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INCORPORATING ENVIRONMENTAL EDUCATION INTO THE CURRICULUM
THROUGH THE USE OF CHILDREN'S LITERATURE

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Education

by
Tina Marie Prosch

June 1996


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Approved by:



Dr. Darleen Stoner, First Reader

June 14, 1996

Date



Dr. Iris Riggs, Second Reader

ABSTRACT

This project uses children's literature books to teach environmental concepts in grades Kindergarten through sixth utilizing all areas of the curriculum: language arts, mathematics, science, social studies, art, music, and physical education. The fictional books chosen for this project were Fox Song by Joseph Bruchac (1993), Just A Dream by Chris Van Allsburg (1990), and Whale's Song by Dyan Sheldon (1991). Units were developed based on the storyline of each book and applicable environmental concepts. The units encompass thematic teaching and whole language strategies.

ACKNOWLEDGMENTS

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I also would like to thank all of my colleagues in both California and Michigan who assisted in field testing, reading, and supporting me in my endeavors.

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TABLE OF CONTENTS

ABSTRACT iii

ACKNOWLEDGMENTS iv

INTRODUCTION 1

REVIEW OF RELATED LITERATURE

 RATIONALE FOR ENVIRONMENTAL EDUCATION 5

 ROLE OF CHILDREN'S LITERATURE 7

 INTEGRATION INTO THE CURRICULUM 8

GOALS AND OBJECTIVES 15

DESIGN OF PROJECT 16

IMPLICATIONS FOR EDUCATORS 17

APPENDIX A: FOX SONG BY JOSEPH BRUCHAC 18

APPENDIX B: JUST A DREAM BY CHRIS VAN ALLSBURG 31

APPENDIX C: WHALE'S SONG BY DYAN SHELDON 51

APPENDIX D: ANNOTATED BIBLIOGRAPHY

 OF CHILDREN'S BOOKS 64

REFERENCES 66

INTRODUCTION

After dinner Walter took out the trash. Three cans stood next to the garage. One was for bottles, one for cans, and one for everything else. As usual, Walter dumped everything into one can. He was too busy to sort through garbage, especially when there was something good on television (Just A Dream by Chris Van Allsburg, 1990).

Does the excerpt from Just A Dream epitomize most children's attitudes towards the environment? What are children learning in schools, at camp, or at home about environmental problems? Are they being prepared to deal with the circumstances of overpopulation, toxic waste, and depletion of natural resources? Do they see a personal connection with these problems?

This project used three children's picture books that deal with environmental attitudes and issues: Just A Dream by Chris Van Allsburg (1990), Fox Song by Joseph Bruchac (1993), and Whale's Song by Dyan Sheldon (1991). The environmental concepts in these fictional books are highlighted and reinforced through using interdisciplinary activities. It is this author's hope that this project will inspire educators to adopt these and other children's books to incorporate environmental issues into their curriculum, moving students from awareness to action.

The term "environment" is broad-based and encompasses the natural world and the built world in which we live (Arms, 1990). Roxborough (1988, p. 28) wrote, "as we are all part of this world, we must be encouraged to observe, experiment, discuss, and to be active to grasp a fuller understanding of the world as a whole."

Environmental education is interdisciplinary, taught in or out of the classroom, which can incorporate all subjects of an already established curriculum. Environmental education can be woven through daily lessons by using children's picture books with environmental topics such as energy conservation, endangered species, meteorology and natural habitats. Educators, whether a camp counselor or classroom teacher, can utilize these books to stress respect and personal care of the environment, along with the importance of a sustainable future through individual actions. Education is necessary in order to solve today's problems, and they can only be solved by individual actions (Arms, 1990).

Education is the means by which society prepares children to become responsible citizens; thus education must be environmental (Ramsey, Hungerford, & Volk, 1992). Yet, many school curricula neglect the environmental aspect in their required curriculum. This project has demonstrated how environmental issues can effectively be integrated into any educational program through the use of children's

literature, thus assisting in the development of a rich, meaning-centered, thinking curriculum. It supports the recommendation by the California Department of Education in It's Elementary that educators have a rich, meaning-centered, thinking curriculum established for students (1992).

The books used for this project deal with many of today's environmental issues: deforestation, air and water pollution, overpopulation, loss of habitats, homes, and heritage. The activities use a science concept as a running theme, incorporating whole language strategies along with many other teaching techniques. The activities start on an awareness level progressing to action.

The activities were designed for students in Kindergarten through sixth grade. Primary grade activities were designed specifically for grades Kindergarten through third and have been field tested with students at that level. Upper grade activities have been field tested with students in grades four through six and are appropriate for those grade levels.

Many children's books were read for this project. The books chosen and referred to in the units have been noted in the annotated bibliography.

REVIEW OF RELATED LITERATURE

Rationale for Incorporating Environmental Education

Environmental education has been defined as a way to "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, Hungerford, & Volk, 1992, p. 36). The goal of environmental education is to improve the quality of life by providing people with the tools they need, empowering them to solve and prevent future environmental problems (Braus & Wood, 1993).

