

Environmental Education at St. Barnabas



Applications of Sustainable Development
Galen University
Spring 2009

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Acknowledgements

With the success of our service-learning project comes many acknowledgements. We could not have done this without the help of St. Barnabas—specifically, the encouragement and freedom given to us by the wonderful principal Miss Shaw, as well as standards three and four teacher Miss Jones and standard five teacher Miss Gonzalez. Galen University has provided us the educational setting to embark on such a project and we thank them for that. Within our Applications of Sustainable Development class, we would like to thank our Professor, Jay Ashman, as well as Kaela Gray from the University of Vermont for the dedication they have shown to our group as well as the rest of the class throughout our projects. Without their help and guidance, nothing would have been possible. Lastly, we would love to thank the kids of St. Barnabas for giving us the chance to teach them. Without their interest and excitement, our project would have been little more than just another class assignment.

Introduction & Problem Statement

Our group's project focused on teaching Environmental Education to Standards Three, Four, and Five at the St. Barnabas Anglican Primary School in Central Farm, Cayo District, Belize. The Standard Three and Four class consisted of thirty students and the Standard Five class consisted of seventeen students.

To begin teaching Environmental Education at St. Barnabas, our group identified the problem statement that would set the direction of our actual service-learning project. After a discussion and reaching group consensus, our final problem statement is: "There is a lack of environmental education, hands on learning, and place-based education in the school systems of Belize."

After identifying this problem statement, we discussed what the implications of this problem were for Belizean students. We came up with a statement that outlined the effects, which is: "The lack of environmental education leads to an early disconnect between the natural world and the students living within it, resulting in the degradation of the resources and environments around them."

Lastly, we developed our goal statement, which was: "Through continuing the progress of last year's program and implementing an Environmental Awareness curriculum, we will strive to provide the students with knowledge that instills a deeper understanding of the natural world and shapes their views and actions towards it."

Methods

In order to successfully teach the environmental education curriculum we developed for St. Barnabas, our group used varying methods and approaches. Our methods can be divided into two sub-categories: group organization methods, and the methods we used to prepare for lessons each week.

Group Organization Methods

We started by assigning roles within the group and followed that by holding meetings with the faculty we would be directly working with throughout the semester. Over time, we developed the most efficient ways to work together as a group, create lesson plans (see Appendix 2), and teach the students of St. Barnabas in a manner that best suited them.

One of the most crucial components to developing a successful service-learning project is the working dynamics among the group members. From the beginning we assigned group roles to ensure no overlap or confusion. We discussed our personal vision and what we each considered to be important for teaching the students. This gave us all a better understanding of the direction we collectively wished to go in and which group members specialized or had specific knowledge in certain topics. After our personal and group goals were established, we moved into the development of our lesson plan topics and how we could go about teaching them to the children.

Before we discussed developing actual lessons, we met with Miss Shaw, Miss Jones, and Miss Gonzalez on two separate occasions. In these meetings we identified the topics of environmental education the students had already been introduced to, which gave our group ideas about what new lessons to teach them. The teachers expressed their expectations for us and suggested possible topics we could include when developing our lesson plans. During these

meetings we figured out logistics, contact information, and potential meeting times that would work best during the week.

The group decided that, both in order to most effectively teach individual lessons and to gain familiarity with the students, it would be best to split our initial group of six into two separate subgroups of three each. Each subgroup of three taught one lesson per week. One subgroup—Eli, Celso, and Liz—taught Miss Jones’ Standards Three and Four class, and the other subgroup—Ashley, Andrew, and Catherine—taught Miss Gonzalez’s Standard Five class.

Preparation Procedures

To gain insight into the different approaches currently being explored within the environmental education field, we reviewed published literature concerning the subject and completed a literature review (see Appendix 1). Half of the group researched sources and wrote a synopsis of the information while the others compiled and edited the final paper. The three common themes that were strongly emphasized in each source were: the importance of outdoor education, guiding the students with self-learning, and the effectiveness of focusing the curriculum around the land and local issues.

We met as a group at least once a week to create the lesson plan for the following week, using what we learned from the previous class to ensure that the next lesson would be effective. During the weekly meetings, we delineated how the lesson for the following week would function. Games, activities, discussion topics, PowerPoint presentations, and personal roles were assigned. These meetings also served as a time to debrief and discuss what worked, or what clearly didn’t, in the previous lesson. Learning from those discussions, we were able to create the best lesson possible for the next week. At the beginning of the project, we brainstormed some of the topics we might want to cover in the course of the semester, then sketched out which weeks we might want to cover those topics, giving us a general direction for creating the lessons

each week. But we didn't develop the lessons until the week before it was to be taught; this gave us the flexibility to adjust each lesson according to how the students were learning and how different approaches were being received, and kept us from becoming locked into a pre-determined curriculum.

Teaching Methods

We taught twice a week at St. Barnabas, each class lasting about one hour. Monday's class—Standards Three and Four, taught by Eli, Celso, and Liz—started at 9:00 a.m. and ended at 10:00 a.m. Thursday's class—Standard Five, taught by Ashley, Andrew, and Catherine—started at 2:30 p.m. and ended at 3:30 p.m.

As a way of gauging the students' knowledge of the environment, we created a pre-test (see Appendix 3) to be handed out during our first lesson. It had questions regarding: the importance of the environment to their everyday life and their place in the environment, their favorite subjects in school, and environmental problems in Belize. This gave us a basic understanding of what we should focus on throughout our time teaching them. From that information, we created two graphs to quantify the student responses to two of the questions asked on the pre-test, (see Appendices 5 & 6).

