unifying concepts and processes is presented for grades K-12, because the understanding and abilities associated with major conceptual and procedural schemes need to be developed over an entire education, and the unifying concepts and processes transcend disciplinary boundaries. The next seven categories are clustered for grades K-4, 5-8, and 9-12. Those clusters were selected based on a combination of factors, including cognitive development theory, the classroom experience of teachers, organization of schools, and the frameworks of other disciplinary-based standards.

The sequence of the seven grade-level content standards is not arbitrary: Each standard subsumes the knowledge and skills of other standards. Students' understandings and abilities are grounded in the experience of inquiry, and inquiry is the foundation for the development of understandings and abilities of the other content standards. The personal and social aspects of science are emphasized increasingly in the progression from science as inquiry standards to the history and nature of science standards. Students need solid knowledge and understanding in physical, life, and earth and space science if they are to apply science.

Multidisciplinary perspectives also increase from the subject-matter standards to the standard on the history and nature of science, providing many opportunities for integrated approaches to science teaching.

UNIFYING CONCEPTS AND PROCESSES STANDARD

Conceptual and procedural schemes unify science disciplines and provide students with powerful ideas to help them understand the natural world. Because of the underlying principles embodied in this standard, the understandings and abilities described here are repeated in the other content standards. Unifying concepts and processes include

- Systems, order, and organization.
- Evidence, models, and explanation.
- Change, constancy, and measurement.
- Evolution and equilibrium.
- Form and function.

This standard describes some of the integrative schemes that can bring together students' many experiences in science education across grades K-12. The unifying concepts and processes standard can be the focus of instruction at any grade level but should always be closely linked to outcomes aligned with other content standards. In the early grades, instruction should establish the meaning and use of unifying concepts and processes—for example, what it means to measure and how to use measurement tools. At the upper grades, the standard should facilitate and enhance the learning of scientific concepts and principles by providing students with a big picture of scientific ideas—for example, how measurement is important in all scientific endeavors.

The National Research Council National Science Education Standards suggests several standards that link to global change:

- For grades K-4:

Science in personal and social perspectives: personal health, characteristics and changes in populations, types of resources, and changes in environments. Unifying concepts and processes: change constancy, and measurement.

- For grades 5-8:

Life science: populations and ecosystems, diversity and adaptations of organisms; Science in personal and social perspectives: personal health, populations, resources, and environments, natural hazards, risks and benefits; Unifying concepts and processes: evidence models, and explanations; change, constancy and measurement, evolution and equilibrium.

- For grades 9-12:

Physical science: chemical reactions, forces and motions, conservation of energy and increase in disorder, interactions of energy and matter. Life science: the interdependence of organisms; matter, energy, and organization in living systems; Earth and Space science: energy in the Earth system; origin and evolution of the Earth system; Science in personal and social perspectives; personal and community health, population growth, natural resources, environmental quality, natural and human-induced hazards, science and technology in local, national, and global challenges; History and nature of science: nature of scientific knowledge; historical perspectives; Unifying concepts and process: evidence, models and explanation; change, constancy and measurement.

Similarly, the National Geography Standards, published in 1994 in *Geography for Life*, include standards that link to global change, such as

- The world in spatial terms; how to use maps, how to analyse the spatial organization of people, places and environments on Earth's surface;
- Places and regions: the physical and human characteristics of places, how culture and experience influence people's perceptions of places and regions;
- Physical systems: physical processes that shape the patterns of Earth's surface, the characteristics and spatial distribution of ecosystems on Earth's surface;
- Human systems; characteristics, distribution, and migration of human populations on Earth's surface; patterns and networks of economic interdependence on Earth's surface; processes, patterns and functions of human settlement

Environment and society: how human actions modify the physical environment, how physical systems affect human systems, the changes that occur in the meaning, use, distribution, and importance of resources.

<http://www.nap.edu/readingroom/books/nSES/html/6a.html>

Appendix B-6**Declaration of Thessaloniki, Greece 1997**

The Thessaloniki Conference enhanced mutual understanding and a comprehension of the different conditions prevailing in countries and regions. The conference was also considered instrumental in strengthening participants' skills and motivation to move forward with their own work and action, but also in prompting others to become involved. A Declaration was adopted by the conference participants.

The objectives of the conference were to highlight the critical role of education and public awareness in achieving sustainability, to consider the important contribution of environmental education, to provide elements for the further development of the work program of the UN Commission on Sustainable Development (CSD) , and to mobilize action at international, national and local levels.

The work of the Conference was conducted primarily through two Fora: an Issues Forum and an Innovative Practices Forum. Numerous workshops, poster sessions, an international youth forum, an exhibition, and several cultural events also took place. A team of young people prepared daily news bulletins, containing summaries of discussions and interviews with participants, from the Students' Commission/TG Magazine of Toronto, Canada.

1. We, the participants from governmental, intergovernmental non-governmental organizations (NGOs) and the civil society at large from 83 countries present at the International Conference on Environment and Society: Education and Public Awareness for Sustainability, organized in Thessaloniki by UNESCO and the Government of Greece, from 8 to 12 December 1997, unanimously adopt the following Declaration.

We take note that:

2. The recommendations and action plans of the Belgrade Conference on Environmental Education (1975), the Tbilisi Intergovernmental Conference on Environmental Education (1977), the Moscow Conference on Environmental Education and Training (1987), and the Toronto World Congress for Education and Communication on Environment and Development (1992) are still valid and not fully explored.

3. Insufficient progress has been made five years after the Earth Summit in Rio as it has been recognized by the international community.

4. The Thessaloniki Conference has benefited from the numerous international, regional and national meetings held during 1997 in India, Thailand, Canada, Mexico, Cuba, Brazil, Greece and the Mediterranean region.

5. The vision of education and public awareness has been further developed, enriched and reinforced by the major UN Conferences: on Environment and Development (Rio, 1992); Human Rights (Vienna, 1993); Population and Development (Cairo, 1994); Social Development (Copenhagen, 1995); Women (Beijing, 1995) and Human Settlements (Istanbul, 1996), as well as the nineteenth special session of the United Nations General Assembly (1997). The action plans of these conferences, as well as the special work program of the UN Commission on Sustainable Development adopted in 1996, are to be implemented by national governments, civil society (including non-governmental organizations, youth, enterprises and the educational community), the United Nations system and other international organizations.

We reaffirm that:

6. In order to achieve sustainability, an enormous co-ordination and integration of efforts is required in a number of crucial sectors and rapid and radical change of behaviors and lifestyles, including changing consumption and production patterns. For this, appropriate education and public awareness should be recognized as one of the pillars of sustainability together with legislation, economy and technology.
7. Poverty makes the delivery of education and other social services more difficult and leads to population growth and environmental degradation. Poverty reduction is thus an essential goal and indispensable condition for sustainability.
8. A collective learning process, partnerships, equal participation and continuous dialogue are required among governments, local authorities, academia, enterprises, consumers, NGOs, media and other actors in order to raise awareness, search for alternatives and change behaviors and lifestyles, including consumption and production patterns, towards sustainability.
9. Education is an indispensable means to give to all women and men in the world the capacity to own their own lives, to exercise personal choice and responsibility, to learn throughout life without frontiers, be they geographical, political, cultural, religious, linguistic or gender.
10. The reorientation of education as a whole towards sustainability involves all levels of formal, non-formal and informal education in all countries. The concept of sustainability encompasses not only environment but also poverty, population, health, food security, democracy, human rights and peace. Sustainability is, in the final analysis, a moral and ethical imperative in which cultural diversity and traditional knowledge need to be respected.
11. Environmental education, as developed within the framework of the Tbilisi recommendations and as it has evolved since then, addressing the entire range of global issues included in Agenda 21 and the major UN Conferences, has also been dealt with as education for sustainability. This allows that it may also be referred to as education for environment and sustainability.
12. All subject areas, including the humanities and the social sciences, need to address issues related to environment and sustainable development. Addressing sustainability requires a holistic, interdisciplinary approach, which brings together the different disciplines and institutions while retaining their distinct identities.
13. While the basic content and action framework for environment and sustainability is largely in place, the translation of these parameters into action for education will need to take into account particular local, regional or national contexts. The reorientation of education as a whole called for in chapter 36 of Agenda 21 must involve not only the educational community, but also governments, financial institutions, and all other actors.

We recommend that:

14. Governments and leaders around the world honor the commitments already made during the series of United Nations conferences, and give to education the necessary means to fulfill its role in achieving a sustainable future.

15. Action plans for formal education for environment and sustainability with concrete targets and strategies for non-formal and informal education should be elaborated at national and local levels. Education should be an integral part of local Agenda 21 initiatives.
16. National councils for sustainable development and other relevant bodies give education, public awareness and training a central role for action including better coordination among the relevant national ministries and other entities, including major groups.
17. Governments and international, regional and national financial institutions, as well as the productive sector, be encouraged to mobilize additional resources and increase investments in education and public awareness. The establishment of special funds for education for sustainable development should be considered as a specific way to increase support and visibility.
18. All actors reinvest a portion of the savings from the greening process into strengthening of environmental education, information, public awareness and training program.
19. The scientific community plays an active role in ensuring that the content of education and a public awareness program is based on accurate, up to-date information.
20. The media be sensitized and invited to mobilize its know-how and distribution channels to diffuse the key messages, while helping to translate the complexity of the issues into meaningful and understandable information to the public. The full potential of new information systems should be used properly for this purpose.
21. Schools be encouraged and supported to adjust their curricula to meet the needs for a sustainable future.
22. Non-governmental organizations be given adequate institutional and financial support in order to further mobilize people on issues of environment and sustainability, within communities and at national, regional and international levels.
23. All actors - governments, major groups, the education community, the United Nations system and other international organizations, the international financial institutions, - contribute to the implementation of chapter 36 of Agenda 21, and in particular to the work program on education, public awareness and training of the UN Commission on Sustainable Development.
24. Special emphasis should be given to the strengthening and eventual reorientation of teacher training program and identification and sharing of innovative practices. Support should be given to research in interdisciplinary teaching methodologies and in assessing the impact of relevant educational programs.
25. The United Nations system, including UNESCO and UNEP, in cooperation with international NGOs, major groups and all other actors, continue to give priority to education, public awareness and training for sustainability, in particular at national and local level.
26. A Thessaloniki International Award under the auspices of UNESCO be established to be given every second year for exemplary educational projects for environment and sustainability.

27. An international conference be held in 2007, after ten years, in order to assess the implementation and the progress of the suggested educational process.

We thank

28. The Government of Greece for having joined with UNESCO to organize the International Conference in Thessaloniki.

We request

29. The Government of Greece to transmit the outcome of this Conference to the Commission on Sustainable Development at the Sixth Session in April 1998. [Environment, 1997 #27]

<http://www.unesco.org/education/esd/english/international/thesdecl.shtml>

Appendix B-7**U.N. Kyoto Conference of the Parties (1997)**

The United Nations Education, Scientific and Cultural Organization (UNESCO) articulated the role of values in moving toward a sustainable future. “Sustainable development is widely understood to involve the natural sciences and economics. But it is even more fundamentally concerned with culture: with the values people hold and how they perceive their relations with others. It responds to an imperative need to imagine a new basis for relationships among peoples and with the habitat that sustains human life. [U.N. Kyoto Conference of the Parties, 1997, Dec. #25] (Mortensen in Wheeler 2000, p. 19)

The analysis in the report was undertaken at the request of the U.S. House of Representatives Committee on Science. In its request, the Committee asked the Energy Information Administration (EIA) to analyze the Kyoto Protocol, “focusing on U.S. energy use and prices and the economy in the 2008-2012 time frame.” The Committee specified that EIA consider several cases for energy-related carbon reductions in its analysis, with sensitivities evaluating some key uncertainties: U.S. economic growth, the cost and performance of energy-using technologies, and the possible construction of new nuclear power plants. The United States agreed to reduce emissions from 1990 levels by 7 percent during the period 2008 to 2012.

(<http://www.eia.doe.gov/oiaf/kyoto/kyotorpt.html>) (taken from internet in Dec. 2003)

**Appendix B-8 Report from Assistant U.S. Secretary of State for Oceans,
International Environmental and Scientific Affairs (2002)**

Assistant U.S. Secretary of State for Oceans, International Environmental and Scientific Affairs, John Turner testifying at a joint Senate hearing for both the Senate Committee on Environment and Public Works and the Senate Committee on Foreign Relations on July 2, 2002 said, “The United States is a world leader in the initiation and implementation of multilateral environmental agreements. We are a leader in addressing environmental challenges on the international level, having spearheaded efforts to negotiate environmental agreements on issues ranging from ozone depletion to stemming illegal trade in endangered species”.

Turner outlined the history and status of U.S. involvement and implementation in five international environmental agreements: the Montreal Protocol on Substances that Deplete the Ozone Layer; the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); the U.N. Framework Convention on Climate Change (UNFCCC); the North American Agreement on Environmental Cooperation (NAAEC); and the U.N. Convention to Combat Desertification (UNCCD). “The Montreal Protocol”, he said, “has made remarkable progress in protecting the stratospheric ozone layer by phasing out the consumption and use of ozone depleting substances on a global scale.”

Regarding the Kyoto Protocol, which resulted from negotiations under the UNFCCC, Turner said that while the Bush Administration has announced it will not pursue ratification of the protocol itself, it remains actively involved in the UNFCCC process to address climate change. “Both with our continued, active participation under the UNFCCC and in our bilateral relationships that complement and enhance our multilateral cooperation, we are seeking to build relationships that will enable us and others to address the long term challenge of climate change on a balanced and measured basis, consistent with the need to ensure the continued economic prosperity for our citizens and our nation,” he said. [U.S. Department of State’s Office of International Information Programs, 2002 #343]

Appendix B-9 Asst Secretary Turner's Speech, Stockholm 2004

The United States is working with its international partners to improve and preserve the environment through initiatives relating to land preservation, illegal logging, renewable energy development and climate change, says Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs John F. Turner.

"The United States is deeply engaged with the world community in fighting environmental degradation in the developing world," Turner said in a March 2 speech to the Stockholm School of Economics.

The speech was delivered during a two-week European trip that is taking Turner to Copenhagen, Stockholm, Helsinki and St. Petersburg.

Turner says environmental progress is now linked to the concept of sustainable development and meeting the needs of people. "It links environmental stewardship, economic growth, and social development in order to lift people out of poverty," Turner said. "After all, it's impossible for citizens to focus on protecting their environment when they are hungry or sick, or their daily life is punctuated by violence and corruption."

Turner also noted U.S. participation in an international partnership to preserve tropical forestland in the Congo Basin, and is supporting African governments in efforts to improve forest stewardship, reduce illegal logging and the taking of bushmeat.

The Bush administration has been criticized in Europe for its decision not to sign the Kyoto Protocol to reduce greenhouse gas emission. Turner asked his audiences to put differences about that decision aside and instead recognize that the United States is still conducting an aggressive campaign to address climate change.

"The United States has cemented 13 formal bilateral relationships with both developed and developing countries to address climate change," Turner said. He also cited significant U.S. investments in climate science, renewable energy and energy-efficient technologies.

"Of course our countries will differ from time to time on how best to preserve this great blue orb entrusted to our care," Turner said. "But let us move past these differences and take action in the areas where we do agree."

John F. Turner, Assistant Secretary for Oceans and International Environmental and Scientific Affairs Remarks to Stockholm School of Economics Stockholm, Sweden March 2, 2004

"Thank you very much for that kind introduction. It's a pleasure to be here. On behalf of President Bush and Secretary Powell, I want to salute Sweden's remarkable record of environmental stewardship. It's truly inspiring. Thank you for being such exceptional global neighbors.

I very much appreciate this opportunity to document a few of the more important U.S. environmental achievements over the years and to detail some of the exciting work we are currently engaged in.

Despite the caricature of Americans as self-centered, gas guzzling, trash-producing gluttons, my fellow citizens care about the environment. A recent opinion poll documented that more than 60% of Americans describe themselves as active environmentalists or sympathetic to the environment; 70% purchase what they describe as "environmentally friendly" products; 80% say they have reduced household energy use; and 90% recycle on a routine basis. Another survey showed that Americans overwhelming support our nation's major environmental laws and more than 80% of Americans favor strengthening these environmental standards.

History of the American Environmental Movement

We are far from perfect. But, by and large, America's history of environmental stewardship is a solid one, as old as the country itself.

Thomas Jefferson, one of our country's founding fathers, first set aside land in 1774 for future generations to enjoy. He purchased a gigantic natural limestone arch from British

King George III to protect it from harm. Present-day visitors to Virginia can still enjoy the awe-inspiring formation.

In the 1800s, as early explorers mapped our country's western frontier, they developed a reverence for the West's seemingly limitless resources and expansive vistas. "America the Beautiful," an anthem to my country's spacious skies, majestic mountains, and vast fields and forests, records the wonder they surely felt.

Theodore Roosevelt, our nation's first conservationist president, translated this ethic into policy. As he set aside five national parks, more than 50 wildlife preserves, and hundreds of national forests, he made environmental protection—especially land conservation—a priority for our government.

Today, the National Park System that Roosevelt launched encompasses some 38 million hectares (84.5 million acres), an area roughly the size of Germany. The federal government also manages another 220 million hectares of wildlife reserves, refuges, wilderness areas and marine sanctuaries.

Roosevelt planted the seeds for the modern American environmental movement that blossomed on a spring day some sixty years later. On April 22, 1970, 20 million Americans gathered to celebrate the first Earth Day. They forged a grass-roots movement to clean up the environment and protect it from future harm.

The years immediately following that first Earth Day were a vibrant period for environmental legislation in the U.S. The Environmental Protection Agency was born; the President's Council on Environmental Quality was created; President Richard Nixon signed into law the National Environmental Policy Act, the Clean Air Act, the Clean Water Act, and the Endangered Species Act. Many of these measures were the first of their kind worldwide.

As a result, the U.S. environment is healthier today than it was when the modern environmental movement began. This is pretty impressive considering that in the past 30 years the U.S. Gross Domestic Product (GDP) increased 160% while energy consumption grew only 45%. In other words, the amount of energy used to produce each dollar of economic growth decreased 44%.

Today, we face more complex environmental challenges than those of the 1960s and '70s. We have instituted most of the "easy" answers for our environmental problems. Now the remaining challenges require more complicated technology that is relatively costly compared to the incremental improvements it produces. Even so, we are confronting these more complex challenges head on.

Bush Administration Environmental Record

Now, what about the critics who say the Bush Administration—at best—lacks an environmental policy? Or—at worst—is engaged in an assault on the environment?

It's clear that we have failed in the court of public opinion to tell our story. If you'll indulge me, I'd like to share with you what the United States is doing internationally to promote responsible stewardship of the Earth.

Sustainable Development

More than ever before, the United States is deeply engaged with the world community in fighting environmental degradation in the developing world. We are achieving this goal through the new consensus we have forged on development assistance. At its core, this new approach is about taking care of people. It links environmental stewardship, economic growth, and social development in order to lift people out of poverty. After all, it's impossible for citizens to focus on protecting their environment when they are hungry or sick, or their daily life is punctuated by violence and corruption.

Partnership among governments, the private sector, and non-governmental organizations is the watchword of this new strategy. Through such partnerships we can increase citizen involvement, promote the use of cutting-edge science and technology, welcome entrepreneurship, encourage trade and protect the environment.

President Bush has committed an unprecedented level of new resources to carry out this strategy. Last year, he called for a \$5-billion increase over three years in U.S. development

assistance to poor countries. And the President is on track to meet his \$15 billion, five-year commitment to fight the global pandemics of HIV/AIDS, TB and malaria.

This outlay from the American people represents the largest international assistance package for the developing world in U.S. history. It is in the spirit of President Truman's Marshall Plan and President Kennedy's Alliance for Progress. And it will leverage a great deal more in private investment from other countries.

What does this mean on a human scale? It means putting clean water in the mouths of thirsty boys and girls; it means preserving the biodiversity of a fragile African ecosystem; it means preventing the transmission of a deadly disease from mother to child.

Congo Basin Forest Partnership

Let me give you an example of this new approach in the area of forest conservation. Together with some 29 governments, international organizations, business and environmental groups, we've formed the Congo Basin Forest Partnership. It aims to establish national networks of protected areas across central Africa in order to safeguard one of the two largest intact tropical forests. At the same time, it offers local people a stake in the forest by promoting sustainable harvesting and providing livelihoods such as ecotourism.

Driving forces in this partnership are the six Congo Basin countries that have courageously bet their future well-being on the benefits of forest conservation. These nations see a future based on enjoying, not exploiting, nature.

The United States will contribute \$53 million over four years to create the training programs, infrastructure, and management and enforcement regimes necessary to make the vision of a system of protected areas a success. In total, we have the potential of developing as many as 27 national parks and protecting more than 10 million hectares—an area about the size of the Swedish county of Norrbotten.

This is just one of dozens of partnerships that the U.S. has forged to expand the circle of development and create a more hopeful and secure world for all of us.

President's Initiative Against Illegal Logging

The Congo Basin Forest Partnership is also a powerful mechanism for stemming the take of bushmeat and advancing the fight against illegal logging. Illegal logging destroys ecosystems and threatens protected areas worldwide with an economic cost to the tune of \$10-\$15 billion annually.

That is why President Bush launched a new initiative to help developing countries reduce threats from illegal logging in protected areas. Through the initiative, we are working with other governments and NGOs to improve forest law enforcement in Africa, protect orangutan habitat in Indonesia, monitor forests in Brazil with remote sensing, and many other actions.