Educators often feel threatened by environmental education due to a lack of information, materials, or the misunderstanding that this is another popular innovation to add to core curriculum in an already chaotic schedule. Although there is widespread interest in environmental education, curriculum development has not been a priority (Disinger, 1989). Yet, by incorporating environmental education into daily lessons, educators can try new activities and learn more about issues concerning the environment along with the students (Braus & Wood, 1993).

It's Elementary (California Department of Education, 1992) stated that students are actually more like scientists inclined towards making sense of the world, providing a powerful motivation to learn. This motivation can be used

to develop the ability to think critically and creatively (Braus & Wood, 1993), as well as a way to draw students into participation and action. Thus, educators must seize the opportunity to move beyond traditional methods of teaching, incorporating issues of and interaction with the natural world into a curriculum (Cohen & Trostle, 1990). Students should be given the opportunity to delve into nature, to seek information firsthand rather than only in science books.

Educators must help students to "build on awareness to develop values, motivation, and a need to move themselves and others to action" (Kalinowski, 1990-1991, p. 7), along with clarifying the students' role and how they contribute to environmental problems (Braus & Wood, 1993). To accomplish this, environmental education programs must be infused into all subject areas at all grade levels, and relate to student's experiences, being as concrete as possible (Engleson, 1990).

Involving a child in the outdoors fosters their ecological understandings (Cohen & Trostle, 1990). By fostering their understanding of ecological and environmental issues, educators will develop students capable of making responsible decisions towards a sustainable future concerning their community, country, and world.

Role of Children's Literature

One of the best ways to incorporate environmental education in the classroom is through children's literature (O'Brien & Stoner, 1987). Literature has enormous power. It enables a child to step beyond their own backyard into a world different from their own. Literature books offer children a chance to reflect on our shared environment along with providing clear explanations of important concepts. Stories also highlight social and moral concerns, stimulating a better understanding of the world through the use of language and images (Harris, 1990). Reading or hearing stories and other literature that present conflicts of any kind enable students to develop their perceptions of issues in history and current times, according to With History-Social Science for All, (California Department of Education, 1992).

Lamme and Krogh, with Yachmetz (1992) wrote that children identify with characters in a story, which can lead to the development of role-taking, empathy, and the ability to reason. They also stated that a literature-based program lends itself to extension activities while promoting a love of literature. Children begin to compare their actions with those of the characters in the story; so begins the problem solving as students define their values with those of the characters and of society. "As they identify with characters in stories, children learn role-taking, which can

lead to the development of empathy and the ability to reason from more than an egocentric point of view" (Lamme et al., 1992, p. 13).

Educators can combine the strengths of literature with an existing elementary program to enrich student's understanding of ecology. Careful selection of literature books can help to reinforce previous lessons as well as support enrichment activities (O'Brien & Stoner, 1987). Using children's literature to develop students' knowledge and awareness of ecological issues will assist them in making responsible decisions concerning the world around them in a non-threatening way. As educators, "we can provide a mechanism to extend the impact of our teaching far beyond the few hours we spend with our students" (Vogl, 1985, p. 2).

Integration into the Curriculum

Environmental content and skills can often be integrated into existing curriculum without interfering with current established guidelines (Ramsey et al., 1992). Elaborate units or lessons do not need to be written which isolate environmental issues. Language arts, mathematics, music, art, drama, science, and history can all be taught using environmental education as the theme connecting all curricular areas (Braus & Wood, 1993). It's Elementary (California Department of Education, 1992) stated that

integration of units benefits students and allows them the time to accomplish a task.

Environmental education should not be treated as a single subject but as a support to enhance all curriculum. Incorporating environmental issues into a program can provide problem solving at all levels, topics, and problems that cut across the curriculum and develop the integration of knowledge (Wilke, 1993).

Disinger (1989) found that most educators infused environmental education into mainstream curricular areas. Infusion was easier due to minimal resources needed and supplementary resources that already existed. In order to enhance students awareness an educator needs only to begin with an environment students are familiar with: the classroom, the campus, the backyard, or the park. From there, educators can develop the students' appreciation the world by incorporating environmental issues throughout existing curriculum.

One way to explore and infuse these issues is through mathematics. It's Elementary (California Department of Education, 1992) stated that students interpret the world around them through mathematical experiences. The Mathematics Framework for California Public Schools (California Department of Education, 1992) also stated that students understand mathematics best when they have wrestled with issues, struggled with problems, and reached

conclusions. This holds true for anyone dealing with a problem--mathematics or otherwise. People understand issues better when they are personally connected with them, struggle, and actively work to reach a solution. Lessons in mathematics are a way to "explore and gain control over situations in the real world" (It's Elementary, California Department of Education, 1992).

Incorporating awareness of the environment into daily lessons extends the math lesson from rote mastery of computational skills to exploring the real world through everyday experiences according to the Mathematics Framework for California Public Schools (California Department of Education, 1992). It's Elementary (California Department of Education, 1992) echoed the same philosophy: students are expected to be active, engaged participants in their learnings.

Language arts is also a key curricular area in an elementary program. Basal readers and whole language curriculum often include stories dealing with animals: whales, worms, pandas, butterflies, bears, and others. Including lessons centered around an environmental aspect or issue only takes a little imagination (Cohen & Trostle, 1990). Good elementary programs use reading not as an independent subject, but as a tool of discovery that entices students to learn of new worlds (It's Elementary, California Department of Education, 1992).