At the end of our final lesson at St. Barnabas, we handed out post-tests to the students in order to compare students' responses after six lessons to their responses before we began (see Appendix 4). The purpose of the pre- and post-tests was to gauge how much the students had learned regarding environmental issues and their role in the environment during our time at St. Barnabas.

From the start, our group decided that our priority would be incorporating an interactive and outdoors portion into each lesson, while also integrating a place-based focus into the topics we were going to teach. This formed the basis for each lesson plan. We started with a

concentration on the interconnectedness of all species, including humans, in ecosystems, using those present in Belize as examples. We then moved into the human impact on the ecosystems of Belize and global environmental issues. We concluded with both global and local solutions to environmental problems, focusing on the idea of sustainability.

We started each lesson with a review of the previous week's topic, followed by an introduction to what would be covered that day, and closing with an outside activity. The indoors portion of our lessons typically featured a PowerPoint presentation, a brief online video, or pictures printed out to pass around for the students to look at and connect to the topic. All the lessons we developed included an interactive, student-guided learning approach by having the students categorize various words related to the week's topic and then discussing their choices, or simply having them try to identify the importance of the topic before we taught it. Each lesson also included time spent outdoors participating in games or hands-on demonstrations of concepts to further reinforce the lesson topic.

Literature review research, meetings within our group, meetings held with the faculty of St. Barnabas, and a constant re-evaluation of our progress and of the relative success of our teaching approaches were crucial methods used throughout the semester. As a result of using these methods, our group was able to develop our project efficiently, ensuring that everything progressed smoothly and successfully.



Interactive game: Categorizing nouns that are part of the environment and nouns that are not part of the environment. From Lesson 1.



Twine food web reinforced the fact that all species in an ecosystem are interdependent. From Lesson 2.



Students have rest of the class guess which environmental problem is represented in drawn picture. From Lesson 3.

Results and Findings

Throughout our service-learning project we have made observations and come to conclusions that have led to a better understanding of Environmental Education, specifically in Belize. We wanted to do as many of our lessons and activities as possible outdoors, not only to excite the kids but also to include nature in each of our lessons. Some of these activities included: a web game, to show the interconnectivity between the environment and humans; and a population density game, to represent the overpopulation of our planet. We found these activities to be crucial to our lessons and extremely effective and fun for the students. Outdoor learning also enhanced the participation of the entire class. They were more eager to learn in an outdoor setting, as opposed to in a classroom setting. We brought many new environmental concepts into the classroom, and discovered that—while some of these concepts are more difficult to understand than others—the students seem to enthusiastically grasp the concepts when they were used in an interactive learning setting (e.g. games and categorizing).

On a more local level, we found that the students seemed to understand lessons better when we related them back to the Cayo District or Belize in general. It gave them a connection to the lesson, and also allowed them to see environmental problems first hand. They understood these concepts fully and were able to recognize them in their everyday lives. Another method we tried to include was guiding their learning. We did this by first asking them questions, and then requiring them to write, draw, or act out responses. This kept them engaged and focused and allowed them to think critically. We found that these techniques result in greater overall participation and enthusiasm from the students than traditional lecture methods.

The pre-test (see Appendix 3) and post-test (see Appendix 4) allowed us an opportunity to examine how the students' understanding of environmental problems, and their attitudes toward the environment, were influenced or changed in the time that we were teaching at St. Barnabas. It gave us a chance to see what the students took away from our lessons. From the

discrepancy in responses between the pre-test and the post-test, it was clear that students had gained the ability to use technical environmental terms to concisely identify pertinent environmental problems. Pre-test responses to the prompt “name one environmental problem in Belize” garnered generalized responses such as “garbage” and “crime/killing,” that described problems that were more of social problems than environmental concerns. It provided us the insight that these students were not certain about their role in the environment or even how they were part of it. However, when asked the question “how important is the environment in your everyday life?” students mostly responded “very important” or “important.” It showed us that the students at least knew that the environment was important to their lives, but they weren't necessarily sure how their lives connected to the environment (see Appendix 5).

The post-test showed more encouraging results. Students responded to the aforementioned prompt “name one environmental problem in Belize” with the responses “pollution,” “deforestation,” and “global warming.” This demonstrated that students’ environmental vocabularies had expanded, as had their knowledge of some of the most crucial environmental issues that affect Belize. Along with this increased knowledge it was clear that there was an increased awareness of students’ local environment and how they impact it. One of the post-test prompts asked the students to suggest something they could do to decrease the impact they have on the environment. Students suggested cleaning up trash, attempting to halt pollution, conserving resources such as water and energy, and planting trees. It was clear that not only had we successfully educated the students about actions they could take to improve their local environments, but we did it in such a way that the students were able to think critically about their environmental impacts.

Finally, the post-test served as a tool for us to see how much knowledge we had left the students with. Our final question was “what is one *new* thing you have learned from us?” The answers were evenly spread between the responses: “environment/ecosystems,” “greenhouse

effect & global warming,” “deforestation,” and “sustainability” (see Appendix 6). This was very encouraging for us as teachers because it allowed us to see that the topics covered in each of our lesson plans were well-received and remembered throughout the course of the semester. The comparison of the pre- and post-tests showed that we successfully educated the students with a focused understanding of the natural world and of the environment in which they live. Students clearly retained valuable information and understood their role in the environment.