Debt-for-Nature Swap

We are also engaged in forest conservation through debt-for nature swaps. These innovative agreements allow developing nations to simultaneously reduce their debt to the United States government and protect valuable tropical forests. For instance, an agreement with Peru will enable the preservation of more than 12.5 million hectares of rain forest-habitat for rare species like scarlet macaws, jaguars, and pink river dolphins.

Oceans

Of course, with one of the longest coastlines in the world, oceans policy is another critical piece of the U.S. approach to environmental protection.

Presently, we are working to join Sweden and 144 other nations as a party to the Law of the Sea Convention. This treaty has proved enormously successful in promoting better management of the ocean's vast resources. And it will be an increasingly critical environmental protection tool as technology opens new ways to tap the ocean's riches.

One of the most valuable ocean resources to the economies of Sweden and the U.S. is fish. Yet we face a world in which the fishing capacity of the fleets has outpaced the reproductive capacity of the fish stocks. A world in which a growing number of fishing vessels do not abide by agreed rules. A world in which there are serious concerns about the effects of fishing operations on other marine life.

We are pioneering new techniques to crackdown on illegal fishing worldwide. For example, one innovative approach uses trade to deter illegal fishing and, by extension, protect our ocean resources.

Even when fishermen play by the rules, however, their operations can threaten the marine ecosystem. Every year, an estimated 27 million tons of fish, marine mammals, sharks, sea turtles, and seabirds are unintentionally swept up in fishing nets or accidentally hooked in longline fishing operations and thrown back dead into the ocean.

In many cases, however, a simple solution can be found. Take the case of sea turtles, which often become entangled in shrimp trawl nets and drown. Because of this threat and others, all species of sea turtles are endangered. In 1989, we required U.S. shrimpers to use turtle protection devices in their shrimping nets. These devices are basically trap doors sewn into the end of a shrimp net allowing sea turtles to escape while retaining nearly all the shrimp. They can be fitted to nets for between \$50 and \$400 each, and have been proven 97% effective in protecting sea turtles. In addition to requiring U.S. shrimpers to use these devices, the U.S. also banned the importation of shrimp harvested in ways that harm sea turtles.

Climate

Now, I know some of you are wondering, "That's all good, but what about global climate change?" I want to take just a few moments to discuss this topic, which is of great concern to the people of Europe and the United States. I do not wish to rehash our disagreements over the Kyoto Protocol. Instead, I'd like to explain the key features of the U.S. policy on climate change.

We remain active in the U.N. Framework Convention on Climate Change and support its ultimate goal: the stabilization of greenhouse gas concentrations at a level that will prevent dangerous human interference with the climate. In addition, the United States has cemented 13 formal bilateral relationships with both developed and developing countries to address climate change. Together with the U.S., these countries account for more than 70% of greenhouse gas emissions.

What's more, the U.S. spends \$1.7 billion annually on climate science and related research – more than the rest of the world combined. In the near term, we are putting in place a series of measures to reduce greenhouse gas emissions, using tax incentives to promote the use of renewable energy and energy-efficient technologies. We have requested more than \$370 million in 2005 for energy research, development and deployment, and over half a billion dollars to promote energy efficiency.

Looking at the long-term, we are investing in transformational technologies that will revolutionize how the world produces and consumes energy.

Last year, we launched the Carbon Sequestration Leadership Forum—an effort to develop technologies to separate and store carbon dioxide from burning coal before it enters the atmosphere. In tandem with this, the U.S. is also sponsoring a \$1 billion, 10-year demonstration project to create the world's first coal-based, zero-emissions power plant known as FutureGen.

Over the next five years, the United States has pledged \$1.7 billion to develop clean, hydrogen-powered automobiles. With this new national commitment, we are hopeful that the first car driven by a child born today could be powered by hydrogen, and pollution-free. With regard to nuclear energy, earlier this year President Bush announced that the United States would rejoin the International Thermonuclear Experimental Reactor. ITER—as it is known, aims to develop nuclear fusion as an energy source by mid-century. While it remains a great challenge, if our efforts are successful, fusion – the energy of the sun and stars – can provide an abundant source of emission-free energy.

Finally, we are delighted that Sweden has joined with the U.S. and 28 other U.S. in developing an international, comprehensive, integrated and sustained earth observation system. This system will be a pivotal element in understanding climate change and working to combat it.

In closing, to answer the question posed in the title of my speech, Is Uncle Sam an environmentalist? I believe he is. Of course our countries will differ from time to time on how best to preserve this great blue orb entrusted to our care. But let us move past these differences and take action in the areas where we do agree.

As we tackle these challenges, we should keep in mind the words of the great American naturalist John Muir. He said of the environment, “We all dwell in a house of one room.” Muir’s remarks remind us that we truly are global neighbors; that we share one planet. Let us come together as a global family to protect our precious shared resource. Thank you.”

U.S. Department of State’s Bureau of International Information Programs.

[US, 2004 #404] <http://usinfo.state.gov/gi/Archive/2004/Mar/08-169243.html>

Appendix B-10 NBC Nightly News June 8, 2005

NBC Nightly news reported that a U.S. official edited warming, emission link-report
WASHINGTON (Reuters) - A White House official who previously worked for the American Petroleum Institute has repeatedly edited government climate reports in a way that downplays links between greenhouse gas emissions and global warming, The New York Times reported on Wednesday June 8, 2005.

In a memo sent last week to top officials dealing with climate change at a dozen agencies, Piltz charged that "politicization by the White House" was undermining the credibility and integrity of the science program.

http://news.yahoo.com/news?tmpl=story&u=/nm/20050608/sc_nm/environment_climate_dc_8

Appendix B-11 The U.S. Global Change Research Program (USGCRP)

"The Global Change Education Resource Guide is a multi-media set of materials which includes a scientific overview of global change, fact sheets, published articles, teacher developed classroom activities and a resource bibliography. Topics include natural variability, greenhouse effect, sea level rise, ozone depletion, ecosystem response and decision-making under scientific uncertainty. 26,500 sets of materials were distributed nationwide through the informal global change educator network; the GLOBE (Global Learning and Observations to Benefit the Environment) program, the JASON project, the National Science Teachers Association and internationally through the Department of State overseas posts and the Peace Corps. The Resource Guide was developed and supported by the National Oceanic and Atmospheric Administration and the multi-media guide was produced and distributed by the U.S. Department of Agriculture, National Aeronautics and Space Administration, the Department of Energy, the Department of Defense, Department of State and the U.S. Environmental Protection Agency. (Mortensen in Wheeler p.23)

For the 25th anniversary of Earth Day in April of 1995, the USGCRP produced a highly successful three-hour live videoconference, broadcast nation-wide from Washington, D.C. The program was entitled "A Gathering for the Earth" and featured Native Elders in a round table discussion, live performances from the Ellipse in front of the White House, success stories of sustainable practices in communities and businesses, and students in Moscow and D.C. interviewing the astronaut and cosmonauts aboard the MIR Space Station. Over 1500 known down link sites participated in the program, with interactive call-in question and answer periods. Participants represented school systems, museums, colleges, libraries, communities, and businesses. The videotape of the program was reproduced and provided for subsequent educational use to all down link sites."

Appendix B-12 The National Environmental Education & Training Foundation (NEETF)

Environmental education (EE) is linked to many of society's core goals such as: better health, improved education, environmentally sound and profitable business, and volunteerism in local communities. Each of their programs also focuses on the needs of under-resourced people in American society.

Their Mission: A stronger future through environmental learning-Improved health, education, business, and ecological protection through innovative environmental learning. Their Goals: EE in Our Schools: Core environmental literacy for America's children while improving their overall academic success. EE for the Adult Public: Baseline environmental knowledge for America's adults to increase individual stewardship. EE for Health Professionals: A stronger public health safety net through environmentally educated health care givers. EE for Business Managers: Training and information for a critical mass of environmentally effective and responsible business managers.

Their Work: Research and Fact-finding on public and professional environmental literacy. Signature Programs including: GreenBiz.Com, The EnvironMentors Project, National Public Lands Day, the NEETF/Roper Report Card, our TV Weather and Environment program, our Health and Environment initiative and others. Policy Development such as working with agencies and other governmental leaders to create more effective public environmental education programs. Leverage - The Foundation receives a modest annual appropriation through the National Environmental Education Act which it leverages into some \$15 million to \$18 million in grants and contributed program support-a 25-to-one return on Congressional investment.

The Foundation is overseen by a combination of leaders in education, business, and the non-governmental and governmental sectors. They work in partnership with many leading organizations in the field.

More than ever before, the United States is deeply engaged with the world community in fighting environmental degradation in the developing world. We are achieving this goal through the new consensus we have forged on development assistance. At its core, this new approach is about taking care of people. It links environmental stewardship, economic growth, and social development in order to lift people out of poverty. After all, it's impossible for citizens to focus on protecting their environment when they are hungry or sick, or their daily life is punctuated by violence and corruption.

Appendix B-13 Florida Statutes on Environmental Education

The Florida Legislature in 1989, mandated that the public school system, kindergarten-university, act as the primary delivery system to create environmentally literate citizens. The law reads:

"The legislature further recognizes that the education of the people in this state is critical to maintaining the delicate relationships among all forms of life and their environments. It is the intent of the legislature that the public schools, community colleges and state universities serve as the primary delivery system to create a continuing awareness of the essential mission to preserve the earth's capability to sustain life in the most healthful, enjoyable and productive environment possible. (Florida Statute, SS229.8005, sec. 30, para. 2, 1989.

In 2002, the Florida Legislature passed law 372.674 pertaining to Environmental Education. The 2002 Florida Statutes Title XXVIII NATURAL RESOURCES; CONSERVATION, RECLAMATION, AND USE Chapter 372 WILDLIFE states:

The Fish and Wildlife Conservation Commission may establish programs and activities to develop and distribute environmental education materials that will assist the public in understanding and appreciating Florida's environment and problems and issues facing our state's unique and fragile ecological systems. Such programs shall assist schoolteachers, state administrators, and others in the essential mission to preserve the capability to sustain the functions of our lands, water, wildlife habitats, and other natural resources in the most healthful, enjoyable, and productive manner. ("Florida Natural Resources; Conservation, Reclamation, and Use Act," 2002 Title XXVIII)

Appendix B-14 The Florida Department of Environmental Protection

The department administers regulatory programs and issues permits for air, water and waste management. It oversees the State's land and water conservation program, Florida Forever, and manages the nationally award-winning Florida Park Service. The department is the main architect of the \$7.8 billion funding and management plan to restore America's Everglades – the largest water restoration project in the history of the world.

In 1993, the Florida Legislature merged the Department of Environmental Regulation with the Department of Natural Resources to form the Department of Environmental Protection.

The Florida Department of Environmental Protection is one of fifteen state government agencies under the executive branch of the Governor. The agency has 3000 full-time employees working in its capital offices, two state-of-the-art laboratories and six regional offices.

An annotated list of books related to nature and the environment for readers in elementary school and to some extent middle school was compiled by Kathy Putnam and users of the EE-Link Web site.

Appendix B-15 TV Channel 10 (local) News Website

Pertaining to Everglades National Park. It states:

Water in South Florida once flowed freely from the Kissimmee River to Lake Okeechobee and southward over low-lying lands to the estuaries of Biscayne Bay, the Ten Thousand Islands, and Florida Bay. This shallow, slow-moving sheet of water covered almost 11,000 square miles, creating a mosaic of ponds, sloughs, sawgrass marshes, hardwood hammock, and forested uplands. For thousands of years this intricate system evolved into a finely balanced ecosystem that formed the biological infrastructure for the southern half of the state.

Early colonial settlers and land developers viewed the Everglades as a worthless swamp in need of reclamation. The dream of draining the swampland took hold in the first half of the 1800s. By the 1880s developers started digging drainage canals, which took place without an understanding of the dynamics of the ecosystem and were generally inadequate for the task. They caused localized silting problems, but overall the ecosystem was resilient enough to sustain itself.

The notion of draining the vast wetland persisted. Expanded dredging efforts between 1905 and 1910 transformed large tracts from wetland to agricultural land. This abundance of “new” land stimulated the first of several South Florida land booms. Railroads constructed by entrepreneurs like Henry B. Plant and Henry M. Flagler made the region more accessible and attractive to tourists. By the 1920s visitors and new residents flocked to blossoming towns like Fort Lauderdale, Miami, and Fort Myers. As they arrived, developers cut more canals and built new roads. To ensure good ocean views, they removed mangroves from the shorelines and replaced them with palm trees. Little by little canals, roads, and buildings displaced native habitats.

The year 1948 marked an even greater change when Congress authorized the Central and South Florida Project. This involved the construction of an elaborate system of roads, canals, levees, and water-control structures stretching throughout South Florida. Constructed by the Army Corps of Engineers, and sponsored by the Central and Southern Flood Control District (later redesignated the South Florida Water Management District), the project purposes were to provide water and flood protection for urban and agricultural lands, a water supply for Everglades National Park, the preservation of fish and wildlife habitat, facilitate navigation and recreation, and the prevention of salt water intrusion. While the project still provides many of the intended benefits, the alteration of regional wetland areas, estuaries, and bays — combined with increasing population pressures and changing land uses — has significantly degraded the natural system.

Today 50 percent of South Florida’s original wetland areas no longer exist. The numbers of wading birds, such as egrets, herons, and ibises, have been reduced by 90 percent. Entire populations of animals, including the manatee, the Cape Sable seaside sparrow, the Miami blackheaded snake, the wood stork, and the Florida panther, are at risk of disappearing. Exotic pest plants such as melaleuca, Brazilian pepper, and Australian pine have invaded natural areas, choking out native plants and altering habitats. Massive die-offs of seagrass beds in Florida Bay have been followed by the extensive losses of wading birds, fish, shrimp, sponges, and mangroves. These grim indicators warn of a system under assault and in jeopardy of collapse.

<http://www.local10.com/downtoearth/2336268/detail.html>

Appendix B-16 Project Learning Tree

From their start, Project Learning Tree (PLT) has been on the leading edge of educational reform, while building on tried-and-true principles of learning and teaching. PLT began in 1976 when natural resource managers and educators from the American Forest Institute (now the American Forest Foundation) and Western Regional Environmental Education Council (now the Council of Environmental Education) formed a partnership to develop an unbiased, educationally sound program for elementary and secondary students and their teachers.

The partners designed PLT to be shared through trained facilitators (educators, resource managers, or other interested people) who in turn, train others in how to most effectively and efficiently use the curriculum and materials.

The first workshops were held in 13 states that made up the Western Regional Environmental Education Council.

PLT went international in the 1980s. Canada was the second country to join the PLT community. Now, educators in Canada, the U.S. Territories, Japan, Mexico, Sweden, Slovakia, China, Finland, Brazil, Jordan, and the Philippines use PLT. Materials have been translated and adapted for use in these countries.

The PLT network got stronger in 1987, when the first International PLT Coordinator's Conference was held. By the end of the 1980s, PLT had reached 49 states.

In 1990, PLT launched a major, multi-year revision of the curriculum. More than 300 people participated in regional writing workshops and revision sessions to revamp the elementary and secondary curriculum. Another 300 educators participated in the pilot test, field test and formal evaluation of the materials. In 1993, the new PreK-8 curriculum was released. Every year the guide is reprinted to meet demand and to provide opportunities for updates and revisions. The guide is now in its 11th edition. In 1993, Green Works was launched. This service-learning and community action program assists educators and students, with developing action plans to improve their neighborhood environment through partnerships and grants. To better address teachers and students at the secondary level, PLT created stand-alone modules on such topics as forest ecology, solid waste, and risk. The first module appeared in 1995. PLT in the City began in 1995 as a targeted way to involve urban educators and students in environmental education. PLT is used in many cities across the country with special PLT in the City initiatives in New Orleans, Houston, Richmond, Atlanta, and Washington, D.C.

Appendix B-17

Roper Starch Worldwide (1994)

The National Environmental Education and Training Foundation (NEETF) was chartered by the US Congress in 1990 to serve as the link between the public and private sectors to facilitate partnerships in support of environmental education. The NEETF commissioned a survey on environmental attitudes and behaviors of disadvantaged youth in America to identify the critical gaps in environmental education so that their resources, among others, can be more effectively targeted to filling in those gaps.[Roper, 1994 #303] Their goal was to create an environmentally literate workforce and citizenry that will take personal and professional action to prevent pollution before it occurs. Phase 1 consisted of qualitative research among students from disadvantaged areas through nine focus groups in three cities--New York, Los Angeles and Chicago. Phase 2 was a nationwide quantitative survey of 982 students in grades 4 through 12. This phase allowed comparison by gender, grade, and religion. Phase 3 consisted of an in-depth quantitative survey based on 2,139 interviews among students from disadvantaged areas.

Pollution, and other problems that threaten neighborhoods and the nation were often seen by young people today as affecting everyday life. Air pollution, litter and damage to the ozone layer were problems most often named as personally affecting students every day. There were several key differences between disadvantaged and non-disadvantaged students. Those from disadvantaged areas were significantly more likely to report that shortages of good drinking water (45% vs. 33% of non-disadvantaged students), lead poisoning from water and paint (32% vs. 21%) and pollution from toxic dump sites (28% vs. 18%) affected them every day.

An especially encouraging result of the research is the high level of interest young people expressed in wanting to work for a better natural environment. Two-thirds of students from both disadvantaged and non-disadvantaged areas said they would be either very or somewhat interested in working with others or joining a group or club to benefit the environment. Tapping the zeal of those young people interested in working for the environment is key for the future of the environmental movement. Of a list of 15 specific activities to promote interest and increase participation in the environment, the most promising was going camping or hiking/spending more time closer to nature and winning coupons for things in exchange for cleaning up litter or recycling.

Young people were asked which of 19 issues they see as one of the most serious environmental problems. Those issues, which may be considered health problems, include damage to the ozone layer, air pollution and shortages of good drinking water, pollution from toxic dumpsites and global warming. Pollution of water from fertilizers and pesticides used in farming and lead poisoning from water or old paint also relate to human health.

Several other problems were more ecological in nature. These included destruction of the rainforest, pollution of lakes, rivers, streams, polluted ocean waters and unsafe beaches. Other ecological problems were endangered animals, plants, insects and damage to the environment from mining/cutting trees, destruction or filling in of wetlands and acid rain. Five other problems included not enough open areas, not enough landfill space for trash, littering of trash and garbage, too little recycling and not enough energy. Not all students were equally involved in practicing environment-friendly activities at home. Students from disadvantaged areas were significantly less likely than students from non-disadvantaged areas to engage in activities relating to litter and recycling. Among students from disadvantaged areas, more girls than boys said they and their family try to save energy, try to save water, cut down on littering, pick up litter and buy recycled products. Over seven in ten students from disadvantaged and non-disadvantaged areas said they learned about the environment from TV news and TV nature programs. [Roper, 1994 #303]

Students from disadvantaged areas were significantly more likely to be very worried about a variety of issues facing the nation today, but not when it came to the harming of the natural environment. The issues of greater concern to students from disadvantaged areas were more local and immediate in nature, whereas those generally of greater concern to students from non-disadvantaged areas were on a less immediate, perhaps more future scale. When asked how much young people felt they were learning about the environment in school, students from disadvantaged areas were significantly more likely than those from

non-disadvantaged areas to report learning either a lot or a fair amount on the subject (48% vs. 38%). There was a clear correlation between the amount of learning in school reported by these students, and their self-reported knowledge about the environment, which also correlated with concern about and involvement with the environment. This may be an important result to focus on, an indication that school is evidently an effective way to reach, educate and motivate students from the disadvantaged areas to work for the environment. However, this process should start early in school, as the survey suggested that learning about the environment in school decreased markedly with schooling.

Girls from disadvantaged areas exhibited higher levels of concern than did boys on most issues, a trend seen often in the data. For example, 79% of girls were very worried about AIDS, compared to 65% of boys. Far fewer boys from disadvantaged areas than girls said they were very worried about kidnapping (47% vs. 69%), guns (48% vs. 60%) or crime in the neighborhood (45% vs. 55%). [Roper, 1994 #303]

Appendix C-1 Email from professors at UF re an environmental survey

Hi Arlene,

The only scales I'm aware of for elementary-aged students are the CATES (Children's Attitudes Toward the Environment Scale) and the CHEAKS (Children's Environmental Attitudes and Knowledge Scale). Both have fairly high reliability and can be found in the Journal of EE (CATES is v25, n3, Spring 1994; CHEAKS is v26, n3, Spring 1995). You might want to check in an instrument database, Compendium of Assessment and Research Tools for Measuring Education and Youth Development Outcomes. Their website is <http://cart.rmcdenver.com>

I hope this is helpful!

Julie

From: "Martha C. Monroe" <mcmonroe@ufl.edu>

To: Aaateach@aol.com

CC: jeaston@ufl.edu, jathman@ufl.edu, jrcu@gnv.ifas.ufl.edu

Subject: Re: environmental surveys

Date: Thu, 07 Feb 2002 11:42:04 -0500

Hi Arlene -

Thanks for sending an email -- I was about ready to call you, but this is probably easier. Unfortunately, I'm not familiar with any standardized, validated survey for children 7-12 years to measure environmental knowledge and attitudes. There have been some attempts at such a thing (a Children's Environmental Values Scale, published in Journal of Environmental Education) and you may find some of these things helpful, but I think these are very difficult concepts to measure in youngsters. I'm going to cc some other folks I work with to see if they have any suggestions of tools you can use.

Yep - I work in that building you saw on campus!

Good luck in your laudable efforts! I think it is always important to get a handle on what our learners are picking up from our teaching.

Take care,

Martha

Martha C. Monroe, Assistant Professor/Extension Specialist
School of Forest Resources and Conservation, University of Florida
PO Box 110410, Gainesville FL 32611-0410

At 09:05 AM 2/7/2002 EST, you wrote:

Hi,

I am a National Board Certified Teacher in Miami-Dade County, Florida and I would like to survey the children in my elementary school to see what they know about environmental education, their attitudes about the environment and what would make them try to help the environment.