Whole language strategies are used in the activities of this project. McKinsey (1990-91) stated that according to the whole language philosophy, literature is used as the foundation for teaching in all curricular areas. Literature then becomes the mode by which personal experiences are enriched and intelligent interaction takes place (Lamme et al., 1992). Environmental topics can also be incorporated through poetry about nature, pollution, or environmental ethics (Braus & Wood, 1993). Books with environmental themes inspire collective responsibility for a sustainable future.

Knowing that we are all responsible for the preservation of our planet, educators can link social studies themes using available literature from the reading series. With History-Social Science For All (California Department of Education, 1992) noted that through literature, the understanding of historical concepts and vocabulary is placed within an understandable context. It goes on to say that the study of history becomes enjoyable because literature ignites the imagination. Students become aware that people have the same basic needs whether it be a story written about life in the 1800s or present times. They should also be able to predict that these basic needs will prevail into the future also, thus creating a need for moral challenges and cultivating a sense of responsibility.

It's Elementary (California Department of Education, 1992) pointed out that literature should be used to enhance history studies incorporating adventure, moral challenges, and distant times. Students can examine their own ideas, values, fears, and dreams (With History-Social Science For All, California Department of Education, 1992).

Science is another aspect of the curriculum where environmental concepts can be taught and implemented. The Science Framework for California Public Schools (California Department of Education, 1990) stated that students are most interested in science at the elementary level and that teachers should capitalize on this enthusiasm to make learning enjoyable, interesting, and meaning centered. Students can study their world through general science, biological science, physical and earth science which fit naturally into environmental concepts (Braus & Wood, 1993). Roxborough (1988) wrote that since we are all part of this world, we must be encouraged to observe, experiment, discuss, and participate in it to fully understand our relationship with the world as a whole.

As in the literature books used in this project, science can be taught through topics such as predator/prey relationships, renewable and non-renewable resources, energy flow, or life cycles. It's Elementary (California Department of Education, 1992) stated that students should be doing science at least forty percent of the time, not

only engaging their minds, but their hands also. Science, including environmental education, should be integrated into all subject matters becoming the binding thread. Changes need to be made in order to develop citizens of tomorrow who are knowledgeable concerning the environment and its associated problems, helping to make informed decisions and conserve our natural resources.

Another aspect of the curriculum that could easily lend itself to incorporate environmental concepts would be music, drama, and art. "There are many opportunities to combine environmental education with the arts, or when teaching these subject areas" (Braus & Wood, 1993, p. 38). Students could paint murals, create dances to poems they have written, write songs, and more. In, A Guide to Curriculum Planning in Environmental Education (Engleson, 1990), it stated that the arts can be a means through which the environmental message can be communicated. Educators need only to use a little imagination or be open to allowing time for the students to use theirs.

GOALS AND OBJECTIVES

The goal of this project was to create thematic units for educators that were literature-based while incorporating environmental concepts. The purpose of the units was to aid students in grades Kindergarten through sixth gain respect and appreciation for the environment while developing specific knowledge, a sense of responsibility for the environment, and an enthusiastic commitment toward action.

This goal was achieved in the following manner:

1. Choose three books with environmental emphasis and develop units based on environmental science concepts. Activities were developed based on the concepts derived from each book. The activities were designed to suit all areas of the curriculum.
2. Have activities reviewed by the writer's colleagues.
3. Have activities field tested by the writer as well as by colleagues in California and Michigan.

Modifications to the activities were made where needed based on field testing.

DESIGN OF PROJECT

The books chosen for this project were Just A Dream by Chris Van Allsburg (1990), Fox Song by Joseph Bruchac (1993), and Whale's Song By Dyan Sheldon (1991). For each story, thematic units were developed based on associated environmental concepts. Concepts focused on topics such as change, living things are dependent on the environment, values and how they relate to the utilization of resources, the value of wildlife, and the human threat to wildlife and the environment. Curricular areas covered in the units were: language arts, mathematics, science, social studies, art, music, and physical education.

Resources used were curriculum guides containing lessons relating to environmental education as well as the writer's own experiences and materials. Lessons appropriate for each science concept and grade level were selected and developed. Some lessons were adapted from the original source. Other lessons were used in their original form, with permission for use noted in the lesson.

Each unit consisted of two to three science concepts that can be taught in two to five day plans depending on time allotment. Each concept contains activities incorporating several curricular areas. Each activity has been described fully.

IMPLICATIONS FOR EDUCATORS

Educators must take the initiative to develop environmental programs for their school. Using children's literature, which is often in the reading series required for the school or district, can offer a wealth of opportunities. Environmental content should be woven through the curriculum using a conceptual theme, along with stressing values, developing a sensitivity for the total environment, and a commitment towards action for a sustainable future.

Educators can plan environmentally based lessons by combining children's literature books and their existing school curriculum. This project has demonstrated how to incorporate many environmental concepts into daily lessons through the use of literature with environmental themes. The units developed are thematically based and encompass all areas of the curriculum. The science concept for each lesson was woven through each curricular area. Background information was given along with student activity pages for educators ready to implement the lessons. This project is meant to be "user friendly" and readily adaptable to any school setting.