Future Recommendations

Both of the subgroups teaching students at St. Barnabas felt very good about the progress made over the five weeks spent in the classroom. We built upon pre-existing knowledge, and worked to instill an environmental awareness in the students that went beyond just factual knowledge. Although we felt our service-learning project was successful, we identified aspects of the process that could have been improved upon to enhance the students' experiences and benefit the group's relationship with the teachers at St. Barnabas. Thus, for future groups working with St. Barnabas Anglican Primary School we have the following recommendations:

- After developing lesson plans, practice each lesson plan prior to teaching it. This need not be a full-on rehearsal, but, rather, an overview of the main points that will be covered and the supporting details and examples that will be used.
- For each lesson try to include specific examples, demonstrations, and specific details to help students understand each and every part of the lesson.
- Understand that students have different learning styles. Be prepared to reiterate points in a variety of ways until every student has grasped the subject matter at hand.
- Plan a relevant field trip that ties into the course material and lesson plans. This will help reinforce factual information taught in the classroom, and bring excitement and fun into the students' day.
- Strive to put the teaching material into the larger context of "environment". This could involve adding outdoor activities such as trash pick ups, gardening, weekend after school trips, community projects, etc.
- Brief the teachers at St. Barnabas on the week's class content and lesson plans in advance of the class. Ask for any feedback and make appropriate changes based on the feedback.

- Give the students a pre-test to evaluate what the students already know, and a post-test to determine what they have come away with.
- Finally, continue to focus the program around hands-on, outdoor and place-based education. This will instill a sense of respect for the natural world in the students, and hopefully impact their attitudes and actions towards it.

Works Cited

- American Institute for Research. (2005). Effects of outdoor education programs for school children in California. Palo Alto: CA, Retrieved Saturday February 21, 2009 from <http://www.air.org/news/documents/Outdoorschoolreport.pdf>
- Ballantyne, R., Fein, J., Packer, J., (2000). Program effectiveness in facilitating intergenerational influence in environmental education: lessons from the field. *The Journal of Environmental Education*, 2.
- Beals, S. (4 November 2007). Raising Little Green Thumbs: School Focusing OnEnvironment. *McClatchy - Tribune Business News*. Retrieved February 23, 2009, from ABI/INFORM Dateline database. (Document ID: 1376994651).
- Blair, D. (2009). The Child in the Garden: An Evaluative Review of the Benefits of School Gardening. *The Journal of Environmental Education*, 40(2), 15-38. Retrieved February 23, 2009, from ProQuest Psychology Journals database. (Document ID: 1617888521).
- Gallagher, C., McDonough, M., Namfa, B., Wheeler, C. (2000). Sustainable environmental education for a sustainable environment: lessons from Thailand for other nations. *Water, Air, and Soil Pollution*, 123.
- Grant, T. & Littlejohn, G. (eds), 2005, *Teaching Green - The Elementary Years: Hands-on Learning in Grades K-5*, Toronto: Green Teacher.
- Haigh, M. (July, 2006). Promoting environmental education for sustainable development: The value of links between higher education and Non-governmental Organizations (NGOs). *Journal of Geography of Higher Education*. 30 (2), 327-349. Retrieved February 21, 2009 from Ebscohost database.
- Jacobson, S., McDuff, M., & Monroe, C. (2006). Conservation education in the schools. In W.J Sutherland (Ed.), *Conservation Education and Outreach Techniques* (pp. 85 – 131). New York: Oxford University Press Inc.
- McCarthy, J. (2001) *Environmental Education in Elementary Schools*. Report sent to The Captain Planet Foundation. Atlanta, Georgia.

Appendix 1 Literature Review

Environmental Education: A Process for Changing Attitudes and Behaviors Toward the Environment

Environmental Education Literature Review

ESCI 375: Applications of Sustainable Development

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Galen University, Spring 2009

Introduction

An interest in environmental education has been growing over recent years. Studies have shown that to be effective, environmental education programs should target younger students as well as focus on building a relationship with nature. Building a sense of place and positive attitudes towards the environment is easily done through interactive and outdoor programs. These approaches have been the most successful in implementing and seeing positive feedback in environmental education.

Existence of Environmental Education

McCarthy (2001) states that the primary justifications for the existence of environmental education programs that are most often noted were “ecological”, “conservationist”, and “educational.” The definition of the ecological justification is that “if ‘everything is connected to everything else’, we need to learn to respect the relationships of interdependent social and biological systems. Environmental education supports such understandings” (McCarthy, 2001). The conservationist justification is defined as students’ need to “be taught the wise use and development of the earth’s limited supply of natural resources” (McCarthy, 2001). McCarthy, (2001) states that the educational justification is defined traditionally as “education that has served to equip citizens with the knowledge and understanding needed to make decisions and take action.” McCarthy concludes that environmental education is a key to solving society’s pressing environmental problems. Creating environmental education for younger ages is seen to be more effective than education later in a student’s career.

Systematic planning, implementation and evaluation are the foundation of successful environmental education programs. Environmental education programs within the school system take many forms and include using supplemental materials provided by non-governmental

organizations (NGOs) or curricula that focus solely on the environment. According to Jacobson, McDuff and Monroe (2006) environmental education has remained marginalized from the formal school systems because there is no consistency in how it is administered worldwide. This marginalization is also attributable to the fact that in some countries environmental education is housed within a ministry or government department, but in most countries, there are no formal policies or supporting institutions to oversee it. In these countries, NGOs and other agencies have been providing informal, though less coordinated, support.

Environmental education programs in the school system are effective when benefits accrue to all involved. When project proponents assist teachers and administrators in making their jobs more effective, the approach becomes more practical. The most successful programs have been those that have identified strategies to meet the schools' education needs by involving students in their local environmental needs. Education about the local environment is included in general education requirements. However, these general requirements constrict learning to the classroom and are not focused around outside interactions with nature. Therefore, it is imperative that environmental education programs link these academic requirements with interactions with the natural world. Successful programs within the school system can be achieved using a variety of approaches including environmental based curriculum or action projects (Jacobson, McDuff and Monroe, 2006).