I called Heather at Audubon Society in Miami. She said she had taken a class about writing a survey from you at Pine Jog. She suggested I contact you. I know the State of Wisconsin has a survey that is reliable for older students. Can you help me obtain one for my 7-12 year olds that has reliability?

My own two adult children are Gator alumni and I saw the School of Forestry in Gainesville a few years ago. I assume this is where you teach.

Thanks for your help.

You can reach me at

305-xxxxxx at home,

305-931-1770 Gifted Department at school, Virginia A. Boone Highland Oaks Elementary
954-xxxxxx my cell phone Arlene Amarant

Appendix C-2 Email from Dr. Leeming re CHEAKS

(Scan in)

Subj: **Re: Children's Environmental**
Date: Friday, March 22, 2002 9:06:46 AM
From: frank-leeming@mail.psyc.memphis.edu
To: Aaateach@aol.com

Hi Arlene,

You certainly do have my permission to use the CHEAKS.

Good luck with your research.

Frank Leeming

At 06:23 PM 3/21/2002 -0500, you wrote:
>Dear Dr. Leeming,
>May I have your permission to use "Children's Environmental Attitude and
>Knowledge Scale" to survey the students at my school? I will be surveying
>the students and parents, interviewing them and collecting data for my
>thesis. You will get due credit. Your survey is wonderful. Thanks. (see my
>attachment)
>
>
>Arlene Amarant 305-931-1770 X139

Frank C. Leeming, Ph. D.
Department of Psychology
The University of Memphis
Memphis, TN 38152

Phone: (901) 678-2260
Fax: (901) 678-2579

Hi Arlene,

Appendix C-3

Miami-Dade County Public Schools APPLICANT IDENTIFICATION FORM Research Review Committee

Instructions: Submit one copy.

Title of research project: An Investigation into the Environmental Knowledge, Attitudes, and Behavioral Intentions of Elementary School Students

Request number (MDCOS use only):

Name of applicant: Arlene Amarant

Business address: Virginia A. Boone Highland Oaks Elementary School
20500 N.E. 24th Avenue
Miami, Florida 33180

Home address: Arlene Amarant
20425 N.E. 10th Court
Miami, Florida 33179

Business phone: 305-931-1770 x139

FAX number:

Home phone:

Miami-Dade County Public Schools RESEARCH REVIEW FORM Research Review Committee

Instructions: Submit six copies of this form and six copies of the Prospectus.

1. Title of research project: An Investigation into the Environmental Knowledge, Attitudes, and Behavioral Intentions of Elementary School Students
2. Reason the project is being conducted: To gather information for my thesis.
3. Name of university with which applicant is affiliated: Curtin University, Perth, Australia/Miami
4. Name, title and signature of the student advisor certifying that the Prospectus is acceptable: Not applicable (already approved by Dr. David Treagust, Professor/Advisor Curtin University)
5. Anticipated starting date: March 25, 2002
6. Anticipated completion date: June 12, 2003

7. General purpose of research: To find out what elementary students know about the environment, what are their attitudes towards helping the environment and what have they actually done to help the environment.
8. The primary questions to be addressed by the research are: Are elementary students aware and sensitive to the total environment and its allied problems? What are their attitudes of concern for the environment and their motivation for actively participating in its protection and improvement? Do they feel a sense of responsibility and urgency regarding environmental problems to ensure appropriate action to solve these problems?
9. List the sources of data that are not dependent on school/district records. I will survey elementary school students to find out their knowledge, attitudes and actions. (See Children's Environmental Attitudes and Knowledge Scale (CHEAKS) attached.) I will interview students, also.
10. List the sources of data that are dependent on school/district records: academic grades, FCAT scores in Reading, Math, and Science.
11. Indicate the number of participants and/or subjects in the research. Students grade 4=180; students grade 5=125. Teachers grade 4=6; teachers grade 5=5. Principal=1. Parents=30
12. School level targeted by the research = elementary school
13. Estimate the amount of time the research project will require of each type of participant. Students grade 4=2 hours, students grade 5=2 hours. Teachers grade 4=1 hour, teachers grade 5=1 hour. Principal=1 hour. Parents=1 hour
14. Expected value of the research to education: Promote environmental awareness and engage students in thinking about their responsibility to protect the environment for everyone's future.
15. Expected value of the research to the Miami-Dade County Public Schools: This project will increase the environmental awareness of students, teachers and parents in our school.
16. Is the applicant available to appear before the Research Review Committee? Yes
17. Beginning with the Prospectus, list the titles of all the enclosed documents
 - a. Prospectus
 - b. Parent Permission Form
 - c. Children's Environmental Attitude and Knowledge Scale (CHEAKS)
18. Indicate the anticipated date for submitting an abstract of the research findings to the Research Review Committee: October 2004

Appendix C-4 Permission Letter to Parents

Dear Parents/Guardians,

My name is Arlene Amarant and I am a teacher of science for Gifted Students at your child's school, Virginia A. Boone Highland Oaks Elementary. I am currently pursuing my doctorate in science education. My study explores what students know about the natural environment, what their attitudes are about saving the environment and what they have actually done to help.

There are questionnaires that your child will be given in school to fill out relating to the environment. This will take approximately 30 minutes in his/her class. An example of a question is "To save energy, I turn off lights at home when they are not in use." YES NO

In addition, 10 students and 10 parents will be asked to volunteer to participate in follow up interview about the questionnaire. Parents will be notified of dates and times of all interviews and may be present during student interviews.

Please be assured that all names will be kept strictly confidential and will not be included in the study. Additionally, please be assured that participation in this study is completely voluntary.

The importance of parents' involvement in their child's education is well documented. I hope you will consider participating in this study.

If you have any questions, please call me at 305-931-1770 x139.

Arlene Amarant

National Board Certified Teacher

Virginia A. Boone Highland Oaks Elementary School

Student's Name _____
Grade _____ Homeroom Teacher _____

_____ Yes, I give permission for my child to participate in this study.

Parent's Signature _____ Date _____

No, I do not give permission for my child to participate in this study.

Parent's Signature _____ Date _____

Yes, I would be happy to participate in an interview and/or a focus group. My phone number is _____.

Appendix C-5 Third Grader's Reflections About Science Class

AxxxGxxxx Science

Mrs. Amaran

May 28, 2002

What I learned in 3rd Grade Science and What my Favorite Part Was:

In the beginning of the year, we spent a lot of time doing experiments. My favorite experiment was to see which item floated in a sink filled with water and which item sank. We used oranges, grapefruits, bananas and cans of coke and sprite. We also had a couple of recipes to make. Some things you could eat, like Challah, and others you could not, like play dough. We also had a fruit festival. I brought in pomegranates for the class to try.

We did a lot of things on the internet – first we learned about the Jason project and when we took our first field trip to the IGFA, we had a live remote with the people doing the actual Jason experiments. I learned about Dr. Ballard and the Jason story. The IGFA was a cool place and I loved the virtual fishing and all the live animals.

We also spend time learning about the solar system and the sun. We learned about different planets, spacestations and the Comet Shoemaker-Levy 9. We also studied about the Kennedy Space Center, gravity (we did an experiment that Galileo did at the Leaning Tower of Pisa), orbiting and the North and South Poles. I learned why North America has daylight savings and other places don't.

Some other topics that we covered were about erosion, natural resources and our environment. Our class went to the Explorable Portable and did experiments. We looked through microscopes at algae and drew pictures of what they looked like. We also made a magnet with a needle in a cup filled with water. Mine worked for about 2 weeks – until the water turned brown from the needle rusting.

We also learned about the human body. We studied genes – why people have blue eyes or brown eyes. And we learned about traits – if they are learned or if people are born with them.

One of the funniest papers that I wrote was, "My Life as a Vegetable." I was romaine lettuce and then I planted this kind of lettuce in Mrs. Amaran's garden. It actually grew pretty well. But, the thing that grew the best was some old potatoes where the "eyes" had sprouted. They grew the best!

We discussed the life cycle of frogs and butterflies and talked about migration and metamorphosis. We did another internet project on the Pantanal Expedition in Brazil. But, my favorite part of Science class was the Mast Academy field trip. The solar celebration was great and I like the classroom where we saw all kinds of fish in jars.

It's been a great year and I learned a lot of different things.

Have a great summer!

**Appendix C-7 Videotaped and Transcribed Interviews of 4th Grade Students
Qualitative--Interviews with children 2002** Based on the Children's Environmental
Attitude and Knowledge Scale

Key:

Respondents

Grade	4	5							
Partnership	A	B	C	D	E	F	G	H	I
Class	Regular		Gifted						
Gender	Female		Male						

(Verbal Commitment)

1. I would be willing to stop buying some products to save animal's lives.

- a. very true b. mostly true c. not sure d. mostly false f. very false

1,A,4,G,F "I put very true because I love animals."

2,A,4,G,F "I put very false, but like my partner, I'm the same, because I know I love animals and I would do that" (She realized that she didn't understand the question when she answered it on the written survey and immediately changed her response when she heard her partner read her answer.)

(Interviewer asked for an example of what product student would be willing to stop buying)

1,A,4,G,F "You know when they use certain things like sunscreens and it says they test it on animals, that can be really bad because you don't know what it can do to the animals. So that's why I would stop buying some sunscreen they tested on animals or eye products or something like that."

2,A,4,G,F "People stop buying fur coats, and they (the producers) wouldn't do it any more because they wouldn't make any money." (Student knew a little about economics--supply and demand).

2. I would **not** be willing to save energy by using less air conditioning.

- a. very true b. mostly true c. not sure d. mostly false e. very false

2,A,4,G,F

" I said 'not sure' because the air conditioning...like sometimes I get sick because I have asthma and sometimes I need the air conditioning because sometimes I get (pause to think of the word) claustrophobic and I need the air, no matter what." (medical reason to use energy)

1,A,4,G,F

"I put mostly false because I also was thinking I get asthma and my mom does, too, and we get allergies a lot, and stuff, because of the 3 cats in the house and we have an inhaler. So that's why I usually have the air conditioning on. But if I didn't have asthma and stuff and I wasn't sick, I'd put very false because I'd want to save the energy. I love cats even though I'm allergic to them and still have them. Maybe when I'm sleeping, my mom turns the air off to save energy." (medical reason to use energy) (Child thinks parent saves energy)

3. To save water, I would be willing to use less water when I bathe.

- a. very true b. mostly true c. not sure d. mostly false e. very false

2,A,4,G,F

"I said very true. Because we're not the only people in the world, other people need it too, and so do animals. (a world view) And plus if we didn't have the water, like the ocean and the water (didn't know to call it 'fresh' water'-vocabulary) gives us oxygen (Child has a misconception) that would be like taking away energy and oxygen from the world."

1,A,4,G,F

"I would say very true, like you, because sometimes when people brush their teeth they leave the water on which uses up gallons and gallons of water. Some ways you can save water are like if you stick a log inside a toilet when you flush it, you can save about a gallon of water. You should take a bath when you bathe because baths use up less water because it's not constantly running when you shower so yes, I would be willing to use less water when I bathe." (Child had some prior education about water conservation.)

4. I would **not** give \$15 of my own money to help the environment.

- a. very true b. mostly true c. not sure d. mostly false e. very false

2,A,4,G,F

"I would be willing to give \$15 out of all of the money in the world, so that nothing bad would happen to the environment"

1,A,4,G,F

"I put very false, because okay, people know me and my reputation is like 'animals" (lover) 'animals, animals and the environment'. Like there could be a little cockroach in math class and everybody goes crazy over it and they say 'Oh, my gosh, there's a cockroach,

let's kill it.' Well, the cockroach isn't saying, 'Oh, my gosh, there is a human, let's step on it and kill it.' (Personification of an insect, shows respect for living things.) Like \$15 could do a lot to help save the environment. So if one person gives them \$15 and then a bunch of people give them \$15, and that can really help the environment by saving the animals. And, you know, stuff like make campaigns and (partner answers 'clean up trash around the park) I would definitely give \$15 to help the environment.

5. I would be willing to ride the bus to more places in order to reduce air pollution.

- very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"I put 'C', not sure,(hesitation) but I would put 'A' because I would want to reduce air pollution because it's really important to us to have clean air and fresh air because whatever you can do (Child is analyzing and evaluating) to make more of that and to make air better, I think, yeah, you should ride it. If anything, ride the car (child doesn't understand that people riding their individual cars cause more air pollution than the same number of people riding just one bus.) but if you ride the bus to more places you can reduce more air pollution to our environment and our animals and all the living things in this world." (Child generalizes)

2,A,4,G,F

"I put mostly true because sometimes I need to ride the car places because I need to get there on time. But the bus, I would ride it, say twenty people ride the bus, at least, saying twenty times the pollution to the air and plus, like, once again, we need air to breathe and the animals and the plants. So that's why I would mostly ride the bus."

6. I would **not** be willing to separate my family's trash for recycling.

- very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"Actually I put very false because I think that recycling is very important to our environment and to recycle a bottle of water that's this small (Child shows size of bottle with hands) can even help a lot. Because if you throw it away, then you are cutting down trees and people cut down trees for the things they need. (Child is generalizing to a concept which is familiar. Child is not familiar with what makes plastic.)And if you just use it once and waste those things, then it's useless to cut them down so (Partner adds 'It's like getting rid of oxygen like with the newspapers). Exactly, my mom, she just took a big green box and she put all of her recycling in it. And then she'll wash it out and then we can use it again, like a bottle of water, we can refill it." (Child does not generalize to recycling products down to their basic materials and then reforming them, such as plastic soda bottles.)

2,A,4,G,F

"I put very false, like sometimes people just throw it away or something, sometimes people just throw it on the ground instead of even throwing it away, and that would take sometimes like a million years, 500 years or even 30 days, and that's a long time

sometimes, I mean a month. (The student knows that different things take different times to biodegrade. Officer Snook Program taught this to the students last year.) And then I mean, like (Student's partner intervenes, 'And so you're saying that you would want to separate your garbage.) Yeah."

7. I would give \$15 of my own money to help protect wild animals.

- very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"Definitely, yes, because I love animals. And wild animals, they're becoming extinct . Okay...(student is collecting her thoughts) people are cutting, people are killing them just to make fur coats. But I think the only reason you should kill animals is if you need to survive. Like if you're lost in a forest and you need to survive (Partner interjects, 'Like the Indians' (Student has the conception that Indians do not live in cities as the student does.) Yeah, like you need clothes, and food to eat, then definitely people will do anything to survive. But you just want to make money to give it to a store, I think that is really cruel, because I think people should learn that I don't think they would like it if people came over and cut all of their skin off and or shot them just to make money and hang them up as decorations. And you know I would never buy stuff like that so, yes, I would definitely give \$15 because \$15 is a lot for animals."

2,A,4,G,F

"I have the same answer, I would definitely give \$15 because animals are very important sometimes, and I mean and ...fur coats, just to buy something? Like, (Child playacts) 'Oh, this is really cool, it's made out of animal skin.' (Child shows sarcasm) I think that is really cruel. Like leather, (Child veers off the question of protecting wild animals, not domesticated ones used for making leather.) I would never buy leather boots or anything." (Misconception...child doesn't realize that many sneakers are made of leather and child wears them.)

1,A,4,G,F

"Yeah, on Animal Planet they have a show "Animals Attack" but they should change it around, people attack. More people attack animals than when animals attack people. Animals attack people to protect their babies and their environment because they don't know any better because they don't know what the people are going to do."

2,A,4,G,F

"Yes, they don't go to school like us or anything." (Partner agrees and says 'Exactly').

8. To save energy, I would be willing to use dimmer (less bright) light bulbs.

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"I put very true because the more energy you save, the more air you have, and the more air you have the more you have to live. And people want to live their lives happy and stuff so, I put very true because if anything, I mean, to use different light bulbs, would be

awesome because you're saving energy. Energy is very important to the whole environment and to the whole world. And it, and if, and if, (Child is thinking while talking) if it's only a few light bulbs well, it still helps a lot.

2,A,4,G,F

"I put mostly true because my dad can't see very well and he needs bright lights (Partner nods her head in agreement) But if I could I would put very true because we need more air for this world. 'Cause we're cutting down all these trees and that's very bad because that's most of our..well.. (Child hesitates and partner says, 'life') environment. And if we didn't have these trees we would be dead right now. (Partner says, 'No, we depend on them.)

9. To save water, I would be willing to turnoff the water while I wash my hands. .

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"I put very true because I already do that. And just because, (pause) okay there is only two people living in my house (Child looks straight at camera). But let's say that there is a family of five, a mom, a dad and (hesitation to count the number) three children. And if each one of those family members keeps the water on while they are brushing their (hesitation, thinking)...washing their hands, that could use up at least five gallons of water which is very bad. So, I think that, you know (child looks at survey question again) like, also when you're brushing your teeth turn off the water. Because you can save gallons of water. And in the future, when there is a drought, you'll probably say, 'Oh, my gosh, I should have turned the water off when I was washing my hands and brushing my teeth.'

2,A,4,G,F

"Well, I said very true, because first of all, I already do that, like you (do). But I mean, like, we get our water from the Everglades and it's the only Everglades in the world (Misconception...the water for Miami is pumped up from the Biscayne Aquifer which is between the Everglades and the coastal ridge.) and if we use that up, we've already destroyed half of it, and if that goes away (shaking her head from side to side) we have Okeechobee (Misconception..we don't get our water from that lake) (Partner says 'It's only 12 feet deep) but when that leaves, we won't know what to do. We won't have that much water (Child is concerned about a major problem in our community) and we'll have a drought again."

10. I would go from house to house to pass out environmental information.

- a. very true b. mostly true c.not sure d. mostly false e. very false

2,A,4,G,F

"Well I said I'm not sure. But of course I would go around to people (because I care about the environment) that I know, but to other places...who I'm not sure who lives there. I wouldn't want to do that because you never know who lives there. But, I mean to tell people about environmental information, it's very important because they can do something, like they can say 'Oh, I don't care

about the environment' but after you talk to them or something, maybe they can change their minds and do something about it.

1,A,4,G,F

Yeah, I put mostly true, as my partner said, I don't want to knock on a stranger's door, you know, kidnapping. But, yeah, like when Friends of the Everglades came and she gave us a packet, I read it to my mom and I went over it and stuff. If people don't want it, they'll throw it on the floor and then the ink goes into the aquifer from the paper. (Child is transferring knowledge about water and pollutants seeping down into the ground). And then when we pump back the water, we'll be drinking that ink. So, I would only give out environmental information to people that I know would be interested in saving the environment and stuff."

0. I would be willing to write letters asking people to reduce pollution.

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"I put very true because I think it's better writing letters than knocking on people's doors, you can go on web sites and stuff, and I went to the library and I got this book called *Kid Heroes*. It's about all these kids that helped save animals and reduce air pollution and they helped. That's why they are called Kid Heroes. They give you an address to write to. And I wrote a letter and they wrote me back telling me how grateful they were to have us tell them ways how to save the environment. So I was very happy after I received the letter back from them. And you can also make pen pals while you're doing this. So you can do two things at the same time...teach people ways to reduce air pollution and you can make friends at the same time."

2,A,4,G,F

"Well, I put not sure because like sometimes people write back nasty letters like if you send them a letter...like I would like to (write letters) sometime because I think the environment is really important and some people think 'Oh I don't care about the environment and who cares if it goes away'. But if it goes away, then we would be like...dead. Writing letters asking people to reduce pollution is very good. Because if we reduce pollution, then we'll have more air and, you know, so it's very good."

1. I would be willing to go from house to house asking people to recycle.

- a. very true b. mostly true c. not sure d. mostly false e. very false

2,A,4,G,F

"I put mostly true. But once again, I wouldn't go around asking strangers to recycle. And plus recycling...newspaper, we get that from trees. And if we recycled that maybe we could use that again and again and again instead of cutting down several trees. And how many newspapers go out in a day? That's like a lot. And some people don't even read the newspaper and they have it anyway. So that would be saving a lot."

1,A,4,G,F

"I put mostly true because as my partner said, I won't want to knock on people's doors that I don't know because of all the problems

going on. About recycling...as I said, I would only give it to people that would listen to me and recycle, like maybe family members. But I have my own little recycling bin in my room to put everything that I use in and when I'm done with a water bottle, I can refill it again. But you know how many people don't recycle in the world? (Child generalizes) That's a lot of people because there are about 6 point billion people in this world, and let's say, about 3 point billion don't recycle, probably more, that's a lot of trees wasted. I mean we cut down the trees to use the things, like water bottles and newspapers and then if we just throw them away, we're just killing the trees."

Actual Commitment

13. I have **not** written someone about a pollution problem.

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"I put very false because I've written many, many letters. I've written to all my family members and Kid Heroes and I've actually adopted a whale, in my second grade class. My whole class did. And we wrote to them, well they wrote to us first about polluting and everything, yeah and I wrote, we wrote back to them. And I even won a contest once in kindergarten at my other school so yeah, I have wrote, written."

2,A,4,G,F

"I said very true, but after the survey it made me think a lot more about it so I think I will, now. (Partner says 'That's very good')."

14. I have talked with my parents about how to help with environmental problems. a.
very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"I put mostly true because my mom works from nine to five and my dad is in Rhode Island with his band. So there's really no time, but when I get a chance, maybe on the weekends after I go to dance class. My mom sat down with me one day and she told me 'We're going to start recycling. And we're going to start doing this to help the environment. Like, (child's name) turn off the water when you are brushing your teeth and turn off the water and turn off the water when you are washing your hands.' So, that's what I think we should do."