APPENDIX A:

Fox Song by Joseph Bruchac

(1993) New York: Philomel Books

A beautifully written and illustrated story of the relationship shared between Jamie and her great-grandmother. Jamie reflects on their special bond and how Grama Bowman taught her about the world around them as shown through Native American legend and customs.

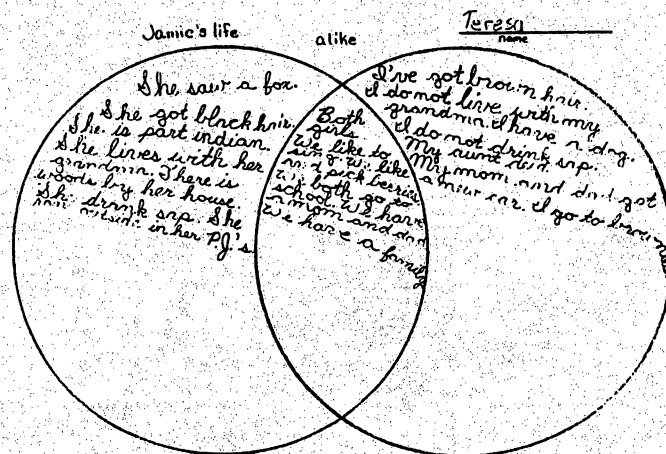
Science Concept 1: Living things are in a process of constant change.

Before reading the story to students, ask them to think about one thing that has already changed their life or something that is changing their life; change can be anything the students feel impacted their life in some way. Record all of the answers given. Introduce the setting and characters of the story; read Fox Song. As you read the story, ask students to listen for things that changed in Jamie's life. After the story has been read, record answers the students have given. The reader should have two lists: student's life, Jamie's life. Students should conclude that their lives are in change. Save the lists for future lessons.

Integrating science concept into the curriculum

Language Arts: For primary students. Reread the story to students or have them retell it to you. On butcher paper or on the board, draw a Venn diagram (see Student Activity #1). The diagram will be used to compare the students' lives to Jamie's. Specify one circle as Jamie's life, the other as the students'. Have them write their name in the blank. This is to help them identify with the side they are writing in for themselves as opposed to the side for Jamie. (See Figure 1) Answers that are solely Jamie belong in the section where the circles do not intersect. Answers that are solely students' belong in the opposing section where the circles do not intersect. Answers that can be for both Jamie and the students belongs only in the section where the circles intersect. While the teacher is recording the answers on the board, students should be recording answers on their page. Compare Jamie's life to that of the students'. Have the students decide in which section their answers should be written. When all students have had the opportunity to answer, ask: "How do you think Jamie's life changed with the death of her "grama"? Since students have just compared their life to Jamie's, use the diagram or list

previously made to help generate answers if needed. Students could draw a picture or write about a time when their life changed.



For upper grade students: Discuss the story and how their lives are similar or different to Jamie's. How have their lives changed? Was it a change for the better? Did they have a choice in the matter? If they were confronted with the same or a similar situation again, what would they do? What would they do differently? After students have discussed what changes have occurred, they could write a diamante poem contrasting how their life was before and after a specific change. See example as follows:

Before
 Angry, Confused
 Losing, Frustrated, Longing
 Family, School, Ability, Self
 Belonging, Renewed, Living
 Warm, Happy
 After

A diamante poem is shaped like a diamond and follows a particular pattern: one word - a noun (the subject); two words - adjectives; three words - participles (-ed or -ing); four words - nouns: the first two relating to the noun on line one, the second two relating to the noun on line seven; three words - participles; two words - adjectives; one word - noun (or the opposite of the subject). It might be easier if students start with the beginning and ending lines first and then develop the rest of the poem.

For all students: Have them notice the different seasons in the story. Discuss how seasons bring about change in the natural environment (leaves falling, butterflies emerging from their chrysalis, when frost is on the ground, etc.).

Explain that a Haiku is a three-lined poem that does not rhyme, and is a type of Japanese poetry consisting of a 5-7-5 syllable pattern. A Haiku has five syllables in the first line, seven in the second, and five in the third line. It is usually written about nature. See example as follows:

Butterfly
Egg, caterpillar,
Chrysalis to butterfly
Constantly changing.

Students can write a Haiku on their favorite season or a particular change that takes place in nature. Primary students can write a class Haiku, while upper grades will do them individually. Suggestion: have students brainstorm a list of appropriate words before developing their poems.

Math: For primary and limited English speaking students: Discuss what season each student likes best. The instructor might want to have pictures available of each season. After a brief discussion, pass out small pieces of paper about three inches square on which students draw their favorite season. When finished, have students paste the pictures onto a graph prepared by the teacher listing the different seasons. When all pictures have been pasted to the graph, involve the students in interpreting the graph by asking: What was the most favorite season? Which was the least favorite? How many total on the graph? How many more did the most favorite season have than the least favorite? Were any seasons not chosen? After the discussion, have primary students make cartoon bubbles (see Student Activity Page 2), writing or drawing something the graph is saying. Cut out and glue the bubbles on to the perimeter of the graph and hang on the wall to refer back to and for students to read. Upper grade students can write story problems using the information on the graph.