Being Effective-Early Education

There is a lack of environmental education being taught in elementary schools throughout nations like the United States. Students should be taught at a young age that they have a direct impact on the environment as well as that the environment has a direct impact on them. They are capable of comprehending environmental matters at a young age, as evidenced in numerous studies (McCarthy, 2001).

McCarthy (2001) suggests that environmental education programs should follow a “knowledge-attitude-behavior change model,” which asserts that an increase in knowledge leads to a change in attitude, which then influences behavior. McCarthy’s (2001) article drew from several papers that looked at children who have experienced environmental education. He deduced that students can understand the concepts they are presented with and have more positive attitudes towards the environment than their classmates who did not receive the same lessons and concluded that this approach clearly allows for effective education.

McCarthy (2001) conducted a test on the effects of a formal environmental education program among some seventh grade students. The study evaluated the effectiveness of the program using several key components and provides information on pre/post tests that were given to assess the impact. The conclusion was that the program was successful as it showed a measured increase in the students’ environmental awareness.

McCarthy (2001) also presented a longitudinal study of the development of students’ scientific conceptions regarding ecological processes. These processes included conditions for life, decomposition, and the role of the flower in plant reproduction. The study focused on twenty-three students who were interviewed eleven times between the ages of nine and fifteen, and who were interviewed again at the ages of fifteen and nineteen. The study concluded that conceptions developed at an early age were important for future conceptual development, so an early introduction of certain environmental concepts could aid students in more fully understanding ecological processes.

According to Haigh (2006), learning more about the environment generally translates into learning more about what has been done to the environment rather than what can be done to care for it. Haigh (2006) further states that environmental education can contribute effectively to sustainable development only if it is developed and implemented as a process that remains with the students even after leaving the classroom; that is, it is a lifelong process that is not limited to

only a few years of formal education. Environmental education must do more than create and increase awareness of environmental issues. It should affect students in such a way that they adjust, or consider adjusting, the way they act in the world (Haigh, 2006).

Building Connections with Nature

Children learn best through active exploration of the world around them, and for this reason the hands-on, multi-sensory, multidisciplinary nature of environmental education is particularly well suited to meeting the developmental needs of students in the elementary years (Grant and Littlejohn, 2005).

Grant and Littlejohn (2005) argue that it is vital for students to have opportunities to develop a personal connection with nature because we protect what we care about, and we care about what we know well. When students are encouraged to explore the natural world — to learn about local plants and animals, to observe and anticipate seasonal patterns— they are more likely to develop a lifelong love of nature that will translate into a lifelong commitment to environmental stewardship.

Education should emphasize our connections with other people and other species, and between human activities and planetary systems. We are connected to other people, other species, and other lands through the foods we eat, the clothes we wear, the items and materials we use every day, and our common reliance on a healthy environment. By gaining an understanding of this global interdependence, children become better equipped to make everyday choices that respect the rights of others and lessen their impact on the Earth's life support systems (Grant and Littlejohn, 2005).

According to Grant and Littlejohn, (2005) education should help students move from having a basic awareness, to gaining a deeper knowledge, and then to action. Even young children should have opportunities to take action to improve local environments. When students

act on environmental problems, they begin to understand their complexity, to learn the critical thinking and negotiating skills needed to solve them, and to develop the practical competence that democratic societies require of their citizens. At the same time, educators have a responsibility not to burden children with catastrophic and complex environmental problems that are beyond their ability to help remedy. Finding the right balance is crucial.

The question of how and to what extent environmental education programs affect students has been discussed for several years. However, only recently has there been an interest in going beyond specific outcomes, such as environmental knowledge, attitudes and skills. Outdoor education is a vital component of environmental education. At the core of these programs is the goal to get students into nature and actively engage them in their lesson materials. In practice, however, outdoor programs vary greatly in content and duration. A study conducted by the America Institute for Research (2005) among 255 sixth grade students from four elementary schools who participated in three outdoor education programs noted significant increases in one of three areas. The study looked at the impact on social and personal skills, stewardship and appreciation for the environment, and increase in knowledge and understanding of science concepts. The most notable was “concern about the environment.” According to the study, parents and teachers reported that their children had significantly “larger gain in environmental behaviors, when compared to children who did not attend the program” (America Institute for Research, 2005, p. vi). Furthermore, teachers and the outdoor education staff reported that they observed other positive outcomes among children who attended the program. These included “increased confidence and self esteem, positive relationships among students and reduced discipline and behavior problems” (America Institute for Research, 2005, p. vi). In essence, students who participate in outdoor education programs are in tune with positive environmental behavior.

Outdoors Experience in Environmental Education

In his 2007 article, Beals talks about the implementation of environmental education into primary school curricula. At an elementary school in Connecticut, University of Connecticut interns are making an effort to help teachers include nature and the environment in daily classroom curricula. They are using the environment to help teach subjects like math and poetry. This integrated, cross-subject approach and its complementary activities allow students to get outside and have proven to be successful. Activities like collecting leaves outside and writing poems about them, or fashion shows with recycled clothes, or swapping books among students, all help to build environmental awareness.

Blair (2009) points out that the National Environmental Education and Training Foundation endorsed learning within nature, as the natural environment enables learning that is problem-based and interdisciplinary, with a significant positive impact on achievement. Like the program at the Connecticut elementary school, gardening as an educational instrument is able to reach across disciplines to provide a more complete means of education (Blair, 2009). Beals (2007) quotes one of the University of Connecticut interns as saying that “environmental education is a key thing...it provides students with a more well-rounded education.”