2,A,4,G,F

"Well, I have talked with my parents about this and they said turn off the water, as you said. And we should start recycling, which we did. So many people don't recycle. I think we should start something, like a committee or something one day, but we haven't yet."

15. I turn off the water in the sink while I brush my teeth to conserve water.

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"I put very true because actually I do. I think it's very important. As I said before, there could be five family members in the house. And if each family member doesn't turn off the water when they are brushing their teeth. So that could use up five gallons of water each, that is really bad. So after I found all of that information out, I definitely started to turn off the water when I brush my teeth."

2,A,4,G,F

"I put the same thing because water is really, really important to everybody in the world because without water we wouldn't be here. Animals need it and every living thing needs it. If we waste it that is really, really bad."

16. To save energy, I turn off lights at home when they are not in use.

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

" I put very true because I do that already. People don't think about saving energy as much as they think about saving water, and animals and stuff. So people don't turn off the lights because people don't think about saving energy. No one really does. But then when I read the survey and figured out that energy is so important to this world and to us and to all the living creatures, yeah, I turn off the lights when they're not in use. Definitely."

2,A,4,G,F

"I definitely turn off the lights at home when they are not in use like sometimes when my dad starts to watch TV in the living room and he doesn't turn off the lights I say "Dad, you need to turn off the light." And when I talk to him about it, he now turns off the lights. Energy is really important to us. Turning off the lights is very important because we can save a lot of energy. (Misconception that lights are so expensive. ...The truth is that the cost of lights is minimal compared to the cost of air conditioning or heating.)

17. I have asked my parents not to buy products made from animal fur.

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"I haven't asked them because they don't because my mom, my dad, and I are animal lovers. People know me and I love animals. I would never buy anything that had to do with animals or animal fur. We need animals and we need plants. I would never buy leather, like a leather watch or anything."

2,A,4,G,F

" I said, I wouldn't have to ask my parents, like you (said) because my parents love animals. But they might look at it, and I'd say 'Mom don't buy that' but she said 'Don't worry, I'm not.' But if somebody else were looking at it (animal products) like my friends, I would say 'Why are you buying that? It's made from animal fur. Don't you love animals? And they say 'Like yeah, but it's really pretty.'

1,A,4,G,F

"Like in the movie called *Lifesize* this lady was wearing a big furry jacket and one person came up to her and said, 'You should love animals, not wear them.' That's a really good message that people all over the world should know."

18. I have asked my family to recycle some of the things we use.

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"I put very false, because I don't really have to ask them. I mean, my mom knows already what the causes are if you don't recycle and stuff. (Child means effects not causes.) It's very bad for the trees and animals. I don't really ask her but when my grandparents came from England, they weren't recycling that much, so I asked them and I talked to them about it. So yeah."

2,A,4,G,F

"I said not sure because usually she does recycle and my dad recycles too. But say they forget. Then I say 'Recycle that. They can use that over in many different ways. And when my grandma and my uncle are here they don't recycle at all. Like your grandparents don't. They just throw things away, like paper plates. I say, 'You can recycle that.' You can save say, whatever that is made out of.'

19. I have asked others what I can do to help reduce pollution.

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"Well, yeah. When I was little I didn't know what the causes were, so I asked a lot of people. So when I got older, I finally understood what the causes are (child means effects not causes) if you don't recycle. And so, yeah, I've asked people and I've told people and people have asked me.'

2,A,4,G,F

" I did ask others when I was younger, like you (did) I had no clue that it took a million years to make something disappear off the ground (Child does not realize that matter can be changed into energy) Now I ask other kids that I know, like 'What can you do to recycle? Do you know anything to do?' And I tell them what they can do to recycle."

20. I often read stories that are mostly about the environment

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"Definitely. When I buy books or check them out at the library, and it has to be a fable or something, I usually get one about animals or like *The Jungle Book* I once got. It's not true but it's about the environment and the animals. Some TV shows that I watch

sometimes in the morning are about, you know, saving the environment . But if it is nonfiction, then I usually get one about cats or the environment, But in our library, they don't have nonfiction books that are on my (reading) level about the environment so I usually take some about animals or vets (veterinarians) or something like that.."

2,A,4,G,F

"Whenever I can I try to read books about things that have to do with the environment, but when I can't find any, I usually check out animal books, because I love animals and I want to like find stuff that we could help with. Like say, they need something, and we're like killing that thing, well we could try to help that.(endangered species)"

21. I do **not** let a water faucet run when it is not necessary.

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"I put very true because water is very important to us because as I said a couple of questions before, in the future, when there is a big drought, and we have water limits on what we use, then we're going to say, 'I should have turned the faucet off when I brushed my teeth.' And even though people think it's only a little bit of water to wash your hands, every bit of water that you can save can count. And it helps a lot to the world and the environment. And so, I don't think it's necessary to leave it on. What's the point? If there are five family members and they each let the water run a gallon, they could waste five gallons or more by letting the water run about a minute."

2,A,4,G,F

"Well, I said very true because water... we have a limit of water in Florida. It's not like we have all the water in the world that we can have. (Partner says 'We only have one Everglades.') Yeah, and there is only one Everglades. I know we have a limit because we get our water from the Everglades and Lake Okeechobee. When that runs out we will have to get our water that takes away water from other places. (Misconception, Miami pumps its water up from the Biscayne Aquifer made of limestone rock.) (Partner says 'And Lake Okeechobee is only twelve feet deep and that's very shallow. And we use a lot of it.) (At this point, interviewer clears up the misconception that was mentioned two times and tells the students that Miami gets its water from the Biscayne Aquifer.) I think people pollute the aquifer. As we said before, ink gets in the aquifer and then we pump it back up. And we're drinking that water. We learned this from the Earthman Project last week and last year. (Interviewer asks students to try to remember what they learned about the environment in school in the last few years.) Our teacher last year taught us about the planets and stars in science. In second grade we did a lot of projects about animals. I don't really remember that far back. I do remember that one year one teacher had us write notes on how we could save water." (Children have very limited long term memory about environmental curriculum they were taught.)

22. I leave the refrigerator door open while I decide what to get out. a.
very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F "I put very false. I usually open the door, see what's in it and close the refrigerator. (Child is very specific and uses hand actions to remember order of her events.) Sometimes when we just go shopping and we put everything away, I kind of know what we just got. So I'll open the refrigerator door, know where everything is, and I'll just take it out."

2,A,4,G,F "Well, I don't leave the refrigerator door open. It's kind of saving energy sometimes, and then you waste energy. It's very important to the world. Usually I go shopping with my mom. So I know what we got. Usually I get something from the cabinet, not from the refrigerator."

23. I have put up a bird house near my home.

a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F "I put very true because when I lived in New York there were a lot of pigeons around in the summertime, so me and my mom built a birdhouse for all the birds to come eat seed. And also in the wintertime when there wasn't that much food, I put up a bird house. It was kind of made out of seed. So, yeah. I like to save animals. Because in the wintertime there is not that much food and water around, so I set up a little thing for all the birds."

2,A,4,G,F "I have in England, because I know there's a lot of pigeons there. Sometimes in the winter and sometimes in the summer I go there. And it's very cold there and there is not that much food, as she said. So I did make a birdhouse and I put seeds in it and every time I could go, I refilled it."

24. I do **not** separate things at home for recycling.

a. very true b. mostly true c. not sure d. mostly false e. very false

2,A,4,G,F "I said very false. Because I know we have. Paper, plastic and aluminum... boxes for everything. And whenever I can I check and see if it's all right. And if it's wrong, I put it in the right box so everything comes out right so nothing gets mixed up or anything. In Dade County we recycle aluminum, paper, plastic and glass."

1,A,4,G,F "I do separate things at home for recycling because I feel it is very important. And also, at my dance school, they have one garbage can that says 'trash only' and another garbage can for cans, and another garbage can for plastic and aluminum. A lot of times I see people in my neighborhood selling lemonade and stuff. They put it in the little Aquafina (water) bottles and they take off the sticker. One time I was in line because I wanted to get one, and one kid threw one on the ground. I picked it up and I put it in my recycling box. "

How do you really feel. (Affect)

25. I am frightened to think people don't care about the environment.

- a. very true b. mostly true c. not sure d. mostly false e. very false

2,A,4,G,F

"I put very true because, say, people say they don't care about the environment and, say, they throw all their stuff away and they don't recycle it and everything and one day they're going to say 'Oh I wish I had recycled that' because (maybe) there wouldn't be enough trees in the world maybe, one time, because we would waste all the newspaper. Because I know we recycle newspaper. We put it in a basket and then we recycle it."

1,A,4,G,F

"I put very true because when I know that people don't care about the environment and stuff, I know that they can do things (that are) bad, like kill animals for fur, and use up all the water and keep the faucet on. So, I am very frightened because people do things like that, like they keep the faucet on and then, sometimes in the future they're going to say, 'Oh, my gosh. What did we do?' (Child reflects on problem) (Partner says, 'We might not even do it but the other people cause it.) There are a lot of people in this world, and most people don't recycle, so yeah."

26. I get angry about the damage pollution does to the environment.

- a. very true b. mostly true c. not sure d. mostly false e. very false

2,A,4,G,F

"Well, I put very true, because when things damage the environment it hurts me because sometimes it can hurt the animals, too (Partner says, and other things.) Yeah, because people throw glass bottles on the ground, animals can step on it. Sometimes I cry because, I mean, I love animals and I don't want to see them get hurt. And when they pollute it hurts the plants (Child does not address the fact that air, water and soils can be affected which, in turn, affects plants and animals.)

(Interviewer asks children to discuss pollution caused by fossil fuels.)

1,A,4,G,F

I've heard of fossils and I've heard of fuel but I've never heard of fossil fuels. Fuels are like when you are running a car there is a little thing on the back (child means tailpipe). All the pollutants come out the back and that pollutes our air. And that's why, in the previous question before, it was about buses. A lot of people... there can fit about forty people on a bus. And if more people go in one bus, instead of two people in a car, then that can save a lot of energy and (there will be) less pollution to the environment.

(Interviewer asks if the children know anything about another fossil fuel, coal.)

2,A,4,G,F "Well, you can put coal in a chimney and it will burn. You can put it in a grill." (Misconception, child thinks charcoal is coal).

(Interviewer asks children if they know anything about natural gas.)

1,A,4,G,F "No, but I've heard about oil. How do people use fossil fuels? Do they pollute the air? (Interviewer explains about fossil fuels.)

27. It makes me happy when people recycle used bottles, cans, and paper.

a. very true b. mostly true c. not sure d. mostly false e. very false

2,A,4,G,F "I said very true, because when we reuse stuff, we won't just be throwing it away. Like trees, we need trees. And if we don't recycle them, that's very bad because if we recycle them we don't have to cut down more trees and more trees to get that newspaper."

1,A,4,G,F "I put very true because it makes me really happy when people recycle because knowing the causes (child means 'effects') of when people don't recycle, those are really bad causes (child means 'effects'). And then in the future, if something bad happens to our world, as I said in previous questions, we'll be saying 'I should have recycled this and I should have recycled that.' (Child's view is that people need to plan for the future.) Because people, (child means) like children, are the future. And when they don't recycle and stuff and they don't know anything about conserving water, or saving animals, that's really bad. So, I'm very happy when people recycle."

28. I get angry when I think about companies testing products on animals.

a. very true b. mostly true c. not sure d. mostly false e. very false

2,A,4,G,F "It makes me very angry, because, I mean, say it could be poisonous to the animal and that animal would die. You'd never know. I think it's kind of mean, to test things on animals. I mean, why don't they do some on humans?"

1,A,4,G,F "People know me, that I love animals. Once we watched a movie in science class. They were doing all these experiments on bats. And the bat came back and it had a switch in its head. And people would switch it and stuff and he would go all crazy. And I think it's really bad when people do this to animals because let's say eye drops, and they test them in the animal's eye. That can burn the animal's eye or it can blind the animal. And I think it's really bad. (Partner says, 'And then the animal won't be able to see and then they get run over by a car or something.') (Misconception that laboratory animals are let loose).

29. It makes me happy to see people trying to save energy.

a. very true b. mostly true c. not sure d. mostly false e. very false

2,A,4,G,F

"I would say yes because energy is very important to the world. When you don't save energy, most people don't know the causes (child means the effects) and those causes are very bad some times."

1,A,4,G,F

"I put very true. As my partner said, people don't think about saving energy. They think about saving water and animals which is the average thought of people that want to save things but really no one thinks about saving energy because it's not in people's minds. But when you leave the refrigerator open, when you're thinking about something, it's using up a lot of energy. And that's really bad because and as my partner said, people don't know the causes (child means effects) of these things. So that's why it makes me very happy when people try to save energy."

Interviewer asks "Give me an example of somebody who tries to save energy who you didn't expect to save energy.

2,A,4,G,F

"My dad. He would watch TV and turn on the lights and then he just left. But then I said, 'Dad, you're wasting energy.' And then, sometimes he doesn't listen to me but most of the time he does. And I didn't expect him to remember because he doesn't have such a great mind, but then he started to save, like a lot of energy, because he never used to turn off the lights. But now, he tells me to turn off the lights.

1,A,4,G,F

"One person who would be very amazing would be me. When I was very little and we were getting ready to go to school, I would have the TV on and the lights on and I would leave them on by accident (Child calls it by accident when it was not.) Because I didn't know the causes (child means effects.). My mom would tell me. 'In the morning, you have to help me by turning off these lights and the TV.' She wanted me to turn off the lights, and stuff, not to save energy but so she could be on time. But I realized when I read the survey that if you don't turn them off then using up energy is just as bad as using up water. So I was surprised." (Child's mother may have wanted lights and TV off to save electricity and costs.)

30. I am **not** worried about running out of water.

- a. very true b. mostly true c. not sure d. mostly false e. very false

2,A,4,G,F

"I said very false, because as we said before, we wouldn't be here without water. Water is one of the most important things, like energy and the environment. Water is what keeps us alive."

1,A,4,G,F

"I do worry, a lot, so I put very false because I love the environment and I think it's very important that people try to save water. Then in the future, we might have a drought. And people will think back, and learn (from) their mistakes. And I think that they should just think ahead and see what could happen in the future, and then they could try and think back and they would say, 'I'm going to turn off the water when I brush my teeth.'

31. I do **not** worry about environmental problems.

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"I put very false, because I do worry a lot about environmental problems, When people kill animals, these animals can become extinct and that's not good. And then people cut down trees. And they don't recycle. We're just cutting down trees for nothing. (Partner says when you cut down a tree, well you can replace it with a seed, but that tree is not going to . .) I also worry because when people learn about these things, they say 'I'm not going to do this, I'm not going to do that'. And when they're older, they forget and they start not recycling and not turning off the water. So, yes, I'm very worried about this" (Child feels that when people are older, they feel less responsible to save the environment.)

2,A,4,G,F

"When the animals become extinct, and say that person really likes the animal but they kill it anyway, they'll say, 'Oh I didn't mean to do that.' But that doesn't matter anymore but the animal won't come back.' (Partner says, 'It can come back, like scientists taking DNA but I mean, it's not just going to come out nowhere.')

1,A,4,G,F

"There are very few osprey birds left in the Everglades because they are big and maybe there wasn't enough space for them. People took a lot of the Everglades and made it into buildings so they (the osprey) would have nowhere else to go. And also because people could kill them and use their feathers for hats."

32. I am **not** frightened about the effects of pollution on my family.

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"I put very false. (Child re-reads the question to herself.) Pollution would have a lot of effects on my family. I have animals and the animals go outside. If people pollute the grounds and stuff, I think, the air, that all the animals and the birds, that they can get very sick for breathing in that air and doing all that stuff. And I think that is really bad."

2,A,4,G,F

"Well I have dogs, too. And they go outside a lot. And trucks go by my house all the time and they are polluting the air. My dogs go outside, they don't know the difference, most likely. And when they breathe that air, they can get very sick from that."

33. I get upset when I think of the things people throw away that could be recycled.

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"I put very true. When people recycle they are kind of helping the environment and saving trees. But if you cut down a tree and you only use that product once, like newspaper or something, it's just worthless, you're hardly even using it, like newspapers. How many newspapers go out in a day, that's a lot. And when people don't

even read it and they just throw it away, that's a lot of trees you're killing. But if you recycle, you're saving them, you're helping them."

2,A,4,G,F

"I put mostly true because usually I don't pay attention, because I'm focused on something else. But when I do see people not recycling that is very bad. Because being able to use something again, that's really good. Like trees and plants, when they make stuff out of them, that's getting rid of them, oxygen. But being that they use it again, it's not that terrible. It's not getting rid of the tree, it's just using it over and over again."

34. It makes me sad to see houses being built where animals used to live.

- a. very true b. mostly true c. not sure d. mostly false e. very false

2,A,4,G,F

"Yes, I have a place right next to my house. There were lots of trees and monkeys living there. They just cut all the trees down I think that's very bad. Where are the monkeys going to go? They're probably dead by now. If people love animals, why do they destroy them and destroy their habitats?"

1,A,4,G,F

"I put very true because animals can get extinct when they do that; and also, the Everglades. People shouldn't be cutting down the Everglades. A lot of the animals won't have anywhere to go. We only have one Everglades in this whole entire world, and it's located in Florida. If people cut down trees and everything and the animals have no place to go, then that's really bad. We get water from the Everglades. The (Miccosukee) Indians used to live there and used everything. I learned once on the internet, that the Indians tried not to use as much animal, as possible. And whenever they made tools, they would use wood that they found on the ground, they didn't want to chop down the trees. (Partner says, 'And they loved nature. And whenever they killed an animal, they would pray for that animal.) If they had to cut down the tree to live, they'd do it. But if they didn't have to, they would just use the materials that they would find on the ground."

(Interviewer says, 'Tell me more about the Everglades.")

2,A,4,G,F

"There are loads of animals living there, different kinds of birds, a lot of trees, the Florida panthers, and fish that live in the water. The exotic fish, the ones that are not native, are taking up too much room because there are a lot of them and they don't get along with the other fish." (Child knows about competition between animals.)

1,A,4,G,F

"Also, if people take the water from the Everglades (misconception) let's say they one third the water of the Everglades, that land will dry up. Because we have a dry season, and that's when a lot of the water dries up. And the fish goes over to the area where there is water and that's a lot of room. (Child is discussing an alligator hole where the alligator digs down and fish still have enough water in which to swim.) We never really studied about fish in the Everglades. We learned a little bit about the alligators and the

Florida panthers in science class. We're just learning about the water cycle, evaporation, condensation, precipitation and ground water. We're learning a little about the food cycle. Cheetas hunt deer. When people start killing the deer and the things that the cheetas eat, the cheetas don't have anything and the cheetas die. Then whatever eats the cheetas will die. The top of the food chain will die. Natural disasters could endanger lions, like a drought.

35. It frightens me to think how much energy is wasted.

- a. very true b. mostly true c. not sure d. mostly false e. very false

1,A,4,G,F

"I put very true because I know that energy is very important to our habitat and to our world. Let's say there are at least six family members in a house, if each of those family members keeps the refrigerator door open when they are deciding, they are like "Oh, I don't know what to get.' And they keep it open for periods of time, which is so bad. Because people don't know the consequences or causes of this (child means effect) when energy is wasted. I put very true, it does frighten me."

2,A,4,G,F

"I put mostly true. Because before the survey, I didn't know much about energy and stuff, but then I learned. And now I would say very true because it's like, energy is very important and when you waste energy, I mean. I think the lights and TV and the computer uses the most energy in my house. (Misconception, in truth, the air conditioning uses the most energy.)

36. It upsets me when I see people use too much water.

- a. very true b. mostly true c. not sure d. mostly false e. very false

2,A,4,G,F

"Yes, because water is wasted not just for you but for the whole world. Maybe there won't be enough water for other people in the world and they don't waste water. It's just because of other people. And then when we have a drought, they're going to say, 'I used too much water.' But that's not going to change anything."

1,A,4,G,F

"I put very true, because it does upset me when people use too much water. And as my partner said, it's not just using the water for you, it's using the water for the whole world. And there's a lot of people in this world. And we do have a lot of water. But if we keep using it up, we're not going to have enough water in this world to keep every single person alive. So, yeah, it does scare me a lot. I think there are about six billion people in the world.

(Knowledge

37. Most elephants are killed every year to provide people with:

- a. trophies. b. ivory c. meat. d. oil e. skin

1,A,4,G,F

"I put skin because I don't know a lot of people that eat elephant meat. (Interviewer explains the right answer is ivory.) What is ivory? (Interviewer says 'Ivory is their tusks. Did you know about their tusks?) Oh, yeah. What about the shofar? You know, in my synagogue, they blow the shofar on the new year. (Interviewer explains that is a ram's horn and that is not illegal to buy or sell.)

38. Burning coal for energy is a problem because it:

- a. releases carbon dioxide and other pollutants into the air.
- b. decreases needed acid rain.
- c. reduces the amount of ozone in the stratosphere.
- d. is too expensive.
- e. pollutes the water in aquifers.

1,A,4,G,F

"I put releases carbon dioxide and other pollutants into the air. (Interviewer says 'That is right'. Have you ever seen a coal mine?) Oh yeah, I learned about it in social studies. The miners go into the ground."

39. Ecology assumes that man is what part of nature?

- a. special.
- b. related to all other parts.
- c. not important.
- d. the best part.
- e. the first part.

1,A,4,G,F

"I put E 'the first part'.

2,A,4,G,F

"I put B related to all other parts. They can possibly cause this to happen to all the other parts of it, or they can make it better for all the other parts."

40. Phosphates are harmful in sea water because they:

- a. cause cancer in fish.
- b. stop reproduction in fish.