Science: Students can study the concept of change through this experiment. Materials needed will be: a large jar, soil, water, an aquatic plant, bird seed. Put soil and fill jar completely with water; allow to settle overnight. Place the jar near a window without a lid. Plant an aquatic plant in the jar, which will grow well in this environment. Do not replace the water that evaporates. While the water is evaporating, have students drop a few bird seeds into the jar twice a week. The seeds will germinate and then rot. Keep adding seeds even after the water has evaporated. The aquatic plant will die when most of the water has evaporated, but the bird seed will successfully grow now. Students will need to add water to the jar now to represent rainfall to keep the plants growing. Students can keep a

journal throughout the process to record the changes that occur. Students should conclude that nature is constantly changing.

Social Studies: For all students: To further heighten students awareness of change, have them bring in baby pictures and the most recent picture they have of themselves. Make sure each student has a pair of pictures. (If some students are not be able to bring in pictures, have them draw themselves.) Divide the class into groups of five and have each group place their pictures on their designated table, making sure the pictures on that table are mixed up. The groups then rotate through the tables trying to match up the baby pictures with the current pictures in that group. When all students have finished matching up the pairs, the students go back to their original table to pick up the pictures and see if they were matched correctly. Ask: Were the pictures matched correctly? Were they easy to match? Which students do you think have changed the most? Which pictures were the easiest to match? What did you notice about the pictures? The teacher might want to include their own pictures for this activity.

Science Concept 2: The best way to enjoy nature is to observe and experience it.

Reread the story with students. Discuss the times when Jamie remembered a special event with Grama Bowman. What were they doing? Where did the memory take place? What was observed? How was it experienced? How do you think Jamie or Grama Bowman felt sharing that experience? Students should conclude that the experiences Jamie remembered are taking place out-of-doors where both she and her "grama" are either observing or interacting with nature.

The following activities will give your students ample opportunity to observe, experience, and appreciate their natural surroundings.

Integrating science concept into the curriculum

Social Studies: Puruse the story with the students, taking note of the different habitats illustrated. Take a walking field trip in your community near the school and on the school grounds. Observe the wildlife diversity of plants and animals. Look for different habitats that exist: parking lot, neighborhood park, an apartment area, mud puddle. Students may want to record new information in a journal or take pictures of the diversity observed. What plants and animals live in these habitats? (Animals can range from a dog to the smallest visible insect.) When the

class returns to school, brainstorm plants and animals that were seen. As the students answer, the teacher should record them on the board, dividing them into separate habitats without the titles being given. When all of the students have had an opportunity to answer, the teacher then asks the students why they think the plants and animals were put into the different categories. If needed, refer to the different habitats that were observed. Through categorizing and analysis, students should then be able to name each habitat. If this is difficult for smaller children, have them draw an animal and place it into the predetermined categories the teacher has posted on the board or chart.

Language Arts: Over the span of a week, engage students in outdoor listening activities. Explain rules that you expect to be followed when outside. Rules could be:

- 1) Stay in the assigned area.
- 2) Talk only after the listening activity is over.
During the activity the students need to listen.
- 3) Stay off the playground equipment.
- 4) Walk slowly to and from the listening area.

Have students find a "special spot" to do their listening. Do this activity at different times throughout the week. Listen for three to five minutes. After each activity, record what was heard in some type of journal. Compare the sounds from a morning observation to one in the afternoon or at recess. Classify each sound as to whether it was natural or artificial. Which sounds were enjoyed most? Least? Why? After students have classified and discussed the types of sounds they heard, have them create an alphabet book.

For the alphabet book, each student picks a letter and a sound associated with that letter. Let students draw, color, and write about their chosen sound. Get creative with the hard to do letters. Using the pages the students have completed, bind them and display as a class book. *Animalia* (1986) by Graeme Base or *Eating the Alphabet* (1987) by Lois Ehlert are good examples.

For all students and for pure enjoyment: Read Native American myths about why the bear waddles or why the sun rises, why does the crow have black feathers, etc. These myths can be found in children's books or in anthologies in local libraries. Discuss why these myths have been preserved and why they were told. Native Americans often observed different aspects of nature and tried to interpret them. These stories are just an example of how we benefit from their observations.

Music: Grama Bowman taught Jamie a welcoming song. This song welcomed the new day and the people Jamie would meet. Have students make up a song to welcome someone they know or to show appreciation for a new day, the flowers blooming, wind blowing, etc. The words can be to a familiar tune, a rap, ballad, or which ever the students wish to pursue.

Contact your local library for tapes or records on Native American chants, songs, or song flutes. Use these recordings to enhance the students' appreciation for other cultural types of music, or simply as background music while they are working.

Art: Make pictures with rubbings. Using a sheet of paper and the side of a crayon, the students make a rubbing by placing the paper over a leaf, blade of grass, or tree bark. Rub the crayon over the paper and watch the shape of the object appear. Remind the students to color lightly. If they press too hard the object will not be as defined. Rubbings can be collected and utilized in a variety of ways. For example, have students take rubbings while on the walking field trip and develop a collage from the rubbings; or incorporate them into a picture or the alphabet book. Also, have students place a sheet of paper on a rock and draw the picture there. The picture will be grainy from the texture of the surface used.