In Queensland, Australia, environmental educators similarly use outdoors environmental experiences to help the students learn (Ballantyne, 2000). Activities like planting trees, cleaning creeks, canoeing, and taking rainforest walks helped to raise awareness about the environment and influence attitudes among students. From a survey conducted among students from grades 5-12 in Queensland schools, and their parents, Ballantyne (2000) concluded that involvement in outdoor activities was identified as one of the most effective aspects of a program’s success.

Hands-on Learning

Blair (2009) states that other hands-on activities—like gardening, for example—can be immensely helpful in guiding a student’s environmental education. Recently, states like Texas, California, and Vermont have actively promoted the integration of school gardening into school curricula, especially at the primary level, providing curricula and evaluative research to schools. In Vermont, home of the National Gardening Association (NGA), the state, in conjunction with NGA, provides demonstration gardens, national newsletters, and teacher education. Gardening is increasingly being seen as an effective tool for environmental education.

Gardening can also be incorporated into a model of place-based learning by collaborating with rural community partners that aid and facilitate the study of local natural resources. A school gardening program can help redesign the outdoor space around schools into learning landscapes. Today, children in the U.S. overwhelmingly lack experiential understanding of the environment and of natural ecosystem complexity. Eighty-three percent of the U.S. population lives in metropolitan areas, where urban sprawl and shortages of natural areas hinder the frequency of positive experiences with natural elements in the environment. Contrast this with the experience of a majority of rural children, who have the opportunity to find elements of wonder and intrigue in nature, while establishing intimate or sacred places that help them learn about the world around them (Blair, 2009).

Beals (2007) notes that the students at the Connecticut elementary school were also taking part in hands-on activities. Every morning, the students pack up recyclable items and take them to school, where they sort them into designated bins. After lunch, they compost the food waste outside the school.

In the Queensland schools, Ballantyne (2000) mentions some students’ replies to the survey which indicate the effectiveness of hands-on learning. One student said, “since I did the test (electricity audit), me and my whole family have been trying to save power.” Students also

cited the opportunity to test water or air quality in the local environment as a good chance to learn about nature.

Influencing Attitudes Toward the Environment

Beals (2007) also identified other key elements of the environmental education experience. The simple learning of facts about the environment and problems or issues in the environment was a key to developing an understanding of why there needed to be a focus on getting involved with the environment. Combined with hands-on experience with water testing and research on environmental topics, the students appeared to develop more of a passion for the environment. Beals (2007) notes that at the Connecticut elementary school, environmental education seems to be successfully grooming a new generation of environmentalists.

Gallagher (2000) writes about educational programs in Thailand wherein research and data collection, as well as direct informational knowledge about forests, helped students get involved in community-based efforts to educate the public about the forest and how to protect it. In many instances, students' attitudes towards the environment are significantly impacted. Students studied local forests to learn about the number, kinds, and condition of trees in them and organized reports to present to community members based on this information. Subsequently, the project had great influence in the community as well. One village headman praised the project, saying that before the project began, he worried about the forests because "no one else seemed concerned about them." "Now," he said, "I do not worry any more as I know these students and community members will care for the forests." Clearly, community members were changing their attitudes towards the environment, and these changes seemed to come about as a result of heightened environmental awareness, in addition to first hand involvement in the project.

In Queensland schools, positive attitudes towards the environment were also being noted as a direct result of environmental education (Ballantyne, 2000). In fact, thirty-two percent of students reported that they had changed their behavior in some way as a result of their participation in that particular program. Some students reported that they had learned “it is hazardous to pollute the Earth” or that “water is precious and should definitely be conserved.” Eighty-two percent of parents reported observing some degree of change in their children, most particularly regarding their awareness of and interest in environmental issues, their changing attitudes toward environmental issues, or an overall change in behavior. Such changes in behavior included children taking shorter showers and being generally more aware of their surroundings, or a tendency to gravitate toward classes like Earth Science.

Works Cited

- American Institute for Research. (2005). Effects of outdoor education programs for school children in California. Palo Alto: CA, Retrieved Saturday February 21, 2009 from <http://www.air.org/news/documents/Outdoorschoolreport.pdf>
- Ballantyne, R., Fein, J., Packer, J., (2000). Program effectiveness in facilitating intergenerational influence in environmental education: lessons from the field. *The Journal of Environmental Education*, 2.
- Beals, S. (4 November 2007). Raising Little Green Thumbs: School Focusing OnEnvironment. *McClatchy - Tribune Business News*. Retrieved February 23, 2009, from ABI/INFORM Dateline database. (Document ID: 1376994651).
- Blair, D. (2009). The Child in the Garden: An Evaluative Review of the Benefits of School Gardening. *The Journal of Environmental Education*, 40(2), 15-38. Retrieved February 23, 2009, from ProQuest Psychology Journals database. (Document ID: 1617888521).
- Gallagher, C., McDonough, M., Namfa, B., Wheeler, C. (2000). Sustainable environmental education for a sustainable environment: lessons from Thailand for other nations. *Water, Air, and Soil Pollution*, 123.
- Grant, T. & Littlejohn, G. (eds), 2005, *Teaching Green - The Elementary Years: Hands-on Learning in Grades K-5*, Toronto: Green Teacher.
- Haigh, M. (July, 2006). Promoting environmental education for sustainable development: The value of links between higher education and Non-governmental Organizations (NGOs). *Journal of Geography of Higher Education*. 30 (2), 327-349. Retrieved February 21, 2009 from Ebscohost database.
- Jacobson, S., McDuff, M., & Monroe, C. (2006). Conservation education in the schools. In W.J Sutherland (Ed.), *Conservation Education and Outreach Techniques* (pp. 85 – 131). New York: Oxford University Press Inc.
- McCarthy, J. (2001) *Environmental Education in Elementary Schools*. Report sent to The Captain Planet Foundation. Atlanta, Georgia.