- c. make fish nervous.
- d. make the water cloudy.
- e. suffocate fish by increasing algae.

1,A,4,G,F

"I put stop reproduction in fish."

2,A,4,G,F

"So did I." (Interviewer explains that phosphates are in fertilizer, so what would that do for plants in water.) Suffocate fish by increasing algae.

41. Compared to other paper, recycled paper:

- a. takes more water to make.
- b. takes less energy to make.
- c. is less expensive to buy.
- d. is harder to write on.
- e. produces more pollutants.

1,A,4,G,F

"I put C 'is less expensive to buy.'

2,A,4,G,F

"I put the same thing. I don't know the answer. (Interviewer asks, 'Do you know how to make paper?') No. (Interviewer explains the cutting of trees, sending them downstream, using energy to cut them, slice them, press out the water.) It takes less energy to make recycled paper."

42. The most pollution of our water sources is caused by:

- a. dams on rivers.
- b. chemical runoff from farms.
- c. methane gas.
- d. leaks in the sewers.
- e. human and animal wastes.

1,A,4,G,F

"I put C 'methane gas'."

2,A,4,G,F

"I did, too." After seeing the aerial map with red (showing sugar cane crops giving off heat) around Lake Okeechobee, I think the most pollution is from chemical runoff from farms.

43. Ecology is the study of the relationship between

- a. different species of animals.
- b. plants and the atmosphere.
- c. organisms and their environments.
- d. man and other animals.
- e. man and the environment.

1,A,4,G,F

"I put A but I think it's B. (Partner agrees.) (Interviewer asks them to read the responses to themselves and they do. Interviewer asks children if they know what organisms are.) I don't know what organisms are. (Interviewer explains that ecology is the study of the relationship between 'organisms and their environments')."

44. The most common poisons found in water are:

- a. arsenic, silver nitrates.
- b. hydrocarbons.
- c. carbon monoxide.
- d. sulfur, calcium.
- e. nitrates, phosphates.

2,A,4,G,F

"I was guessing so I put C. I don't know what carbon monoxide is." (Interviewer explains that nitrates and phosphates are the most dangerous and pollute the water. Phosphates used to be in detergents and cause algae growth in waterways.)

45. Where does most of the garbage go after it is dumped from the

garbage trucks?

- a. to an aquifer where it is buried.
- b. into an ocean.
- c. recycled to make plastic.
- d. to a landfill where it is buried.
- e. to farmers to use as fertilizer.

- 1,A,4,G,F "I put C, recycled to make plastic."
- 2,A,4,G,F "I put B, into an ocean". (Interviewer tells students the correct answer is D to a landfill where it is buried. Students said they didn't know what a landfill is.)

46. Which is most responsible for creating acid rain?

- a. sulfur dioxide
- b. carbon dioxide
- c. ozone
- d. nitrogen
- e. ultraviolet radiation

- 1,A,4,G,F "I was guessing so I put B, carbon dioxide."
- 2,A,4,G,F "I put A, sulfur dioxide, but I don't know". (Interviewer explains that sulfur dioxide is the correct answer and that acid rain is eroding the Statue of Liberty, the Acropolis and many other buildings.)

47. Catching tuna in the ocean:

- a. is eliminating a main food source for whales
- b. protects baby sea turtles.
- c. also kills many dolphins.
- d. is now against the law.
- e. is necessary to keep the population size down.

- 1,A,4,G,F "I put A, is eliminating a main food source for whales."

- 2,A,4,G,F "So did I."

- 1,A,4,G,F "But whales don't eat that. They eat this little....krill. But now I'm thinking that... I know it's not against the law. I don't know how tuna are caught. (Interviewer explains they use nets to catch tuna.) I guess they also kill many dolphins." (Interviewer explains the dolphins that we are discussing are mammals, not the fish the dolphin.)

48. Which is an example of a perpetual energy source?

- a. nuclear
- b. oil
- c. wood
- d. uranium
- e. solar

2,A,4,G,F

"I put B but I wasn't sure"

1,A,4,G,F

"I put E but I wasn't sure. I don't know what perpetual means?"
(Interviewer explains it means 'going on forever. What's forever?')
Solar energy goes forever.

49. Which of the following is the most dangerous to the earth's environment?

- a. damming rivers
- b. overpopulation
- c. tornadoes
- d. household pets
- e. nuclear power plants

1,A,4,G,F

"I put E, nuclear power plants and I wasn't sure." (Interviewer asks,
'Why do you think that's dangerous?') They can make fires and it
can cause blowups and things like that.

2,A,4,G,F

"I put C, tornadoes, and I wasn't sure, either." (Interviewer explains
why overpopulation is the most dangerous to the earth's
environment.)

50. Most of the lead in our air is caused by:

- a. cars.
- b. industrial plants
- c. airplanes.
- d. burning refuse.

e. cigarettes.

1,A,4,G,F "I put A cars, because I don't know what they mean by lead. Do they mean pencil lead?"

2,A,4,G,F "I put the same thing, A cars." (Interviewer explains they mean lead which used to be in gasoline and is no longer used.)

51. Precycling means that:

- a. people buy things that can be used again.
- b. more people should ride bicycles
- c. small children should wear the clothes of their older brothers or sisters.
- d. items should be tested before we buy them.
- e. environmental changes are always taking place.

1,A,4,G,F "I put A, people buy things that can be used again."

2,A,4,G,F "So did I."

52. Animals alive today are most likely to become extinct because:

- a. natural selection kills weaker animals.
- b. where they live is getting too warm.
- c. they are unable to reproduce because of pollution.
- d. the habitat where they live is destroyed.
- e. their food supply is destroyed by acid rain.

1,A,4,G,F "I put D, the habitat where they live is destroyed."

2,A,4,G,F "I did, too. The Florida Panther is in danger because people are cutting down their habitat."

53. Coal and petroleum are examples of:

- a. fossil fuels.
- b. renewable sources of energy.

- c. energy sources that are plentiful.
- d. alternative sources of energy.
- e. recycled resources.

2,A,4,G,F "I put B renewable sources of energy. But I'm wrong."

1,A,4,G,F "I put A fossil fuels."

54. Environmental problems are a threat to:

- a. mostly people in small countries.
- b. only people who live in cities.
- c. only wild animals and endangered species.
- d. mostly tropical plants and animals.
- e. all living things in the world.

1,A,4,G,F "I put E, all living things in the world. "

2,A,4,G,F "So did I."

55. Which of the following does **not** do much to reduce the pollution by automobiles:

- a. properly tuned engine.
- b. high octane gas.
- c. low lead gas.
- d. smog control devices.
- e. propane engines.

1,A,4,G,F "I put E, propane engines."

2,A,4,G,F "I put E, propane engines. (Interviewer explains that high octane causes more pollution from automobiles than low octane gas.)"

56. The main problem with landfills is that they:

- a. take up too much space.

- b. are ugly to look at and smell bad.
- c. attract rats and other pests.
- d. prevent farming of nearby land.
- e. do not produce enough methane.

1,A,4,G,F "I put A, take up too much space."

2,A,4,G,F "So did I." (Interviewer asks, "Did you ever see a land fill?")

1,A,4,G,F "I think dredging, when they take sand out of the ocean. But, I'm not sure...it's a dump?" (Interviewer asks if child has ever seen a dump?) Yes, I've seen a dump in New York.)

57. Building a dam on a river can be harmful because it:

- a. makes the river muddy.
- b. can no longer be used to make electricity.
- c. increases level of pollution on the water.
- d. causes the river to flood.
- e. damages the river's natural ecosystem

1,A,4,G,F "I put E, damages the river's natural ecosystem."

2,A,4,G,F "I put E, also. I've seen dams on TV. I know the name Hoover Dam."

1,A,4,G,F "I think I saw a dam when I passed by Texas. I think I saw one."

58. Where is water under the ground found?

- a. in landfills.
- b. in ponds.
- c. in low pressure areas.
- d. in aquifers.
- e. in rivers.

1,A,4,G,F "I put E in rivers." (Child is not familiar with where South Florida gets its water.)

2,A,4,G,F "I put D in aquifers."

59. Killing animals, like wolves, that eat others:

- a. is necessary and should be done.
- b. may increase the number of other animals.
- c. does not affect other animals in the area.
- d. may decrease the number of other animals.
- e. will help protect the environment.

1,A,4,G,F "I put D, may decrease the number of other animals."

2,A,4,G,F " I put B may increase the number of other animals, but I think I meant to put D." (Child is influenced to change her answer after hearing her partner's answer. She really has no experience with this concept of overpopulation of a species.) (Interviewer says, "Think about it. If you kill wolves, what will happen?")

1,A,4,G,F "If people kill wolves?" (Interviewer says, "Yes.") "Things that eat the wolves will die." (Interviewer explains that things the wolf eats, will not die.) "There will be an overpopulation. (Interviewer say, "Give me an example of an animal that a wolf eats?") "A deer. So the correct answer is B." (Child came to realization after thinking of what a wolf eats.)

60. An example of a nonrenewable resource is:

- a. petroleum.
- b. trees.
- c. ocean water.
- d. sunlight.
- e. animals raised for food.

1,A,4,G,F "An example of a non-wearable resource is..." (Interviewer reads word 'nonrenewable' slowly for children.) "I put B, trees. But I think it's D.) (Child changes her answer when she realized the vocabulary and meaning of 'non-renewable', but is still incorrect.)

2,A,4,G,F "I put E, animals raised for food."(Interviewer explains that non-renewable resources can not be replaced once they are used up.) "Petroleum, gas?" (Child is not sure of meaning of petroleum.)

61. Most air pollution in our big cities comes from:

- a. cars.
- b. jet planes.
- c. factories
- d. big trucks
- e. landfills

1,A,4,G,F "I put B, big trucks."

2,A,4,G,F "I put cars." (Interviewer explains most air pollution in our big cities comes from cars. Los Angeles had a big problem because the heavy smog from the cars stays in the valley within the mountains.)

62. An item which can **not** be recycled and used again is:

- a. disposable diapers.
- b. newspapers
- c. aluminum cans
- d. motor oil
- e. plastic bottles

2,A,4,G,F "I put A, disposable diapers."

1,A,4,G,F "I put D, motor oil." (Interviewer explains, "You can recycle motor oil. The gas station is responsible for collecting it and recycling it. The answer is A. You cannot recycle used diapers.)

63. What is the main problem with the use of aquifers for a water supply?

- a. They recharge too quickly.
- b. They are becoming used up.
- c. They contain too much fresh water.
- d. They contain too much salt water.
- e. It is hard to get the water out.

1,A,4,G,F "I put B, they are becoming used up."

2,A,4,G,F "I put E, but I didn't know." (Interviewer says, 'Aquifers are becoming used up.')

64. A species that no longer exists is:

- a. protected.
- b. endangered.
- c. abundant.
- d. extinct.
- e. wild game.

1,A,4,G,F "A species that no longer exists is D extinct. I know that because I've heard it throughout my life."

2,A,4,G,F "I put that, too."

65. Which uses the most energy in an average house in the United States?

- a. lights.
- b. TV.
- c. hot water heater.
- d. telephone.
- e. refrigerator.

1,A,4,G,F "I put A, lights."

2,A,4,G,F "So did I.) (Interviewer reminds children, "You're going to check your electric bill tonight and ask your parents aren't you?")

1,A,4,G,F "What is the right answer?" (Child wants to know immediately. Interviewer says, "Hot water heater. That is because it takes a lot of energy to heat the air or water, or air conditioning.)

66. Which of the following groups is most interested in environmental issues?

- a. Boy Scouts of America
- b. The Sierra Club
- c. Kiwanis

d. 4-H Club

e. The American Cancer Society

1,A,4,G,F "I put The Sierr-ia Club."

2,A,4,G,F "I put A, Boy Scouts of America (Child laughs.) (Interviewer asks, 'Have you ever heard of 4-H?') "Yes we write speeches for the 4-H contest in school" (Interviewer says, "The answer is The Sierra Club, like the Sierra Nevada Mountains..")

1,A,4,G,F "I thought it was a tiger, that's why I put it."

67. I have never taken a written environmental survey before.

a. true

b. false

1,A,4,G,F "I have never taken an environmental survey before, and that is true."

2,A,4,G,F "Yes, true."

68. I would like to learn more about the environment and how to protect our Planet Earth.

a. true

b. false

1,A,4,G,F "True."

2,A,4,G,F "True."

(Interviewer says, "Tell me what you've learned from taking this survey and all of these questions.)

1,A,4,G,F "What I've learned from all these questions and the survey is that protecting and conserving water, conserving land, and recycling is so important to this environment. In the future, people will say, 'Why did I do this? Look at the Earth.' And children now are the future. It's going to affect the future and it's going to affect us. If children could just look ahead and see what could happen, then they should think and say, 'I'm going to turn this water off.'" (Interviewer says, "Now that you've been surveyed and interviewed, what would you like to do next?") "I would like to tell others"

2,A,4,G,F "I would discuss it with my parents. I would tell all the people I know.'

1,A,4,G,F ""I would discuss it with my friends, and relatives. I would maybe write to a company that has to do with this."

2,A,4,G,F "I would discuss it with someone who doesn't turn off the water and maybe they would change their mind eventually and would turn off the water and help."

(Interviewer says I want you to talk about a project you would like to do in school.)

1,A,4,G,F "Really? (Interviewer says, "Yes.") Cool! One project I would like to do after reading the survey and learning about it is make a water cycle project. You could recycle while you are doing this, also. You could take old cardboard, or something and cut it into a circle and make a display of it to show how the water cycle really works. Another thing I would like to do is show an energy chain with animals. (Partner says, 'It's already in our book.') Out of school, maybe start a committee. People sign up for it. And what they have to do is write letters to people all around the world and stuff, telling them about this and asking them if they'd like to join to help the environment. Or I'd ask them to give \$15 to help the environment. (Child is not specific for what the money would be used.)

(Interviewer says, "Think of some things in our school having to do with environmental problems.)

1,A,4,G,F "I think people just throw things on the ground. I think we should tell the principal. She could probably make an announcement. And every class could put their recycled paper in a recycling bin. After maybe a month, we could see who collected the most. Maybe they'd get a party or something. (Interviewer asks, "Have you done that before?")

2,A,4,G,F "When I was in first grade, we went around with trash bags, the whole school would do it to see who got the most trash in the bag. That class would get something."

1,A,4,G,F "Sometimes in aftercare, at least once a week ,we have a partner, we have a glove and we pick everything up from the ground. Sometimes we take things that can be recycled out of the garbage cans.

(Interviewer says, "Besides recycling think of things that are happening on these school grounds. Then I'm going to ask you to walk around and notice good things and things that need to be improved.")

2,A,4,G,F "I've seen a lot of trash on the ground, over by the playground."

1,A,4,G,F "I've also seen a lot of polluting around these grounds and it's really bad. People just waste water. They take their water bottles and just pour them out on the ground. Also, the ground is very dry."

(Interviewer asks if the children can come back during their lunchtime with their teacher's permission to walk around the school grounds and take photos.)

Students went around campus taking photos of what they believed needed improvement in the environment. (See Appendix D-1)

1,A,4,G,F "Yeah."

Interview #2 4th grade boys

(Verbal Commitment)

1. I would be willing to stop buying some products to save animal's lives.
5. very true b. mostly true c. not sure d. mostly false f. very false

3,4,M,G "I said not sure because if I'm on the brink of dying here, I'd probably want to buy that product." Interviewer says "We're talking about every day, today." "But if it's not necessary for me, I would not buy the product. An example would be a fur, mink coat, or a raccoon hat, I don't know if they still sell them. Things like that." (Student may know that animal furs are not sold because of public disapproval.)

4,4,M,G "I don't think I can answer that question, even though I put mostly true, because it depends on the animal. Some animals I'm fond of and some I'm not. " Partner helps distinguish which animals by saying, "So you've never bought, say, whale blubber?"

4,4,M.G "I wouldn't say never, I'd say as far as I know." (Student seems to want to be correct in his description.)

2. I would **not** be willing to save energy by using less air conditioning.

25. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G "That's mostly true because down here in Miami, it can get pretty hot. I would die, but if it was a normal day, (student seems to change his idea) I would turn off the air conditioning or use less that day, if it were about 79 degrees. But, if it was about 90 degrees I would not pay any attention about saving energy, if I was close to dehydration at that point. (Student is concerned about his own comfort.)"

4,4,M,G "That is true, also, I would agree with you. Although I have been very fond (child uses the word "fond" which is in his daily speaking vocabulary) of saving energy, though, I am very sensitive to heat. I do not like extra heat, extra severe heat, I can withstand most heat. It depends, if it's too hot I will not think about saving energy by using

air conditioning. But if it's too cold, I can usually stand that. I'm not too sensitive to cold air (child is reflecting on his feelings).

Partner asks, "Yeah but would you be willing to save energy in other ways, such as turning off lights in your house?" "Yes." "So would I."

3. To save water, I would be willing to use less water when I bathe.

2. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G "Yeah, I would, like taking a shower. As long as I got clean during that shower time I would be willing to use less water and not leisurely just sitting in the shower. But if I was to actually want to take a long shower, I would rather take a bath because it would reduce the amount of water, let's say a forty-minute bath. The shower would keep running, going down the drain, running going down the drain."

4,4,M,G "Yes, very true because I hate taking showers. Whether it's a good shower or a bad shower, I hate taking showers. So that's not a fact of whether I want to save water or not, it's just that I hate taking showers."

4. I would **not** give \$15 of my own money to help the environment.

c. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G "I would give \$15 of my own money, even though that's pushing it money wise, I would still give it because I know how important it is to save the coral reefs, (this child spends a lot of time on weekends in the ocean snorkeling off the shore), endangered species like the Florida Panther, and other animals. Also, to preserve, like the dodo bird, which was hunted out and became extinct."

4,4,M,G "Yes, it depends on my financial state at the moment, because I don't have an abundance of money, because I don't get money, because my parents are not in the best financial state either, and yes, at the moment, I am in the state that I will be willing to give \$15 to help the environment." (Student had to make a decision based on his needs and discretionary spending.)

3,4,M,G "I don't occasionally get money from my parents for doing just one thing (he means for an allowance), but there are some people (students) I know who just get money for taking out the trash, say \$15 a week but that's not worth it (student means he has to work harder for that amount of money).

5. I would be willing to ride the bus to more places in order to reduce air pollution

27. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G "I already ride the bus to school, for one reason, that is, my mom does not want to drive through traffic on Ives Dairy (Road). But some things, you cannot take a bus

to. Like going to the grocery store, you can't take a bus because you'd have so many groceries. (Student is not familiar with urban living and taking mass transit.)

4,4,M,G "No, because I don't have a bus stop really near me. There are no close bus routes. (Student is not familiar with the city transportation a few blocks away.) So I would be more likely to walk, if it were close, or I would have to drive with my Mom."

3,4,M,G "Yeah, that's another factor, not knowing the bus routes and not being close."

6. I would **not** be willing to separate my family's trash for recycling.

4. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G "My family has already worked that out. We have a recycling bin and we put glass, bottles, and things that are recyclable. We also recycle the newspaper, and paper and cardboard. We have a container for each one. We've already worked that out. How about you?"

4,4,M,G "I don't think we've gone to that measure yet. The only things we recycle are bottles, cans, plastic, glass and newspaper and paper. And then we have a garbage and that's what we have. There is no other way of separation."

3,4,M,G "That's basically what we have in mine. I mean what else could you recycle?"

7. I would give \$15 of my own money to help protect wild animals.

4. very true b. mostly true c. not sure d. mostly false e. very false

4,4,M,G "Going back to environment and the \$15, would you want to help animals?" (Student has reflected on previous question asked a few minutes prior.)

3,4,M,G "I would give \$15 to animals, (student laughs at what he said) .I mean to help animals. I like panthers, and birds and fish and stuff. I pretty much like animals so I would be willing to give \$15. But as you said before, it depends on the financial state."

4,4,M,G "I agree with that, and like I said before (student must have been thinking about this question to bring it up again) it depends on the animal. If it's something like fish that are endangered, then yes. Because I have a fish tank at my home (personal experience with animals) and I like fish. Another reason is, most endangered animals, I don't know whether it's a coincidence or it's just the animals people like to hunt, but most of the animals that are endangered are either beautiful or powerful majestic figures like the lion although it is not endangered."(Student is not considering the insects and rain forest animals that are endangered.)

3,4,M,G “Or some extinct animals, which were not so pretty, but became extinct, like I said, the dodo bird. If there is a challenge the hunters will take it. A lot of hunters like to hunt birds because they fly and they move fast.”

2. To save energy, I would be willing to use dimmer (less bright) light bulbs.

- very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “Yes I would. But it’s not up to me how I control my light bulbs. It’s up to my parents, yeah my mom and dad. I would love to suggest to them, now that I know that there actually are dimmer light bulbs (students are not educated on conserving light energy). Today I will ask them. (This student says he will take action.) How about you? Will you?”

4,4,M,G “What I do is, most of my lamps have like settings. (He means a three-way bulb.) When you turn it on it’s low and if you turn it again it’s brighter. For anything else, besides when I doing my homework in my room, I use the dim light bulb.

3,4,M.G “Yeah, you mean the two and three-way light bulbs? Yeah, I use that as well, for my homework.”

3. To save water, I would be willing to turnoff the water while I wash my hands.

- very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “While you’re washing your hands, you need water to wash it off, but, while you’re lathering and things, I would be willing to turn it off. I mean it’s stupid not to. But if you weren’t knowledgeable of it, I think you should do it now that you’ve heard of it.”