Have students take a close look at shadows. Before taking them outside, ask the class to predict the color of shadows. Take the students outside to make a shadow drawing. Look at the shadows on the school grounds and have them decide which to draw. Put paper on the shadow and trace the silhouette. Discuss with students the color of the shadow. Trace a shadow in the morning, then in the afternoon. Color the shadows using contrasting colors or colors on which students decided. Discuss why the shadow moved.

Science and Art: Review the page in the story related to the tracks in the snow. Ask students which animal could have made these tracks. Owl? Fox? Grama? Discuss tracking animals. Have them look through guides showing different animal tracks such as Signs Along the River: Learning to Read the Natural Landscape (1986) by Kayo Robertson and A Field Guide to Animal Tracking in North America (1986) by James Halfpenny and Elizabeth Bresiot. Check with your local and school libraries for other books containing animal tracks.

After students have become familiar with different animal tracks, have each student choose one. The track they choose

will be the one they use for the following activity. (Before starting this activity, the teacher might want to recruit parent volunteers or have the students pair up to work as partners. This should save some time when it comes to actually carving the potatoes.) Have students choose a potato that has been cut in half. Using a marker, students should draw their selected track on the potato. Cut or scoop out the part of the potato that isn't part of the track. The track should be higher (in relief). Press the potato track into paint and then on to paper. Option: Have students trade potatoes. Using the different potatoes, students might want to make a story out of different animal tracks, just as Grama Bowman did.

Science and Physical Education: Give students the opportunity to observe natural movement: leaves blowing from the wind, a worm crawling, etc. This can be done 10 minutes prior to recess, immediately following recess, or as homework. Have students record their observations on slips of paper. Put the slips of paper into a bag and take the class outside. The students can be divided into smaller groups or remain together to do this activity. Explain that students will draw a slip of paper and then act out that movement. Remind students of the list of movements generated in class. Have one student draw a slip of paper, read it, then act it out. The rest of the class guesses which part of nature is being acted out. The person who guesses correctly is the one who chooses next. This could also be done by group dramatization.

Science Concept 3: Living things are dependent upon the environment in which they live.

Reread Fox Song. Define dependent as something we can't live without. Ask students on what things Jamie and Grama Bowman were dependent. Ask them on what they are dependent. Accept and record all answers. Some answers might be: food, parents, air. Record new answers and circle them if already listed. One answer should be each other. Discuss how people are a part of the environment and that we are all dependent on other people.

Integrating science concept into the curriculum

Language Arts: For primary students: Make a mini-book showing on what the students are dependent (see Student Activity #3). Students can refer to the list generated if they need help. A word or sentence can be written on each page and a picture drawn.

Upper grade students: Make a mini-book showing on what they are most dependent. Have students share their books and explain why they made those choices.

Physical Education: Play a predator/prey game using the example in the book: Owl tried to get the rabbit but the rabbit was too quick. Owl is a predator--the hunter; Rabbit is the prey--the hunted. Discuss, then reinforce this concept by playing the following game.

Directions for the game are as follows. There should be approximately one predator for every six prey for this freeze tag game. Set up a playing field, designating one end as a food source, the other as shelter. (Food tokens will need to be cut in advance.) Scatter the food tokens (cardboard pieces) at the appropriate end of the field. Inside the playing field place three to five hula hoops; these hoops are temporary shelters or safe zones. Predators cannot tag prey if they have one foot in a safe zone. When the game starts, prey move from the shelter towards the food source, trying not to get tagged by a predator. Prey can use a temporary shelter or freeze in place if a predator is stalking them. Each prey obtains one food token, returns home, and then attempts to get another token. Each prey must get three tokens to survive. Predators, however, need to capture two prey to survive. Captured prey are walked to the sidelines by the predator to await the next game. The game can be played for eight to ten minutes. Limiting factors can also be introduced. A limiting factor is anything that can influence a population: food source, habitat destruction, water, hunting, disease, etc. (Adapted from an activity in Project WILD)

Social Studies: Discuss the relationship Jamie had with her great-grandmother. How did they show respect for each other? How did they show respect for the environment? In what ways did Grama Bowman pass on the Native American traditions related to their use of the environment? In what ways have students' grandparents or parents passed customs to them? Students can discuss and then write about traditions that have been instilled in them through family stories, etc. Students might also want to present or demonstrate a custom or tradition.

Upper grade students could explore the history of the area in which they live, or their genealogical history--interviewing grandparents, making a family tree, etc. Have students present the information obtained in a speech or oral report format.

Many books have been written about Native Americans. Here are just a few to reinforce the concept and lesson just presented: When Clay Sings by Byrd Baylor (1972), Buffalo Woman by Paul Goble (1984), and Brother Eagle, Sister Sky by Chief Seattle, adapted by Susan Jeffers (1991).