Appendix 2 Lesson Plans

Lesson 1: What is the Environment?

Lesson Overview:

Students will play a game to differentiate items that are a part of the environment from those that aren't. They will then discuss their ideas of what the environment is, what the elements of it are, and what their place is in it, then proceed to think about the environment in a setting outside the classroom.

Instructional Objectives:

- Allow for the contemplation of what “environment” is
- Gain appreciation of the all the different parts of the environment
- Students gain understanding of their place in the environment

Supplies Needed:

- Notepads or paper
- Two shoeboxes, one for “environment” and one for “not environment”
- Slips of paper with nouns written on them

Instructional Plan:

Pretest:

10 minutes

Distribute the pre-test to all the students.

Game:

10-15 minutes

Introduce students to the game “What fits in the environment?” Have two teams line up single file on either side of a table. Each player must grab a noun from the pile and decide whether it fits in “Environment” or “Not environment.” Once the player in front of them is done the next player in line may go. The first team to go through the line twice is the winner.

Discussion

10 minutes

Ask the class what sorts of words they put in each category. Why? Is it because it's usually found in town? Is it because that object is found outside? Inside? Is it because it was made by humans? Is it because it comes from the environment? Then ask about the students themselves. Are they a part of the environment? Explain that the “environment” means everything around them, and that includes plants, animals, and even people.

Outside Activity:

15 minutes

Bring crayons, pencils, pens and paper outside. Bring the class to a location outside a short distance from the building. Ask them to choose a place to sit down and close their eyes for a few

minutes. Then, have them draw, write poetry about, write prose about, or otherwise depict the environment on paper.

Lesson 2: Ecology and Ecosystems

Lesson Overview:

The class will consist of an overview of ecology and the five ecosystems in Belize. Then we will take a walk with the class to the creek to explore the elements of the creek's ecosystem. Finally, we will play a game that will illustrate the connectedness of elements of the environment, helping lead into next week's lesson on interrelationships.

Instructional Objectives:

- To introduce students to ecosystems and ecology
- Leave the students with a critical perspective on what removing species from the environment might mean

Supplies Needed:

- Ball of yarn or string
- Posters of ecosystems

Instructional Plan:

Writing on blackboard:

10 -15 minutes

Write definition of ecology and explain it to the class. Ask if the students know any of the five major ecosystems of Belize. List the five major ecosystems of Belize: wetlands/riverine, savannah, marine, deciduous forest, evergreen forest and list some details of each. Describe the plants and animals found in each, and one issue of what is currently important in that ecosystem (deforestation, tourism, etc.). Use the posters of ecosystems to help demonstrate what they look like.

Walk outside:

10-15 minutes

Take the students on a walk to the creek and explain the riverine ecosystem. Ask them to name some elements of this ecosystem. Then briefly talk about biotic factors: trees, fish, and insects; and abiotic factors: the flowing water, sunlight, and temperature.

Game:

10 minutes

The game will consist of passing around a ball of string. Each student should say they are something that exists in Belize, for example a mahogany tree, a jaguar, a highway, a piece of garbage, or a scarlet macaw. Then they should hold their spot on the string and pass the ball to another student somewhat across the circle. The next student repeats the process. The idea is to have a giant web of string between students illustrating the web of interrelationships of things in our environment.

Outside, have the students stand in a circle. Tell the students how they will have to pass or toss the ball of string around and name the object that they want to be. Once all the students have gone, the game ends. Point out how a web has formed and everything is connected. This is

similar to what happens in our environment, where plants, animals, and man-made things depend on each other and are interrelated.

Lesson 3: Environmental Threats and Problems

Lesson Overview:

This lesson will explore local environmental issues and how they are impacting the land, the ecosystems, and the people of Belize. We will take a look at problems relevant right here in Cayo on a daily basis that affect the environment.

Instructional Objectives:

- Introduce environmental problems in Belize
- Get students to think about the meaning of environmental problems and how those problems affect them

Supplies Needed:

- Paper
- Crayons or markers
- Tape
- Index cards or pieces of paper

Instructional Plan:

Importance of Environmental Problems game:

10 minutes

Children form two teams in two lines the length of the classroom. On the chalkboard will categories in which to place each environmental issue. At the top will be a category for those issues that affect Belize the most, below that will be a category for those issues that affect Belize only somewhat, etc., and at the very bottom can be a category for those issues that do not affect Belize at all. It is up to the students to decide how important each issue is in Belize. Each player takes turns taking a card with an environmental issue on it. They must then take the card and put it on the board where they think it belongs.

Introduction to environmental problems in Belize:

10 minutes

Introduce the class to two issues affecting Belize in general: pollution and deforestation. Define both terms. Talk about the different types of pollution, for example (air, chemical, noise, etc.), and the causes of deforestation. Discuss how these problems come about, how they affect the environment, and how they can affect them even right here in Cayo. Demonstrate how something they do, such as throwing a snack bag on the street, can have impact as far away as the sea turtles on the coast.

Introduction to environmental problems in Cayo:

5-10 minutes

Next, move into a couple of issues in Cayo District. Discuss the deforestation taking place as a result of housing development right off the highway. Address the pollution of the Macal River and how you can get sick from swimming or bathing in it. Talk about species extinction as a result of deforestation, and overharvesting such as the hunting of iguanas, a threatened species in Belize.