4,4,M,G “That’s different for me because I have a different way of washing my hands. (Student uses hand gestures.) What I do is, I put it on. And I wash it and I put it under the water while I’m washing. (Student doesn’t know it takes longer than this amount of time for the lather to get rid of germs.) It’s a lot quicker way, and it’s just as good. For me, I can’t turn off the water because it’s just not the way I wash my hands. Like, I’m using the water when it’s on.”(Student clarifies statement in order to reinforce that he is doing the right thing.)

10. I would go from house to house to pass out environmental information.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “I don’t know what I was thinking when I put down mostly false, here, but I would, although it depends. If it were within a one-mile area I would. If it were any farther than that, drastically over that, I would not. A one-mile area is like my small community, I would do that, yeah.

4,4,M,G “I would, but one of the reasons I don’t is because not everyone would like that. If you really think about it, would you want people coming to your door daily passing out flyers? People wouldn’t really like that.”

3,4,M,G “Yeah, but usually I don’t like people coming to my door and giving a presentation on charts, but just having a flyer at my door, or being given a flyer, I don’t mind about that. I mean, it would be better to me for security to lock the door, have them put the flyer down. Then I’d read it. I don’t get too many flyers, I don’t know about you.

11. I would be willing to write letters asking people to reduce pollution.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “I’m not a really big letter writer.” Partner says, ”I agree.” “I hate to type, it takes a while. I guess if the postal is paid and everything, it depends on how many letters. (Student is changing his opinion.) If it were four or five, fold them up and put them in, yeah I would do that. But if I had to write more than ten, ain’t happenin”

4,4,M,G “I’m not really sure about that. If I’m writing to strangers, it’s no. If it’s for friends, who I know don’t do that (he means who don’t reduce pollution), yes, I’d just type away, carbon copy (Student must mean type on a word processor.)

12. I would be willing to go from house to house asking people to recycle.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “No, I would not. I think it’s creepy to have weird people come up to your door and say, “Hi, could you please recycle? Thank you for helping the environment. I’d take a flyer but I would not like someone coming to my door.”

4,4,M,G “I agree with you. My reason would be that people wouldn’t like it and it would be creepy to have people coming to you and asking you to recycle, when you might already be recycling. That might annoy them twice as much.”

(Actual Commitment)

13. I have **not** written someone about a pollution problem.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “When I had answered this survey, I had not. But this is a month later after the survey, and I have. In my community there was a problem with dredging and the fish were killed. And I have written to (child uses wrong word--means ‘written to’) a (uses wrong word--means ‘an’) environmental land use attorney, Brenda Chalifour. (Student took action since the survey was given a month ago.)

4,4,M,G "I don't know how to answer that because I haven't written to someone about pollution but I've put it into my letters, yes."

14. I have talked with my parents about how to help with environmental problems.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G "Again, when I did this (survey) there was not a problem, and I had answered 'no'. But yes, currently, I have been asking my parents how to get involved and I have been getting involved."

4,4,M,G "Yes, it hasn't always been effective, but recently I've given up. But, yes."

15. I turn off the water in the sink while I brush my teeth to conserve water.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G "Yes, I do, every time I brush my teeth. And like I say, every drop counts.

4,4,M,G "Yes, I do. This is how I do it. I turn it on full, it goes onto the toothbrush, I put it on (he means toothpaste) and it's about half a second of full water running. I turn it off, I brush my teeth and I turn it on again and rinse off the toothbrush with another half a second of full. Then I fill up my cup and I rinse out. I turn off the water after I rinse the cup. "

3,4,M,G "Don't you think it would be better to not put the water on high, to put it on low or medium so just enough water goes out?"

4,4,M,G "No, that's just the way I do it. I don't think turning it on high for a half second is the same as turning it on medium for a second. (Student is rationalizing why he does it this way.)

3,4,M,G, "What if you said you could do medium for half a second?"

4,4,M,G "I don't know, I guess I'll try that. I never thought about it." (Says that to please peer.)

3,4,M,G "Well, I guess we've made a point out of that question."

16. To save energy, I turn off lights at home when they are not in use.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G "Yeah, not at my own will but my dad forces me to. I mean, he doesn't force me, he says "Turn off your light, (pointing around in a circle) turn off your light, turn off your light. Now I know, just right away to turn off the light. How about you?"

4,4,M,G “Well, that’s the exact opposite. Actually, I force my mom. Yes, I do.

17. I have asked my parents not to buy products made from animal fur.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “Yes, I have. There haven’t been any recent products bought besides for my brother, maybe leather shoes or a leather coat. But, I mean, leather is expensive! My mom’s had on a mink coat before but she did not buy it. It was borrowed.

4,4,M,G “That’s something like I said before, my mom’s never wanted to. I guess she doesn’t like it. She always buys nylon, polyester, or whatever that is, not animal fur.

18. I have asked my family to recycle some of the things we use.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “Just as you said before, it’s just a natural thing. We never wanted to not recycle, I mean we have a paper bin and we have a recycling thing for glass and tin.

19. I have asked others what I can do to help reduce pollution.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,34,M,G “Since I took the survey, about a month ago, I have asked about our community’s problem and dredging up the sand from the ocean to make more beach. I’ve asked how to reduce that kind of pollution which is made from the sand mixing with the (sea) water to make silt, which falls onto the coral and kills the reef. “

4,4,M,G “No, I don’t ask other people, I get it from books.”

3,4,M,G “I mean other people are writing the books, so it could be considered the same thing, typically. You’re still getting information. It’s like someone trying to speak to more than one person at a time.

20. I often read stories that are mostly about the environment

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “Not very often, but every once in a while, I do.”

4,4,M,G “Same with me, same with me.”

21. I do **not** let a water faucet run when it is not necessary.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G "That's very true for me, if it's not necessary. Every drop counts."

4,4,M,G "I don't let it on my own free will but like once I had forgotten and it was on low for the whole day. But I don't let it on my own if I remember. Usually I do remember, but I have forgotten. (Student tries to take responsibility for his own actions but uses his forgetting as an excuse.)"

22. I leave the refrigerator door open while I decide what to get out.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G "That's what's funny. Because sometimes I know and sometimes I don't, because maybe other people who read this report...what you do is, you know what you want to eat. You open the refrigerator door, but it's not at first sight. You have to move (student plays acts with his arms) and dig. And finally after about 30 minutes of shifting through the refrigerator and basically reorganizing it, sometimes I see it."

4,4,M,G "Sometimes, I have that problem, but not 30 minutes. I just need a snack. After I see every little thing in the refrigerator, I close it and then look in the pantry, then the closet."

3,4,M,G "I was kind of pushing it with the 30 minutes, though. (Admits he exaggerated.) All right, let's go on."

23. I have put up a bird house near my home.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G "I used to. I used to love birds and feed them. I still love them but the bird feeder broke, seeds spilled, never did it again. But I do keep birds (students means in a cage) and if we have any bread I throw it out to the pelicans and stuff. (Fish is the pelican's natural diet, not bread.) Yeah, I have before, but not recently."

4,4,M,G "I made one and I kept it for a few weeks (temporary). It was like corn on the cob with peanut butter and seeds."

3,4,M,G "I had a wooden bird feeder that rotted, fell off a tree, broke."

24. I do **not** separate things at home for recycling.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “I do separate things, that is very true, I do, newspaper, plastic water jugs, plastic, glass and paper. Everything is separated.

34,4,M,G “Everything is separated. We have two sinks, we keep the recycling stuff in that sink. I take it out every night and put it in the proper recycling bins, whether it’s bottles or paper.

How do you really feel. (Affect)

25. I am frightened to think people don’t care about the environment.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “I’m not jumping out of my seat because of it but I think it’s bad and the only thing that scares me is that people leave open bottles of oil that spill on to the ground and things. (Student implies that it seeps down to the water table, from which we get our drinking water.) That scares me. But not other things like people stepping on flowers or someone cut down a mangrove tree. That doesn’t frighten me but I don’t like it. Nothing bad will frighten me. (Student mentions the word ‘frighten’.) It will just make me mad. It will make me want to just go over there..” Partner interjects, “And smack the person in the face.” “No, not smack him, just yell at him and tell him why he’s doing it. And then he’ll say, ‘I never thought of that.’” (Student playacted this dialogue.)

4,4,M.G. “I’m not really frightened. As you said, I’m not jumping out of my seat. What I am scared about is that eventually, we’re going to run out of fossil fuels and we’re going to have to maybe use friction with our own body power work to make electricity, or maybe worse, maybe discard all electrical items and forget about using electricity. And that would not have been so hard if we had not adapted and depended on electricity for so long. (Student has misconception about energy, which can be changed from one form to another.) That’s what really scares me, but mostly I’m angry.

3,4,M,G “What you’re telling me is that there is no other way to make energy without fossil fuels. But have you ever thought of solar energy that could power electricity?”

4,4,M,G “Yeah, but that’s expensive, to build a lot of solar panels.

3,4,M,G “How is that expensive? It’s like having a mint to print as much money as you want. (Student is making an analogy to renewable solar energy.) Metal is fossil fuel. (misconception). We’re using up resources that will never come back, either way. We’re using up more than is formed.

4,4,M,G “What I’m saying is trees shrink as they grow. You could cut a piece of tree bark and make dollar bills out of the wood. They make less money out of the material they have (Student means some is made into wood, not all is made into paper. We are going to run out of trees, (misconception) we’re going to run out of money and then we’ll have to make them out of metal. Then we’re going to run out of fossil fuel (student may think metal currency comes from fossil fuel—misconception) Then we’ll have to use solar energy, what...electronic checks? (Student is fantasizing about money)

3,4,M,G “When they house a plant like that say poplar, they wait until it blossoms and they plant a seed after they cut down the tree. They do this annually.” (Student is explaining to partner that this is a renewable resource.)

26. I get angry about the damage pollution does to the environment.

- a. very true b. mostly true c. not sure d. mostly false e. very false

(Students inadvertently skipped this question on discussion.)

27. It makes me happy when people recycle used bottles, cans, and paper.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “I don’t like how that is worded, just like question #25 says ‘frightened’ I just don’t like how that is worded. Sure, I like when people recycle but it doesn’t make me go ‘Whee, someone did it!’”

4,4,M,G “One person recycling isn’t going to make a difference, but if I find that the whole neighborhood has turned from wasting to recycling, like one of the people who has presented to us, water wasters, or wasters to glades savers. I would be happy if a whole neighborhood, over 500 people were savers.”

3,4,M,G “One person recycling would not make me go skipping down the street singing ‘Oh, he recycled, oh, he recycled, unless everyone else recycled.’”

15. I get angry when I think about companies testing products on animals.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “Yes, yes. I would smack anyone who tests products on animals. (Student previously said he wouldn’t hit anyone.) How about you?”

4,4,M,G “I wouldn’t be as angry if they used it on a clone, but clones are not at a successful rate, yet. So they use it on real animals. (Student under misconception that living things that are cloned do not have the same rights as the parent.) So, yes, I am angry, unless they do like two tests per product. The way they do it is they have a hundred tests per product, maybe. If fifty of them go correct and fifty go wrong, they’re just going to keep doing it.”

3,4,M,G “I believe they test lipsticks on chimps.”

4,4,M,G “Stick with what you have with that, I don’t feel that’s too important.”

3,4,M,G “If you see a darker tinted red, why do you want a different color? If you walk into Publix you can see hundreds of red lipsticks.”

16. It makes me happy to see people trying to save energy.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “If there were a lot of people, it would make me happy, but I would not go skipping down the street.”

4,4,M,G “I have the same answer. Even if my whole block does it, it would really take a lot of more people to get me excited about it and I would say, “Oh, Mom, oh, Mom, the whole neighborhood is recycling, I’m so happy.”(Student has been in whole grade level pep rallies before tests and knows the power of group dynamics.)

17. I am **not** worried about running out of water.

- a. very true b. mostly true c. not sure d. mostly false e. very false

4,4,M,G “I’m not worried. People could use the 70% of earth which is water, filter it, forget how expensive it is, and drink it.” (Student has misconception. Only 1% of earth’s water is potable.)

3,4,M,G “Here’s the down point (he means ‘downside’) to this. That process is called desalination. And they have a plant in Key West and also in California, I believe, and all over the United States. But, it takes a lot of money to filter the salt out of the water and it takes a lot of time.”

4,4,M,G “Yes, and then they can take the salt and sell it.”

18. I do **not** worry about environmental problems.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “I worry. Like I said before, there was a problem with the coral reefs and I was worried.

4,4,M,G “Yes, it is running out. Trees, stuff like that. (Student meant non-renewable resources.)

32. I am **not** frightened about the effects of pollution on my family.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “Yes, I am. This is scary here... pollution effects, dying humans, scary.

4,4,M,G “I would not like to see my mom take a glass of water, drink it, choke and we would have to take her to the hospital. That would be very scary indeed.”

1. I get upset when I think of the things people throw away that could be recycled.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “I don’t like the way the question is worded. My upset is different from your upset. If someone throws something that should be recycled into the garbage, I would say, ‘Reach in there, take it out, and put it in the recycle bin.’ If they don’t, I’ll reach in there and take it out of the garbage, because that’s how much I care about the environment. But I won’t get really uncontrollably very upset.”

4,4,M,G “I wouldn’t yell at them. I would tell them that next time they should (recycle).

2. It makes me sad to see houses being built where animals used to live.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “Yes, it makes me sad. It’s very depressing.”

4,4,M,G “It does make me upset.”

3. It frightens me to think how much energy is wasted.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “It doesn’t frighten me, like my stomach is jumping, like a roller coaster kind of frighten. I don’t even know how much energy is wasted a day. It’s probably a big amount, but, I’m embarrassed that the human race can waste that much.”

4,4,M,G “I am embarrassed, yes that’s the word.”

4. It upsets me when I see people use too much water.

- a. very true b. mostly true c. not sure d. mostly false e. very false

3,4,M,G “Yes”

4,4,M,G “I agree”

(Knowledge)

37. Most elephants are killed every year to provide people with:

- a. trophies.
- b. ivory.
- c. meat
- d. oil
- e. skin.

3,4,M,G “Oil.”

4,4,M,G “Oil? It’s ivory.”

3,4,M,G “Yes, elephants are so big and they kill them just to get the tusks. “

Both tusks represent just five percent of the body and they kill the animal just to get the tusks. They let the rest of it rot or something.”

4,4,M,G “Well, it decomposes, or something.”

3,4,M,G “I kills the animal. (Student puts his hands on partner’s chin.)

4,4,M,G “Yes, it’s good for the plants. It turns to fertilizer. (Student has misconceptions about the nitrogen cycle, biodegraders.) And please refrain from touching me. “

38. Burning coal for energy is a problem because it:

- a. releases carbon dioxide and other pollutants into the air.
- b. decreases needed acid rain.
- c. reduces the amount of ozone in the stratosphere.
- d. is too expensive.
- e. pollutes the water in aquifers.

3,4,M,G “It pollutes the air.”

4,4, M,G “Horrible, horrible pollution. Yes, I wish we could see the big hole in the ozone. Wouldn’t that be neat, a hole in the sky. (Student has a misconception of what ozone is and how it protects the earth from UV rays.)”

3,4,M,G “We’re on record, on the video.” (Student realized his partner should not have said the statement about the hole in the ozone.)

4,4,M,G “Oh, yeah.

39. Ecology assumes that man is what part of nature?

- a. special.
- b. related to all other parts.
- c. not important.

d. the best part.

e. the first part.

3,4,M,G "I think it's the first part because we have the capability of making other plants."

4,4,M,G "I think man is special. Because we are the smartest animal, and we build homes and rule the world." (Student did not connect that man is related to all other parts.)

3,4,M,G "I don't know the answer to this, Mrs. A. please tell me." (Student looks directly at video recorder.)

40. Phosphates are harmful in sea water because they:

a. cause cancer in fish.

b. stop reproduction in fish.

c. make fish nervous.

d. make the water cloudy.

e. suffocate fish by increasing algae.

3,4,M,G "What are phosphates?"

4,4,M,G "I have a fish tank and phosphates are bad for fish. And they kill algae, so it can't be E. (Student has a misconception, Phosphates actually increase algae growth in rivers and on reefs—detrimental to water flow, especially in the Everglades.)

41. Compared to other paper, recycled paper:

a. takes more water to make.

b. takes less energy to make.

c. is less expensive to buy.

d. is harder to write on.

e. produces more pollutants.

3,4,M,G "Takes less energy to make."

4,4,M,G "Is less expensive to buy."

42. The most pollution of our water sources is caused by:

- a. dams on rivers.
- b. chemical runoff from farms.
- c. methane gas.
- d. leaks in the sewers.
- e. human and animal wastes.

3,4,M,G “Chemical runoff from farms.”

4,4,M,G “Yes.”

43. Ecology is the study of the relationship between

- a. different species of animals.
- b. plants and the atmosphere.
- c. organisms and their environments.
- d. man and other animals.
- e. man and the environment.

3,4,M,G “Organisms and their environments.”

4,4,M,G “Yes, I agree.”

44. The most common poisons found in water are:

- a. arsenic, silver nitrates.
- b. hydrocarbons.
- c. carbon monoxide.
- d. sulfur, calcium.
- e. nitrates, phosphates.

3,4,M,G “Nitrates and phosphates.”

4, 4,M,g “True, because phosphates are from fertilizers.”

45. Where does most of the garbage go after it is dumped from the garbage trucks?

- a. to an aquifer where it is buried.
- b. into an ocean.
- c. recycled to make plastic.
- d. to a landfill where it is buried.
- e. to farmers to use as fertilizer.

3,4,M,G "To a landfill where it is buried."

4,4,M,G "Sometimes they burn it, but that causes a hole in the ozone layer."

46. Which is most responsible for creating acid rain?

- a. sulfur dioxide
- b. carbon dioxide
- c. ozone
- d. nitrogen
- e. ultraviolet radiation

3,4,M,G "Sulfur dioxide...I saw information about levels of acid rain in a kid's atlas. I wonder if acid rain can burn through your skin. I saw the church in Pisa, Italy. They said the devil came up and clawed it. It was really acid rain. All the toxins in the air collect with the water and come down as perspiration. (Student means 'precipitation').)

4,4,M,G "Sulfur dioxide."

47. Catching tuna in the ocean:

- a. is eliminating a main food source for whales
- b. protects baby sea turtles.
- c. also kills many dolphins.
- d. is now against the law.

e. is necessary to keep the population size down.

4,4,M,G “Tuna is a main source of food for whales.”

3,4,M,G “Whales don’t eat tuna. I put ‘is now against the law.’ I think though, it also kills many dolphins but I don’t know why.” (Teacher explains that the tuna are caught in big nets and the dolphins get in the catch.) What if they invented sonar beams that only the tuna can hear and it like traps them in this one area? You could distinguish between tuna and dolphin with the sonar pulses, how big they are. Or maybe they could invent an IR (infrared) scan or a gamma ray scan like they do x-rays.” (Student is aware of technology.)

48. Which is an example of a perpetual energy source?

a. nuclear

b. oil

c. wood

d. uranium

e. solar

4,4,M,G “Solar, because solar never really runs out until about 50 million years from now when the sun blows up and then we won’t have solar energy.”

3,4,M,G “Actually we’re going to die in about 800 years. There is a giant asteroid hurling toward us. Everything on the world is going to die. I won’t be around then. Thank G-d. (Student concerned about the future of the earth.)

4,4,M,G “Actually it’s going to hit your grave and pound it down. (Student laughs when he says this. Laughter may be his way to express concern.)

49. Which of the following is the most dangerous to the earth’s environment?

a. damming rivers

b. overpopulation

c. tornadoes

d. household pets

e. nuclear power plants

4,4,M,G “Nuclear power plants?”

3,4,M,G “Yeah, I guess. What if nuclear power plant creates a huge leak and blows up the world? What if a plane was used as a bomb and went into a nuclear power plant? Now it’s not unlikely. (Student knows about terrorist attacks that occurred in 2001 on the Twin Towers in New York, the year prior to this interview.) I guess we could put turrets in front of it and the FAA (Federal Aeronautics Administration) could schedule the flights not to go over there. So, if the plane gets off course, (Student moves his whole body to show direction and he claps to show destruction) the Air Force can come in and, Boom! (Teacher interjects, ‘Before 9-11 when your mindset changed, what do you think the answer was?’) Overpopulation.”

4,4,M,G “Because more people would turn to terrorism and there would be more planes blowing up buildings.” (Teacher says, ‘Think about before that.’)

3,4,M,G “Overpopulation. People were going to use up all the natural resources, and they’re going to use up the oil. Oil is going to be gone, who knows how fast! Oil is going to be like \$20 a gallon in like 50 years. Instead of using oil we can use batteries, wind power, solar power, kinetic energy. Or if you get a really fast growing plant you could use it as fuel. Potato power! They get a giant potato (Students laugh) and stick two wires in it and it lights up the whole thing. (Teacher says, ‘We can use the methane gas which is produced in garbage as fuel.) We could also use methane gas from our ____.” (bodies) (Student uses another word.)

50. Most of the lead in our air is caused by:

- a. cars.
- b. industrial plants
- c. airplanes.
- d. burning refuse.
- e. cigarettes.

3,4,M,G “Industrial plants. Like I’m metal and I’m a corn.” (Student being silly, using the word plant as a corn plant.)

4,4,M,G “Industrial plants. They meant like ‘Ultimate Strike Man’” (Student laughs.) (Teacher says, most of the lead in our air is caused by cars.)

51. Precycling means that:

- a, people buy things that can be used again.
- b. more people should ride bicycles
- c, small children should wear the clothes of their older brothers or sisters.
- d. items should be tested before we buy them.

e. environmental changes are always taking place.

4,4,M,G "More people should ride bicycles. It saves fuel."