Science: Use a food chain to stress the concept of dependency on the environment. The following activity does just that. The instructor will need to make name tags and have a ball of yarn ready. Make up name tags representing a part of the ecosystem. A possible word list could be: sun, squirrel, oxygen, space, rain, moss, duck, pond, oak tree, acorn, hawk, rock, rabbit, grass, earthworm, ant, soil. Once the signs have been made, take the students outside. They should sit in a circle, each wearing a sign. Hand a student the ball of string and ask them to roll it to something she or he is dependent upon. After finding the relationship, the student states why she or he is dependent on it and then rolls the ball to that person. Each person takes a turn finding a relationship. A web should begin to form as the ball is rolled. How many relationships exist throughout the web? Is it clear that everything in the system is dependent on something? Introduce a limiting factor such as pollution.

Hook a metal ring on to the end of the web which would be the last person chosen. The ring represents a limiting factor. State that whomever is touched by the ring is harmed by the pollution and must let go. Students can also state how they were polluted. Begin winding up the string. As the teacher winds up the string, the ring will easily glide to the next person holding it. By the end, the string should be completely rolled up and everyone should have been affected by the pollution. Discuss the fact that even though humans are dependent on the environment for food and other needs, we can have a positive or damaging impact on it.

Art: To show how Native Americans and pioneers were dependent on nature, make natural plant dyes. Materials needed are goldenrod flowers, berries, or walnut husks, wool or cotton cloth (no synthetics), and vinegar.

Procedure: 1) Fill a cooking pot with the goldenrod, onion skins, or walnut husks. Use the flowers of the goldenrod, not the stem. Peel and crush the walnut husks. Fill the pot with water and bring to a boil. Simmer for at least one hour. Remember to stir. 2) Allow mixture to cool and drain off liquid through cheese cloth into another pan. Screen out any remaining plant parts and squeeze the pulp with your hands. Use rubber gloves if using walnuts. 3) Bring

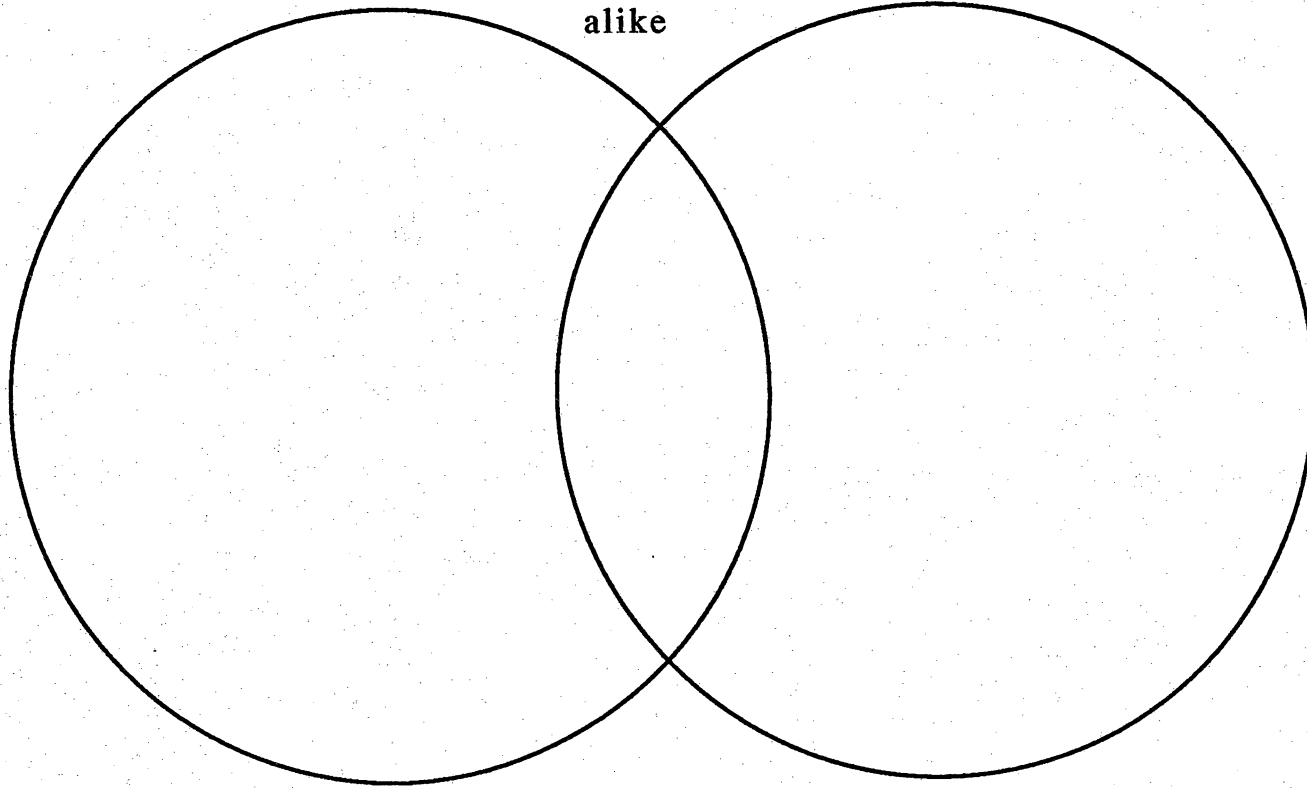
purified dye water to a boil, reduce heat and simmer before adding strips of fabric. Add fabric and simmer for about an hour, stirring with a wooden spoon. Check the fabric until you have reached the desired color. a) Lift out the fabric and rinse with warm water until the runoff water is clear. Hang the fabric to dry and save dye water for reuse if desired.