Act out an environmental problem:25-30 minutes

Each teacher takes a group consisting of an equal portion of the class and takes them either outside the classroom or away from the other groups. Each teacher then acts out an environmental problem, whether it be by pantomime, poem, acting out a skit, drawing, singing, interpretive dance, etc., and the students must guess what it is. Then the teacher facilitates the group's creation of a similar production, which should take about ten minutes. Then the students must present their production to the rest of the class, which must guess what environmental issue they are representing.

Lesson 4: Climate Change and Global Warming

Lesson Overview:

This lesson will explore climate change and global warming, with an emphasis on how it works and how the students might contribute to it.

Instructional Objectives:

- Introduce the concepts of global warming and climate change
- Have the students gain an understanding of the process behind both systems

Supplies Needed:

- Can of hairspray

Instructional Plan:

Demonstrate everyday contributions to global warming:

10 minutes

Bring in an aerosol can such as hairspray or deodorant. Show it to them and ask what it means to them. What comes out of the can when they use it? Does it affect anything other than their hair?

Global warming animation/diagram:

15 minutes

Use a global warming animation and/or diagram to demonstrate the process of global warming. The first one will be an animation of the pollution resulting from cars, industry, electricity use, etc., and how those can lead to environmental problems like polar ice cap melting and climate change, found at <http://www.youtube.com/watch?v=bHUnzPEy-nA>

Then use a diagram of global warming to help explain to the students the contributing factors and the process behind global warming. Go on to define global warming and climate change. Elaborate a little on each definition, then explain the differences between climate change and global warming, and how they are related.

Deforestation Carbon Emissions Game:

15-20 minutes

How the game works: 1/3 of the class are going to represent trees. The other 2/3rds will be carbon molecules. Each of the trees will have ONLY 2 carbon molecules that can attach to it (this will be represented by holding hands). When a farmer/deforester comes in and cuts down the trees and burns it, the tree will become a carbon molecule and they will all be released into the atmosphere (so there will be three in total from each tree). At this point, ALL the carbon molecules will just become part of the gases in the atmosphere. When we give the signal all molecules have to find another tree. The kids/molecules that do not become part of another tree are going to be placed inside the ?emissions? area. This area will a small area roped off where the students have to stand (or a pole in that they all have to hold onto).

The metaphor: The trees can only absorb a certain amount of CO₂ from the atmosphere. In this case, they can only take two molecules at a time. When trees are cut down and burned, CO₂ is released into the atmosphere, and consequently there is more CO₂ and fewer trees to absorb

them. Those molecules that can't find a tree to absorb them are left over, and begin to get more and more concentrated in the atmosphere (in the excess emissions area). This makes the emissions area get more crowded and uncomfortable.

Discussion: The aim of this game is to demonstrate how greenhouse gases can be released into the atmosphere. It is a simple and fun way to get the concept across without over loading the students with too much information. Afterward, talk about the meaning of the game, and how the deforestation of forests ultimately leads to carbon emissions, which in turn contribute to global warming. Discuss how the influx of excess carbon dioxide can lead to an uncomfortable crowding of carbon dioxide molecules in the atmosphere (which is what traps the heat from solar radiation in the atmosphere and leads to global warming).

Lesson 5: Population Problems and Global Sustainability

Lesson Overview:

Today's lesson will focus on global problems caused by rising population densities and then move into issues of global sustainability. With all the problems we've introduced leaving a pretty bleak outlook for the students, we will attempt to counteract that by pointing out ways in which people lived sustainably in the past, and then discussing current movements for sustainability.

Instructional Objectives:

- Students gain an understanding of how overpopulation is affecting the planet and our environment
- Students are introduced to how problems with sustainability have been addressed in the past, and how some areas are addressing them today

Supplies Needed:

- Piece of wood, piece of cardboard, or length of rope or twine
- Projector and laptop for PowerPoint

Instructional Plan:

Population density game:

10 minutes

Use a piece of wood, a piece of cardboard, or a spot on the ground enclosed on the ground with rope that is nearly big enough for all the students to stand on/inside of. Tell one student to stand in the space. Then, have two students stand in it, then four, then eight, sixteen, etc. It will begin to get hard to fit everyone and it will start to get uncomfortable to be that close together.

Introduce population dynamics:

10 minutes

Talk with the class about the game and how it shows how increasing population can cause problems. Draw a diagram on the board showing how the planet has a growing human population but a fixed quantity of natural resources. Discuss how the great number of people on Earth is affecting the planet. Ask what the problem is with the rapid population growth that's taking place around the world. Talk about the following problems as a result of high population densities:

1. Increased production
2. Increased consumption
3. Increased use of natural resources
4. Increased pollution and waste

Sustainability:

5 minutes

Introduce the term "sustainability." Ask if any of the students know what it means, then proceed to define it and write it on the chalkboard.

Global Solutions of the Past:

15 minutes

Talk briefly about how society worked in the past to sustain life. What did people do before there was power, before there were cars and supermarkets and factories to make everything they need? We will use a PowerPoint presentation with pictures of these means of sustainability to help illustrate these ways of life.