3,4,M,G "It's 'C'"

52. Animals alive today are most likely to become extinct because:

- a. natural selection kills weaker animals.
- b. where they live is getting too warm.
- c. they are unable to reproduce because of pollution.
- d. the habitat where they live is destroyed.
- e. their food supply is destroyed by acid rain.

4,4,M,G "The habitat where they live is destroyed."

3,4,M,G "Okay."

4,4,M,G "An example is the Florida Panther. They're cutting down the Everglades. (Student learned this in school from Friends of the Everglades speaker.) (Student taps partner.) I answered already." (Student seems to be a little upset that partner wants to continue to speak.)

3,4,M,G "They are moving a bunch of animal to the Galapagos, and they're building on where they lived in the Amazon. The Amazon, did you know what they did with the Trans-Amazon Highway? They were planning to put a million people from Brazil into the Amazon. They cut down, like millions of acres and then the people left. All the people that worked there left. Now we have a big spot in the Amazon. (Student uses his arms to describe the land being cleared.) Now that they've burned down the trees, the soil is not any good for agricultural use so we cannot plant any other trees. I think they should put topsoil on it and plant trees. You get topsoil from Home Depot. And they could have a stable there..."(Student does not know how topsoil is made but he does know that plants need nutrients.)

4,3,M,G "You could make topsoil from decomposed dead leaves, it makes it richer. I learned that in science class. And you could put cow poop on it for fertilizer."

3,4,M,G "I did a science experiment on that. I had ground coffee, I had cold coffee, I had room temperature coffee, I had regular water. (Student means the water was the control.) I put them on lima bean seeds. (Student means each seed was treated with a different substance.) The result was the one with room temperature grew the best because it had nutrients. I emailed Starbucks and they said that it had the nitrogen and...I took the nutrients that the lady gave me in coffee and then took the nutrients that the plant needed and they matched, like perfectly."

4,3,M,G "Ah, Starbucks can speed up their production of coffee and fertilize the Amazon (Student laughs.)

3,4,M,G “I think every woman should stop drinking coffee and donate it to the Amazon to have the plants grow better. We build a stable in the Amazon, we bring a bunch of horses there, and their remains will make the soil richer. Then in a hundred years, (Student stops to think.) Oh we won’t be alive in a hundred years. “

4,4,M,G “And when the horses decompose, (Student yells.) coffee time!

3,4,M,G “As soon as I get a child I’m going to ‘go’, (He means ‘say’) (Student touches chin of partner again.) ‘You listen to me. You build a stable (Student whispers something to partner, puts his head close to him. Partner raises up his hand to push him away.) That’s on camera.”

4,4,M,G “I’m going to sue you for trying to choke me or something or kind of sort of. (Student Laughs.)

3,4,M,G “Let’s go back.” (They both refer back to survey questions on paper.)

53. Coal and petroleum are examples of:

- a. fossil fuels.
- b. renewable sources of energy.
- c. energy sources that are plentiful.
- d. alternative sources of energy.
- e. recycled resources.

4,4,M,G “Fossil fuels, which are un-renewable (Student means ‘non-renewable.) unless microorganisms start speeding up their ‘decompostation’. (Student means decomposition.)

3,4,M,G “Fossil fuel is when a dinosaur dies and then gets fossilized and turns into fossil fuel.”

4,4,M,G “I have a brachiosaurus skeleton in my car to run it. “ (Student laughs.)

54. Environmental problems are a threat to:

- a. mostly people in small countries.
- b. only people who live in cities.
- c. only wild animals and endangered species.
- d. mostly tropical plants and animals.

e. all living things in the world.

3,4,M,G "All living things in the whole world. (Student changes his mind.) No, not all living things because some living things can survive without oxygen so when the world is just a big desert wasteland (Student is thinking that plants give off oxygen.) like all the little microorganisms can survive, not all the living things."

55. Which of the following does **not** do much to reduce the pollution by automobiles:

a. properly tuned engine.

b. high octane gas.

c. low lead gas.

d. smog control devices.

e. propane engines.

4,4,M,G "Which does not do much? Low lead gas."

3,4,M,G "Now we have no lead gas, not low lead, no."

4,4,M,G "I thought it was high octane gas. What's high octane gas?"

3,4,M,G "Now I got it, properly tuned engine."

4,4,M,G "Oh yeah, that is.. Which does not... (Student reads question again, silently.) No actually it does not because the car would use less. So it's high octane gas because the motor does a little bit."

3,4,M,G "No, propane, I think. Propane is a gas and it's like, it burns really easily and it will fill up the car."

56. The main problem with landfills is that they:

a. take up too much space.

b. are ugly to look at and smell bad.

c. attract rats and other pests.

d. prevent farming of nearby land.

e. do not produce enough methane.

3,4,M,G "They take up too much space."

4,4,M,G “Yeah, because they’re ugly to look at and they smell bad.”

3,4,GM,G “And they attract rats and other pests.”

57. Building a dam on a river can be harmful because it:

- a. makes the river muddy.
- b. can no longer be used to make electricity.
- c. increases level of pollution on the water.
- d. causes the river to flood.
- e. damages the river’s natural ecosystem

4,4,M,G “Damages the river’s natural ecosystem.”

3,4,M,G “Causes the river to flood. Because, like, it backs up the river.”

58. Where is water under the ground found?

- a. in landfills.
- b. in ponds.
- c. in low pressure areas.
- d. in aquifers.
- e. in rivers.

3,4,M,G “In aquifers.”

4,4,M,G “Yes.”

59. Killing animals like wolves that eat others:

- a. is necessary and should be done.
- b. may increase the number of other animals.
- c. does not affect other animals in the area.
- d. may decrease the number of other animals.

e. will help protect the environment.

3,4,M,G "May increase the number of other animals."

4,4,M,G (Student nods in agreement.)

60. An example of a nonrenewable resource is:

- a. petroleum.
- b. trees.
- c. ocean water.
- d. sunlight.
- e. animals raised for food.

3,4,M,G "Animals raised for food."

4,4,M,G "Petroleum is non renewable."

3,4,M,G "Petroleum is what you use for gas grills. (Student means propane gas.) Oh yeah, petroleum jelly is from gasoline."

61. Most air pollution in our big cities comes from:

- a. cars.
- b. jet planes.
- c. factories
- d. big trucks
- e. landfills

3,4,M,G "Factories." (Teacher corrects, 'cars'.)

62. An item which can **not** be recycled and used again is :

- a. disposable diapers.
- b. newspapers
- c. aluminum cans
- d. motor oil

e. plastic bottles

4,4,M,G "Motor oil."

3,3,M,G "Disposable diapers. Because once you have the poop in it you can't extract it."

4,4,M,G "Ah ha, a new diaper saving resource! Use laser and pay a million dollars to extract the poop from diapers."

63. What is the main problem with the use of aquifers for a water supply?

- a. They recharge too quickly.
- b. They are becoming used up.
- c. They contain too much fresh water.
- d. They contain too much salt water.
- e. It is hard to get the water out.

4,4,M,G "They are becoming used up."

3,4,M,G "You know what? Usually in aquifers, I read, that there is a pipe that goes down that is hot. That forces the water up, or something. Since it's so deep, it's hot. There are two pipes. One of them forces something hot, down. It makes the water hot. Wait! That could be a good power source. You open up a hole into the ground and have hot air from magma come up and turn the turbine. (Student is excited about his idea.)

64. A species that no longer exists is:

- a. protected.
- b. endangered.
- c. abundant.
- d. extinct.
- e. wild game.

4,4,M,G "Is protected." (Student smiles as if he knows what he said is incorrect.)

3,4,M,G "Extinct."

65. Which uses the most energy in an average house in the United States?

- a. lights.
- b. TV.
- c. hot water heater.
- d. telephone.
- e. refrigerator.

3,4,M,G "Hot water heater."

4,4,M,G "Telephone."

3,4,M,G "I put TV but I know it's the hot water heater."

66. Which of the following groups is most interested in environmental issues?

- a. Boy Scouts of America
- b. The Sierra Club
- c. Kiwanis
- d. 4-H Club
- e. The American Cancer Society

3,4,M,G "Kiwanis." (Student is a member of Kiwanis Kids.)

4,4,M,G "The Boy Scouts." (Teacher tells them, 'The Sierra Club. Find out more about the Sierra Club and maybe you can go on some of their trips.')

67. I have never taken a written environmental survey before.

- a. true
- b. false

3,4,M,G "True."

4,4,M,G "True."

68. I would like to learn more about the environment and how to protect our Planet Earth.

a. true

b. false

3,4,M,G “True.”

4,4,M,G “False, because I think I already know enough.”

3,4,M,G “You can never know enough about anything. And that’s a true fact. You may be the smartest person on earth, but there is always something to learn.

Appendix C-8

Photos of our school campus taken by students



Oak trees were infested with termites.



Garbage pick up was delayed for days.



No ground cover (plants) to stop erosion of soil.



Strangler fig tree takes over live oak tree.



Girls notice custodian on lawn mower cut grass too short.



Air conditioner puts out very hot air outside of the building.



Grass was growing on the hill but is dead due to students walking on it. This adds to erosion of soil.



New sapling tree from American forests stripped of its bark by weed-eating machine.



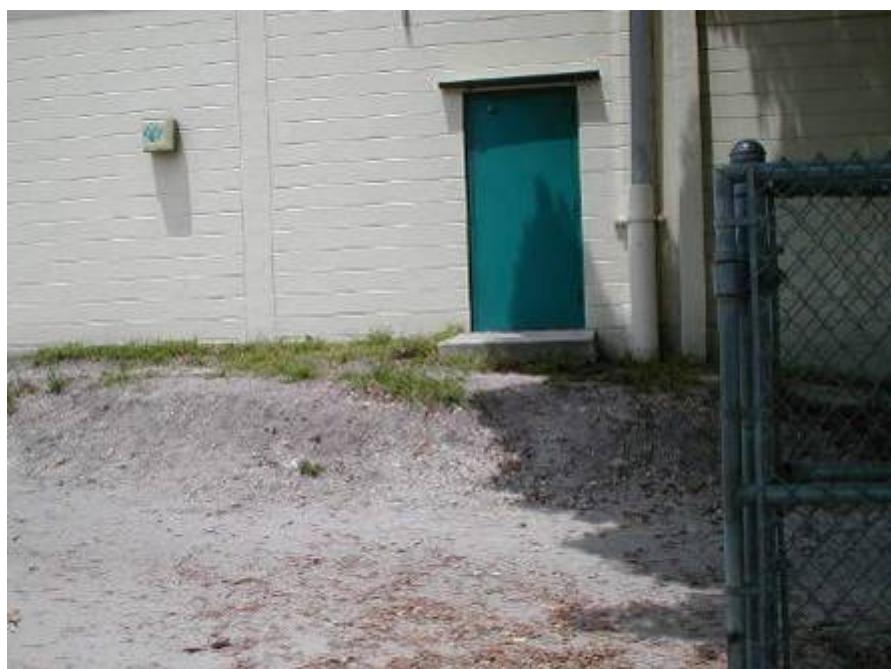
Water fountain dripped and wasted water.



Litter from schoolchildren was on the grounds.



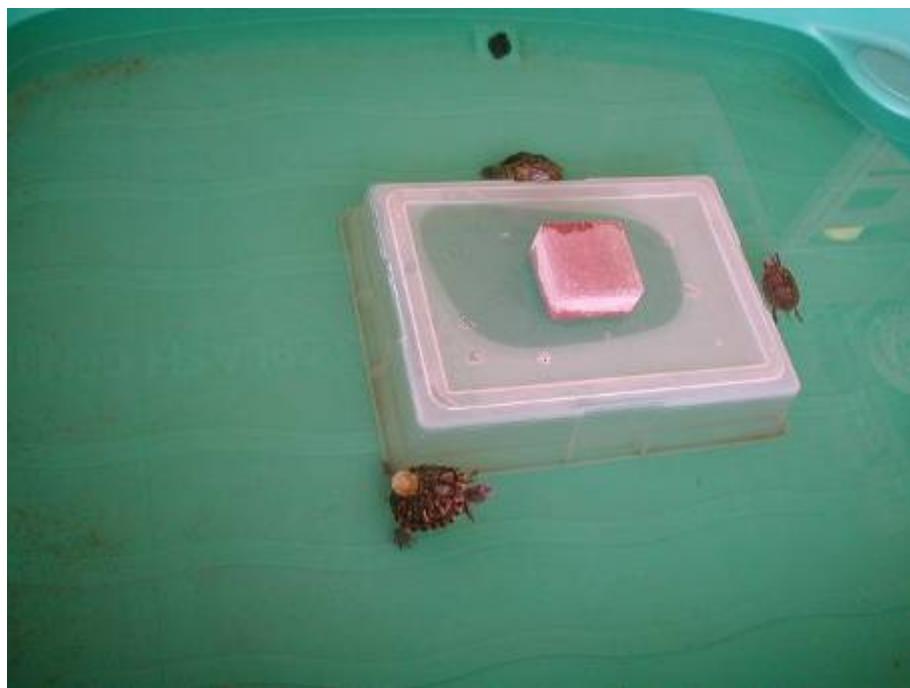
Cardboard lunch tray was thrown on the ground.



Ground was eroding under classroom building.



Lichens were on old oak trees, a symbiotic relationship with algae and fungi.



Baby turtles were in captivity.



Wonderful old oak hammock had squirrels living in the canopy.



Winners of Wonderful Water poster contest were sponsored by South Florida Water Management District.



Students planted our butterfly garden's flowering plants.



Drains were filled with debris and frogs, too.



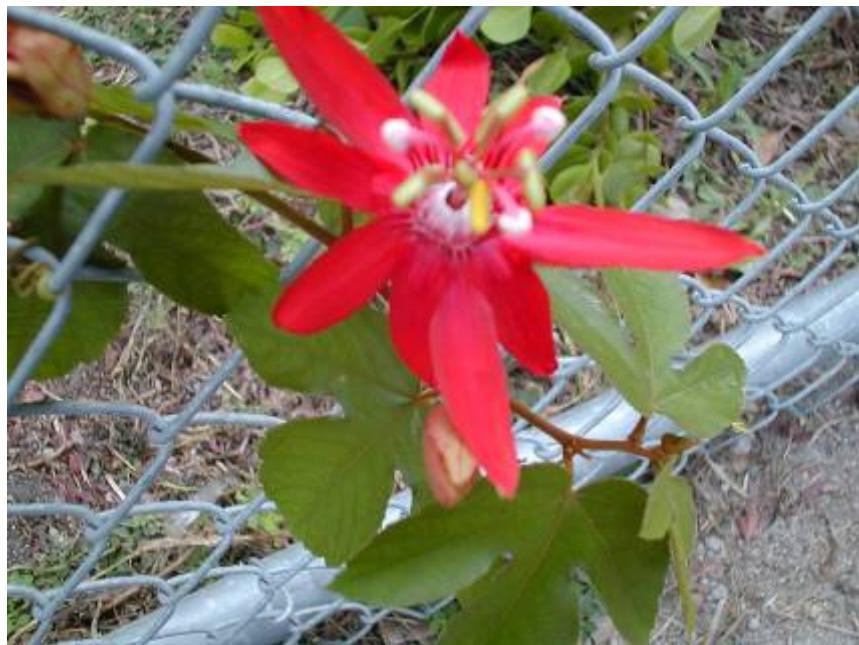
Student made milk carton bird feeders which we hung in butterfly garden.



Students enjoyed outdoor classes with hands-on science activities.



Students were blowing bubbles with bubble solution from recipe.



Student planted passion flowers for larval stage of butterflies.



Students picked up papers from classrooms to put in recycle bins.

Appendix C-10 Parent Survey

BEHAVIOR CHECK LIST

1	Very Frequently
2	Frequently
3	Occasionally
4	Infrequently
5	Very Infrequently

B E H A V I O R	#	No. of Parents												
		1	2	3	4	5	6	7	8	9	10	11	12	13
#1 Recycle newspaper.		1	1	1	1	2	2	3	3	3	2	4	1	1
#2 Recycle aluminum.		2	1	2	2	2	1	1	3	4	2	1	1	1
#3 Recycle glass.		1	1	1	2	4	1	1	4	3	2	1	1	1
#4 Recycle plastic.		1	1	1	2	2	1	1	4	4	2	1	1	1
#5 Recycle metals other than aluminum		1	1	3	2	3	1	1	5	5	2	1	2	1
#6 Buy products in recyclable containers.		1	1	2	1	3	2	1	3	4	3	3	1	1
#7 Use public transportation such as city buses to save gasoline		5	5	5	4	5	5	5	5	5	5	5	5	5
#8 Conserve gasoline by using the car less.		3	3	5	3	3	4	5	3	3	5	3	4	4
#9 Participate in a "car pool"		1	1	5	4	3	5	5	3	5	5	2	1	5
#10 Throw trash out of a car window		5	5	5	5	3	5	5	5	5	4	5	5	5
#11 Turn off lights and appliances when they are not in use.		2	1	1	1	3	2	2	1	1	4	1	1	1
#12 Keep home thermostat set to conserve energy (68 or lower in winter, 75 or higher in summer. in summer)		1	2	2	2	2	1	4	3	1	4	2	3	1
#13 Change thermostat setting when going to bed at night or when the house will be empty during the day.		1	1	3	2	4	1	2	3	3	4	1	1	1
#14 Buy energy saving equipment or appliances such as extra insulation, solar panels, energy- efficient windows, etc. for the house.		1	1	2	2	4	1	3	2	5	4	3	2	1
#15 Take steps to reduce consumption of water.		3	1	1	2	3	1	3	3	2	4	2	4	2
#16 Dispose of lawn waste (grass, leaves) in plastic bags		4	1	2	2	3	1	2	3	1	2	2	1	1
#17 Compost yard or home waste..		4	5	5	1	2	1	5	5	2	2	4	5	5
#18 When shopping, consider the impact of possible purchases upon the environment.		1	5	3	2	5	1	5	3	3	2	3	5	1
#19 Avoid products known or thought to be harmful to the environment.		2	1	2	2	3	1	5	2	1	3	3	3	1
#20 Buy products produced by companies that are thought to be contributing to environmental problems.		3	2	4	5	3	1	5	4	2	3	3	3	5
#21 Buy products made with recycled paper when they are available.		2	1	2	2	4	1	2	3	2	3	3	3	2
#22 Buy products that you think or know contribute to the greenhouse effect..		3	3	4	5	2	5	5	4	5	3	4	4	2
#23 Avoid consumption of animals due to environmental considerations.		1	3	3	5	3	3	5	4	3	3	3	5	5
#24 Buy products made from animal furs or reptile skins.		5	3	5	4	4	4	2	4	5	3	4	5	2
#25 Avoid use of chemical weed killers and/or fertilizers on your lawn due to environmental consideration.	s.	#	4	2	2	3	4	5	4	5	4	3	5	2
#26 Encourage adoption when a large family is desired.		3	3	2	4	1	2	3	3	3	4	4	2	3
#27 Buy books dealing with environmental problems.		3	4	3	3	3	3	3	4	3	4	4	5	5
#28 Discuss concerns over environmental issues with your wife or husband.		2	4	3	2	3	3	3	3	4	5	3	3	3
#29 Discuss concerns over environmental issues with your children.		2	3	2	2	3	3	3	2	3	2	3	3	4
#30 Discuss concerns over environmental issues with friends and/or neighbors.		2	5	2	3	2	4	3	4	3	2	4	3	4
#31 Discuss ways to protect and preserve the environment with your wife or husband.		2	4	2	3	3	2	4	3	3	3	3	3	4
#32 Discuss ways to protect and preserve the environment with your children.		2	3	2	3	3	3	4	2	3	2	3	3	2
#33 Discuss ways to protect and preserve the environment with your friends and/or neighbors.		2	4	3	3	3	1	4	4	2	2	4	3	3
#34 Consider a political candidate's views on environmental issues.		2	3	2	2	3	1	5	3	2	2	3	3	3
#35 Vote for or against a political candidate largely because of the person's views on environmental issues.		2	3	3	3	2	1	5	2	3	2	3	3	3
#36 Make a contribution of time or money to a politician largely because of the person's views on environmental issues.		2	4	4	#	3	1	5	2	3	3	4	3	5
#37 Do you support any family planning organizations? yes=1 no=2		1	2	2	1	1	2	2	2	2	3	2	2	2
#38 Are you a member of one or more environmental organizations? yes=1 no=2		1	2	2	2	1	1	2	2	2	2	2	2	2
#39 Have you made a contribution in the last year to an environmental organization such as Sierra Club, Green Peace, etc? yes=1 no=2		1	2	2	2	2	2	2	1	2	2	2	2	1
#40 Who Completed this questionnaire? Mother Mother=1 Father=2 Other=3		1	1	1	2	1,2	2	1	2	2	1	1	1	1

Appendix D-1 Article by Leonard Pitts, Jr. from *Miami Herald* “On Darfur, here's your action list.”

Jewish World Review June 24, 2005 / 17 Sivan, 5765

On Darfur, here's your action list

By Leonard Pitts, Jr.

<http://www.JewishWorldReview.com> | I guess I had it coming.

A week and a half ago in this space, I shared my anger and frustration over America's silent indifference to the genocide in the Darfur region of Sudan. The column ended with a challenge: give a damn.

I couldn't tell you how many e-mails I received in reply that said, "OK, I give a damn. Now what?" Or, "I'm just one person. What can I do?"

My favorite was from a lady who wrote: "On one hand, the article is well written and valid. On the other, it feels like it is simply an opportunity for you to vent and transfer your feelings of guilt onto the reader, for now you can feel you have taken action and it is the reader's fault things are as they are. ... Giving a damn doesn't mean anything if it isn't backed by actions. Your article doesn't give the reader any avenue to proceed."