1. How did people get around?
 - a. Horses
 - b. Two feet
 - c. Canoes
 - d. Bicycles
 - e. Sailboats
2. How did people get food?
 - a. Subsistence agriculture
 - b. Horses and ploughs
 - c. Windmills
3. How did people do things at night?
 - a. Went to bed
 - b. Candles
 - c. Moonlight
4. How did people get clothes?
 - a. Pick cotton
 - b. Shear sheep
 - c. Weave
 - d. Knit

Global Solutions of Today:15 minutes

1. Renewable Energy
 - a. Solar
 - b. Wind
 - c. Biofuels
2. Conservation
 - a. Land conservation
 - b. Water conservation
 - c. Ecological/habitat conservation
 - d. Resource conservation
3. Environmental Standards
 - a. Emissions
 - b. Deforestation
 - c. Chemical pollutants

Lesson 6: Individual Solutions and Wrap-Up

Lesson Overview:

This lesson will focus mainly on reviewing what the students have learned over the semester and seeing what they have learned. An additional focus will be on personal solutions to larger environmental problems, with an emphasis on eating local food.

Instructional Objectives:

- Wrap up the course and review earlier topics
- Introduce some personal environmental solutions that students can use in everyday life

Supplies Needed:

- Watermelon
- Bananas
- Pineapple
- Bowls
- Forks

Instructional Plan:

Note:

If it's nice out, all of today's class can be conducted outside, and as a final class for the semester, it seems appropriate to make all of today's instruction a component of outdoor education.

Overview of class so far:

10 minutes

Review some of the topics that have been covered with the students. For each topic, reintroduce it and ask what they can tell you about each. Ask how much they remember about the games and what they remember from inside the classroom.

Individual solutions:

10 minutes

Hand out pencil and paper and ask each student to write down a few individual solutions they can do to help the environment. Feel free to add ideas along the way if they have trouble or miss any good ones. Remember some personal solutions such as eating local food, not littering, turning out lights or turning off faucets, picking up trash around the house, and putting garbage out where it can be collected. Use a jar of local peanut butter and a jar of imported (JIF, etc.) peanut butter to illustrate the differences between local and foreign products and speak briefly about the relative advantages/disadvantages of each.

Post-test:

5 minutes

Give the students the post-test to help identify what they have learned and how far they have come in the course of the semester.

Snack time:

15 minutes

As the perfect example of the benefits of local food, share a snack of fruit salad with the class. We're using pineapple, bananas and watermelon from the local market. Don't forget to use some lime juice for the bananas! Banana bread is another possibility.

Appendix 3

Pre-test

Pre Test!

1. Do you think that you as a person play an important role in affecting the environment?

Circle: Strongly Agree Agree Neutral Disagree Strongly Disagree

If so, briefly describe how:

2. Name one environmental problem in Belize:

3. How important is the environment to your everyday life?

Circle: Very Important Important Don't Know Unimportant

4. Do you prefer learning indoors in a classroom or outside?

Circle: Indoors Outdoors

5. What is your favorite subject in school?

Bonus What's your favorite snack?

Appendix 4 Post-test

Post Test!

1. Do you think that you as a person play an important role in effecting the environment?

Circle: Strongly Agree Agree Neutral Disagree Strongly Disagree
If so, briefly describe how:

2. Name one environmental problem in Belize:

3. How important is the environment to your everyday life?

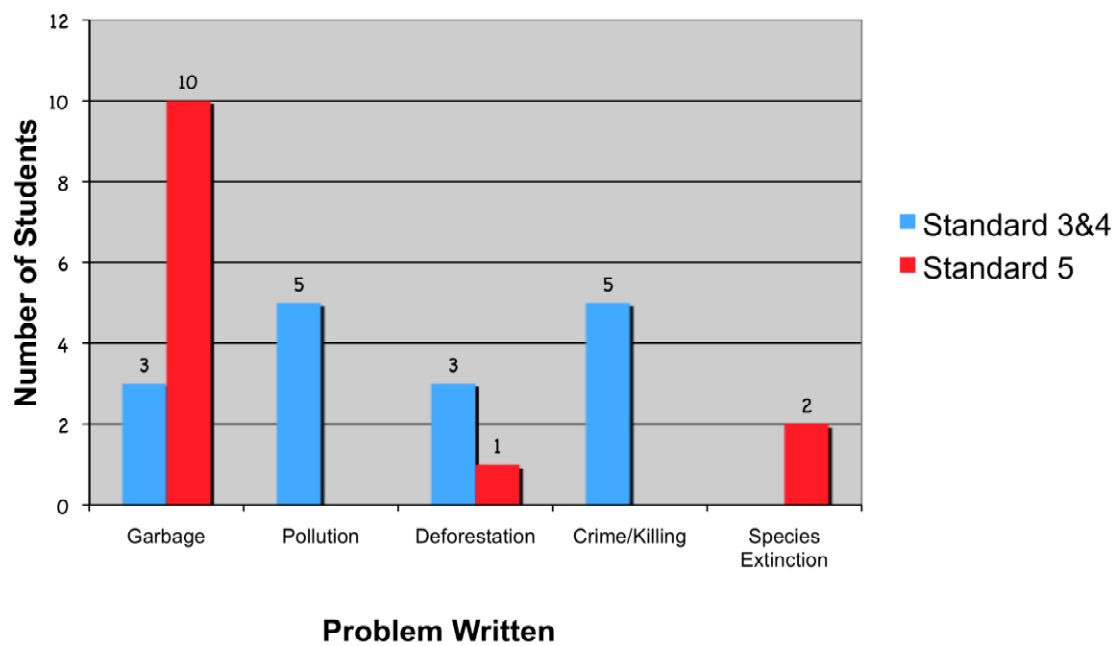
Circle: Very Important Important Don't Know Unimportant

4. What is something you can do to decrease your impact on the Environment?

5. What is one new thing you have learned from us?

Appendix 5 Graph of Responses from Question #2 of Pre-Test

Name One Environmental Problem in Belize Pre-test Results



Appendix 6

Graph of Responses from Question #2 of Post-Test

Name One Environmental Problem in Belize:
Post-test Results