I'd be more offended if she wasn't right. One of the dirty little secrets of scribbling opinions in newspapers for a living is that, on moral issues, you get to feel like you've done your part when all you've really done is your job.

Not that there isn't value in a columnist trying to rouse and shape public opinion. But it can be an easy out. And those who lack that out are always left asking the same question: "What can I do?"

By the same token, though, I think people overdo the "I'm just one person; I'm helpless" routine. Especially in light of two facts: (1) We are fortunate enough to live under a representative government that, in theory and often enough in practice, responds to our concerns and, (2) the Internet gives us more information and personal power than our forebears could have dreamt.

Truth is, we are the least helpless people on earth. So "I'm just one" simply doesn't cut it. Martin Luther King Jr. was just one. Lech Walesa was just one. That guy who blocked a tank in Tiananmen Square was just one.

The death toll in Sudan stands at 400,000 and rising. The United States has provided humanitarian aid, but has declined forcefully to press Sudan — a putative ally in the War on Terror — to stop the massacre. Earlier this year, the Senate passed a resolution — The Darfur Accountability Act — requiring sanctions against Sudan. The White House killed it. American news media have covered all this with a fraction of the energy and attention they accorded the Michael Jackson trial.

What can you do? Here are a few suggestions:

Inform yourself. An excellent place to start is by reading the work of columnist Nicholas D. Kristof, whose ongoing eyewitness accounts of this atrocity have been nothing short of heroic. Google Nicholas, (plus) Kristof, (plus) Sudan.

Inform others. Make it a topic of conversation in your classroom, your lunchroom, your synagogue, your mosque or your church.

Demand coverage. I did a computer search for newspaper references to the Darfur Accountability Act. Know how many hits I got? Eighty-nine. And many of those were just reprints of Kristof's columns. Let this newspaper's editor and your favorite cable news outlet know that this story matters to you.

Appendix D-2 Student "E", in grade 4, Interviewed the Environmental Attorney for Golden Beach, Brenda Chalifour, Esq. 10-02

Dear mrs. amaranth,
here is the interview ---->(of Brenda Chalifour, environmental attorney for the City of Golden Beach, Florida)

1 Q. What is the usual response from communities who want to dredge after telling them the negative effects on dredging?

A. The usual response is that they didn't realize there were negative effects and generally they indicate a desire to protect against the negative effects. Unfortunately, they still want to move forward with the project though.

2 Q. If you would be able to be televised on tv so the whole world could hear you what would you say as an important message to the world?

A We need to take better care of our precious natural resources which are finite some of which cannot ever be replaced. We have to be better stewards. We can't keep taking, taking and taking and expect anything good to come of it.

3 Q. Have you ever persuaded a community to not dredge, if so what did you say?

A No, unfortunately we have not been able to persuade a community not to dredge. We have, however, been successful getting assurances that when bad effects arise that the dredgers will do everything they can to minimize the problems. That's not much success but we'll never give up trying!

4 Q. As a child were you concerned about the environment?

A No, I had absolutely no clue and don't remember being taught much about it either—or maybe it was taught and I just wasn't paying attention.

5 Q. what do you suggest others do to stop dredging?

A We have to work toward changing the standards (laws) of acceptable projects. We have to maybe "just say no" and not allow dredging that will cause damage—even if the dredgers think they can "mitigate" for the damage. We have to recognize you just can't mitigate everything. Some things are provided to us by Mother Nature and ought to simply be left alone. Again, we have to change the laws that allow dredging projects.

6 Q. How long have you known how bad dredging is?

A About 10 years

7 Q. Are there more bad effects of dredging than good?

A It depends. Every project is different but for the most part the scale tips toward more bad than good—especially if you're talking about dredging in the ocean. It's like putting the hose of a vacuum cleaner on the wrong end. When you turn it on, you can't control the fact that stuff just spews out all over the place; scientifically, it is just not possible to control where everything goes. What a mess!

8 Q. What are the good things dredging brings?

A This is a very difficult question to answer. Maybe government regulators can provide you with an answer.

9 Q. What are the bad things dredging brings?

A Like I mentioned earlier, you just can't control everything. The plumes of silt that spew off a dredging project smother our precious coral reefs and kill them (just like putting a pillow over someone's face). It isn't pretty. The reefs, as you know, are our first line of defense against storm surge, are essential fish habitat, and are the basis of billions of dollars of tourist generated revenue. If you destroy the reefs you not only destroy the environment but you go a long way to destroying our economy as well. Additionally, depending on when the dredging is done, it can also destroy turtle nesting habitat. Furthermore, it is very costly and wastes public tax dollars that can be spent on more needed things like classrooms and teachers for children who in Florida whose quality of education is currently ranked 49th (almost last) in the nation. The negative effects can be as far reaching as you can imagine...

10 Q. In what way does dredging harm humans and other land mammals?
A I think we've covered that.

11 Q. What is dredging?
A Dredging is a process of digging a hole in the earth (whether it be on land or in the water) it is digging a hole in the earth.

12 Q. What is erosion?
A Erosion is the loss of land mass (sand) from the shoreline.

13 Q. Is erosion caused by big buildings to close to the shore?
A Scientists differ on the exact and specific causes of erosion but certainly the proximity of buildings to the shoreline has an impact on how quickly a beach will erode. Ocean currents, storm events, lack of protective reefs, hard bottom, dune systems and plantings, pipes draining onto the beach (outfalls for storm water runoff) all contribute as well.

14 Q. Do plants play a part in erosion?
A Yes, absolutely—those off shore on the reefs and those on shore in dunes on the beach. They actually guard against erosion.

15 Q. Will dredging put more animals on the endangered species list?
A Maybe. The key is we need divers to let us know what is out there, what needs to be protected because we just don't think the government has done a good job of inventorying what exists before they dredge. When you mess with Mother Nature, with dredging, for example, there is always a possibility that more animals will be put at risk of becoming an endangered species.

16 Q. Is there anything else you would like to say about dredging and/or the environment?
A We need more defenders of the environment, like yourself. We need people to care about what is going on around them. We need them to stand up and be counted and speak out at every opportunity they can. If we don't protect our environment from destructive, wasteful dredging projects, we will continue to lose precious natural resources—some of which will be gone forever!
sincerely,
E

Appendix D-3 Letter from Parent of Student "R" to the Governor of Florida 5-03

Parent of a Fourth Grader Reflects on her daughter's environmental knowledge after seeing Water Fest with the school in the North Miami Beach Performing Arts Center

Subj: **Earth Day 2003**
Date: Friday, May 2, 2003 7:44:32 AM
From: TS
To: jeb.bush@myflorida.com

I horrible irony happened yesterday before 1,000 students of 4 different schools. Your representative, I believe her name was Amanda, stated that you, Governor Bush, stood for restoration of the Everglades. That it was you, who intended to preserve and protect this State's natural resources. In the afternoon, my daughter read the front page of the Herald (Miami-edition). On the front page, the article discussed "Big Sugar's" bill which you support and are going to sign into law. My daughter noted that the same bill will hinder the recovery of our "River of Grass." My daughter, at age 10, told me about what your representative said and how ironic it is that you say one thing but do another. At age 10, isn't it a shame that our children can't trust their governor. Do the right thing. Veto the bill or at least come out and state that the Everglades and saving the environment is not first on your agenda.

We know that you are a good man and mean the best for the state. But we never considered you duplicitous until now. Do the proper thing and stop the Sugar bill from becoming law. Thank you for listening to me and my daughter.

TS

Appendix D-4 Letter from Governor of Florida to parent of 4th grader

Subj: **Everglades Bill (Senate Bill 626)**

Date: Wednesday, May 7, 2003 11:35:24 AM

From: Jeb.Bush@MyFlorida.com (Governor Jeb Bush)

To: TS

Thank you for your comments regarding Senate Bill 626, legislation passed by the Florida Legislature. My staff and I are in the process of reviewing this bill for technical accuracy, unintended consequences, and other general criteria. I assure you that the important issues you have raised will be duly considered before I take any action.

Regularly updated information on all legislative actions will be available at www.myflorida.com.

Thank you again for writing. Your thoughts on this issue are very valuable to my decision-making process.

Sincerely,
Jeb Bush

Appendix D-5 News release from Governor of Florida to parent of 4th grader

Subj: **GOVERNOR BUSH REACHES OUT TO LEGAL, TECHNICAL EXPERTS ON EVERGLADES**

Date: Thursday, May 15, 2003 3:34:10 PM

From: Jeb.Bush@MyFlorida.com (Governor Jeb Bush)
To: TS

FOR IMMEDIATE RELEASE TUESDAY, MAY 13, 2003

CONTACT: ALIA FARAJ - (850) 488-5394 DEENA WELLS - (850) 245-2112

GOVERNOR BUSH REACHES OUT TO LEGAL, TECHNICAL EXPERTS ON EVERGLADES

~~Unveils website, invites nation to get informed with the facts~~

TALLAHASSEE - Governor Jeb Bush is reaching out to legal advisors, technical experts and the public about efforts to restore America's Everglades. Today, Governor Bush unveiled a new website inviting the nation to learn more about the largest environmental restoration of its kind. Providing extensive and up to date information on Everglades restoration, water quality, legislation, funding and scientific research, the Department of Environmental Protection website outlines Florida's progress to restore the famed River of Grass at <<http://www.dep.state.fl.us/evergladesforever/>>.

"This is a complex issue that has been clouded by a lot of misinformation. Florida's commitment to Everglades cleanup should not be questioned. It remains steadfast," said Governor Bush. "This is an invitation to personally review Florida's report card on this monumental undertaking and to stay informed about the facts of the Everglades restoration."

Appendix D-6 Letter from parent of student "E" to teacher after he met with the Governor

In a message dated 5/14/03 10:13:01 PM, "E's mother writes:

<< Yes, the Governor was very impressed with E, invited us to his office where he showed us his family photos and took pictures with us. He gave E the coin and wrote him a little note, it was very cute. Gov. Bush delighted in telling me how E caught him in the hall and spoke with him, then waited early in the morning by the door so he could greet the Gov and again give him the message he wanted the gov. to act upon.

On the plane coming home, the "suites" from Broward gov. said they meet the night before, trying to figure how to counter the "E Factor"/

Was a tremendous experience for E. >>

Appendix D-7 Teacher's Interview of student "E" after he spoke with Governor of Florida

The last day of class before he graduated from the school. June 11, 2003 9:30-11:30 a.m.

Q: What things would you like me to write about you?

A: I'm a fifth grader at VABHOE. I'm very involved in community service. I SCUBA dive. I have seen the tragedies beneath the sea. I am fighting to protect the S. Florida coral reefs from dredging. I have been to our State Capitol in Tallahassee twice this year. I have had a private meeting with Governor Jeb Bush. I have spoken to the senior aids of the Cabinet members. I feel that I have made an impression on both the Governor and cabinet. I know because some of the cabinet aids told me that they would fight to save the reefs, and that they have the same beliefs as I did. Also, I know, because the Governor asked me to come up to his office and speak with him privately. My mom was in the room with us as was a reporter from the Capitol News Service. A different reporter from the Capitol News Service actually interviewed me on TV. It was broadcast all over South Florida on Channel 6 at 6pm on May 13, 2003.

Q: How do we know the reefs will be saved?

A: I don't. But I know that if many people fight for what's right, they will be saved. Right now it's either dredge or put in sand from the Bahamas on Ft. Lauderdale Beach. The governor said that we should hold off the dredge in Broward County for 18 more months while Broward County does a study on Bahamian aragonite, a type of sand with high magnesium content. If their study proves that Bahamian aragonite will affect the habitat of marine life negatively, as if sea turtles won't lay their eggs in the sand, then Broward County will only be left to dredge, paid for by the State of Florida and the US Government. If that's the case, we have to fight to stop the Federal funding from reaching the project.

Q: What's another alternative?

A.: I can show you the research on a new product called NU Shore. It's a fence that slows down the near shore current and the sand carried by the near shore current slows down and is deposited on the beach causing it to become hundreds of feet wider. They have used this along the coast of South Carolina, I believe. I'll email you the info from their packet.

Q: How did you get the packet?

A: We called the National Conference on Beach Preservation Technology, which is held in different places every year. I attended this conference with my father in the winter of 2003 because we wanted to gain a little more knowledge of other ways to save our beaches. We want to fight to protect our gorgeous reefs that our town of Golden Beach lost in the year 2000 Sunny Isles Project. Sunny Isles is our neighboring community to the South. The sand is deposited naturally from the north of the eastern coast of the US to the south. Because of all the ports for ships, and inlets, like Port Everglades, north of Golden Beach, the beaches are eroding faster. I'll send you a picture and I'll draw it now to explain. If you fly a plane out of Ft. Lauderdale airport, going east towards the Atlantic Ocean, you pass over the Port Everglades. On the north side of the jetty, you can see the sand is building up. This jetty stops the flow of sand to the south. On the other side of the inlet towards the south the beach is eroding. The sand is flowing south but is interrupted by the jetty and the inlet. Broward County wants to do a Sand Bypass Project for the sand to be deposited on the south side. Basically, they dredge sand on the north side of the inlet and dump it on the south side, on the beach. This is very different from dredging way out by the coral reef. In the bad Ft. Lauderdale dredging on the reef, I know they are going to cover hard bottom reef with sand. I know because I've SCUBA dove in Sunny Isles and seen the results. We have a dive spot for leisure diving that been ruined off of one of the condominiums, "destroyers of the environment". I don't mind that they (condominiums) are there, really, it's just that they

build too close to the high water mark. It causes the beach to erode faster and faster and faster.

Q: Why?

A: Because they don't leave any room for sand dunes to be built naturally by the ocean. Then they don't plant sea oats or grass or any plant cover, like sea grapes, cord grass that holds the sand that comes in from the ocean. Therefore, it's just washed back to sea, if there are no plants to hold it.

Q: How can kids help?

A: I met a rep from the USDA on the plane coming home from Tallahassee, who works with a company that takes kids out to plant sand dunes. I have his card and he might come and take one class from our school out to plant sand dunes. There are kids from other schools who planted on beaches in South Florida.

Q: What is another idea to save the beaches.

A: There are some laws in certain places that say you can't build close to the beach. Not only that, but we need to limit the size of some buildings, because overpopulation will cause more buildings to be built. It's just a cycle. As more buildings fill up, more are built. There is a 1500 unit building that's being built right now, next to the water tower on the beach in Hallandale. Can you believe that? It will have four tennis courts.

Q: You live in a town that is totally residential. There are no businesses, just a town hall and maintenance and police service buildings, departments. How do you feel when your friends, who live in a high rise, say to you "I live in a high rise."? (Now Ethan tells me not to write what he said in confidence, off the record.)

A: I'd say, well, how do you feel, knowing that your building is destroying the environment, the fish, the turtles, the reefs, in the long run? It's the ripple effect.

Q: What if they say they chose to live there?

A: I'd say Go destroy the environment, go destroy the reefs, go destroy the fish, but I'll be there to stop you.

Q: What's another thing you could do to convince them?

A: Take them on a glass bottom boat over the reefs, so they can see for themselves, the smothered, and dead coral. The Florida Cabinet aids went there this year or last year to see this tragedy. If everybody sees there is a problem, the builders may be legally required to do something.

Q: How can you educate or did you educate your friend to teach him about the reef?

A: In our elementary school, about two years ago, I brought in the environmental and land use attorney, who is a lobbyist for our town. She spoke to the 5th graders; I was the only fourth grader who heard her. She brought a video showing the devastated coral reef. This year I brought her in again and she spoke to the fifth graders, fourth graders and some first graders.

Q: Then what happened?

A: Some of the kids started to try and get active, some didn't. Some emailed Brenda and some wrote letters to the Governor.

Q: What happened to the letters?

A: I handed them to the cabinet's aids, and asked them to give them to the Governor because they were addressed to him.

Q: Then what?

A: The cabinet aids picked the pretty pictures the kids made. They said this one's cute, they told me to tell them they were very nice and that they liked them, which I did.

Q: Then what did you do?

A: I came back to the class and told them what a great job they did writing the letters and educated the class a little more on the negative effects of dredging for our environment.

Q: Thinking back in your 6 years at Highland Oaks Elementary, what do you remember about learning about the environment?

A: I remember my (interrupted)

"L" a fourth grader enters to get "E" to sign his name on an environmental award certificate for a student.

Q: Tell me about your K-Kids Club at school?

A: It stands for Kiwanis Kids. We do things for people in need, like we went to a nursing home at Douglas Gardens and did a talent show for them.

Q: What do you do for the environment?

A: We made a small butterfly garden near our classroom, and we initiated a recycling project for the whole school. Everyone kind of helped. "E" and I and "J" saw the wrong things put in the recycle bins like candy at Halloween. We put the recycled paper from each class box in a bin, and someone collects it each week in a large truck. I've never seen the truck because they might come early in the morning or on the weekends. I don't know.

Q: Have you educated the other students?

A: No, only those in K-Kids, or those who recycled in their own classrooms. Most kids also learned the benefit of community service by watching us do our collecting.

Q: What do you want kids to know?

A: I want kids to learn that you don't have to waste paper, that you can reuse things. I want them not to litter, oh yes. I knew there was something else. We went around collecting paper off the floor and outside on the school grounds.

Q: What would you like to improve about our school environment?

A: For people to not litter.

A: "E": I think the school kids should plant a tree a month. Or have a field trip to a sanctuary, like Sea Base, which I never was able to attend because the years I was in third through fifth grade the FCAT practice kept us from taking the trip. The teacher never planned it because we were always busy preparing for the test.

A: "L": I think students should go to see all the paper that has been wasted, a trip to the city paper dump or a land fill...to see how much can be recycled. We could compare the amount before recycling to after people recycle.

A: "E". I want kids to know how much paper they have been wasting so they can try to fix it. They should write on the whole sheet and not just one word. That's why they invented something called the eraser. I want kids to know how special the earth's environment is and if we take it for granted we won't have much of it any more.

Q: We have mosquitoes that are biting you now in this classroom. How can we control them?

A: Call mosquito control. No, just clap them and kill them.

Q: Did you know that standing water breeds mosquito larvae?

A: "L": Yes, they're part of a food chain.

Q: "E", what do you remember learning in school about the environment?

A: I remember in Kindergarten, Mrs. K showed us seeds that float down to the ground with the wind and look like little helicopters. They should call them "heavenocopters, not helicopters"

Q: What else do you remember learning about the environment in school?

A: I remember that Mrs. R in first grade explained photosynthesis and the role of chlorophyll in green plants. Like Lou Farigno in the Hulk. It's Italian, he's green and he's mean. They shut down the program on TV when Bill Bixby the actor died.

A: In second grade, we planted a garden outside Mrs. S's class and used the flowers to dry and make Mother's day bookmarks. We understood what plants needed to grow. It's like multi-vitamins we eat every day.

A: (Silence)(Laughter) What did we do in third grade? Fourth grade we planted the butterfly garden and fifth grade we did the recycling project.

Q: Is there anything else you would like to add that you remember learning?

A: I just was about to say that I appreciate your commitment for saving the environment. I thank you so much for taking the time to allow me to share this information.

Q: Do you know the background of the meeting with Brenda Lee Chalifour, the environmental attorney?

A: She heard about the Sunny Isles Project, she came to the Golden Beach Town meeting and spoke about mitigation and the effects of dredging and made friends with my dad and mom. Then I asked her on the phone to come to the school and I made her acquaintance. Then we started an email contact, and I asked her to come to our school the next year. Then we went to Tallahassee this year together. She was talking to some of the Cabinet members when I went in to speak with the governor. I recently spoke to Michael Putney, the reporter for Channel 10 in Miami.

A:"L": ("L" and "E" converse) Steve Erwin, the Crocodile hunter on TV was showing how they transfer crocodiles from one area to another, to save them. The sad thing is that the crocodiles didn't know that they were going to be saved; they were upset that they were captured in a box to be moved.

A:"E": It's like a holding cell.

A:"L": They have a live show with underwater animals tonight.

A: Michael Putney was a nice interviewer. They're nice then, and then some reporters are known to change your words later. Although Michael Putney is not one of those people, he's nice through and through.

A: Email me and I can do an interview on email if you would like to continue.

Q: What part have your parents taken in your environmental education?

A: They've been the main source of environmental education throughout my life, by reading me articles from the newspaper about different problems in the environment. Such as, catching fish with nets, instead of catching one at a time you catch hundreds. I think of that as a balance, we're a predator and they're prey. You can't eat a lot of fish, and you can't kill more than you need, so they need to breed more. So then certain species will become extinct.

Q: So what is keeping us from catching breeding fish?

A: I guess, laws and regulations.

Q: The babies, small fish are regulated. Is that the best way?

A: I think you should only be able to pull out of the water a certain amount of fish. The size should not be too small nor too big ("E" holds his hands apart about two feet wide).

Q: With what question would you like me end this interview?

A: I would like you to end with a question, not from me, but from everyone. Do you choose to save our Earth's environment or kill it?

Q: Do you think that taking the survey influenced the kids who took the survey in fourth, fifth and now sixth grade?

A: I know I have been influenced and I hope that others have been influenced as well.

Teacher's note: "E" was in the Gifted program since Kindergarten. He spearheaded many school/community projects throughout the years. One of these was collecting canned goods and emergency supplies for hurricane victims in Central America and arranging for the U.S. Army airplanes to deliver them. One was helping start the First Lego League in our school to enhance math and engineering skills while learning robotics. One was being president of K-Kids, a community service group to help the needy and help recycle paper at our school. "E" was involved daily with our closed circuit television programs broadcast to all the students in the school. "E" was given the American Legion Award as a fifth grader and was the emcee of the fifth grade graduation.