Students can also make a Huwawanani. This is a piece of flat wood with a loop of string through two holes in the middle of it. It buzzes and whirls when the strings are pulled and relaxed. Anything can be used--a popsicle stick, broom handle, or the remaining tree stump from the Christmas tree. Drill two holes in the center, decorate, run the string through, knot, and whirl away!

Student Activity #1

Jamie's Life

Name



Student Activity #2

Name _____

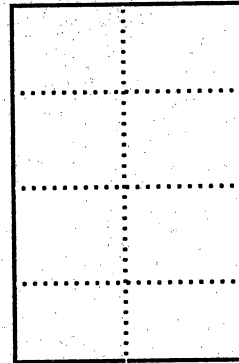
Name _____

Student Activity #3

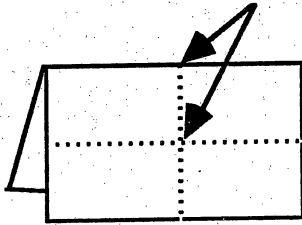
Directions for mini book:

1. Fold the paper in half; Fold in half again.

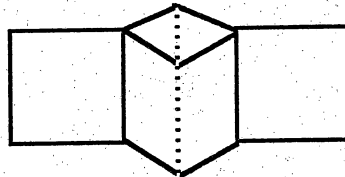
2. Fold the in half vertically; open it up. (there will be eight boxes.)



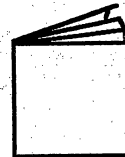
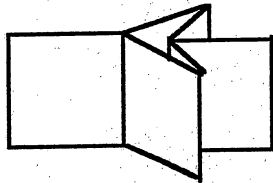
3. Fold the paper in half over your original fold. Cut a slit to the first fold only.



4. Open up the sheet and fold length wise. Now begin to push both ends toward the middle.



5. Keep pushing in to the center until it is flat. Turn the sides in the same direction to complete the mini book.



APPENDIX B:

Just A Dream by Chris Van Allsburg

(1990) Boston: Houghton Mifflin Company

Walter doesn't think that planting a tree is important until he has a dream that takes him to the future. The future is plagued with pollution of every kind. Walter has a rude awakening and decides he needs to change the future by taking responsibility for it today.

Science Concept 1: People's behavior is essential in protecting or destroying the environment.

Before reading the story to students, ask them to think of one problem they see in the environment. Record the answers given. Read Just A Dream. Refer to the list throughout the story if the topic on the page matches a topic on the list. Some discussion questions could be:

- 1) What did Rose value that Walter didn't?
- 2) How did each person's values affect their actions?
- 3) How do Walter's values change during the story?

Integrating science concept into the curriculum

Language Arts: Develop a reader's theater using the different topics in the story such as: water pollution, loss of habitat, deforestation, or recycling. Older students can work in collaborative groups writing their own dialogue while younger students can summarize the story. Also, students can present the reader's theater "Circles On The Earth." (See Student Activity #1).

For all grade levels: students complete a problem/solution organizer (Student Activity #2). Students fill in the problem column by listing the environmental hazards that were referred to in the story. Students then fill in the solutions column by discussing and determining possible solutions for the problem. The result column is filled in last. Review problem one and its solution; discuss what will happen as a result if the solution is accomplished. Record the result. Do each problem in order, step by step. Refer back to the concept when the organizer is completed. How do people's behavior affect the environment? Discuss.

Primary students can write a listing poem dealing with environmental problems raised in the story. This type of poem essentially lists main ideas of the book or topic

chosen. Brainstorm ideas then organize these ideas into a form or list that makes sense. For example:

Owls

Barn Owls, Great Horned Owls, Snowy owls

Owls live in the city.

Owls eat mice and fish.

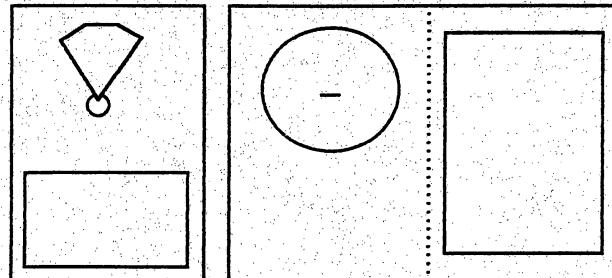
Owls have sharp claws called talons.

But the most important thing about owls is

Owls are losing their habitat.

Older students can develop a picture poem. These poems are words or sentences written in the shape of the topic chosen. Have students chose an issue referred to in the story. Once the topic is chosen, students brainstorm words or sentences related to that topic. The words or sentences are then written in the shape of the topic to make it more concrete than abstract. Some subject ideas are: energy, conservation, pollution, recycling, loss of habitat

For primary and ESL students: Make a dial book. See diagram. Fold a 17" x 22" piece of paper in half. This will be the cover. On an 8" diameter circle, have students fold it in half twice to divide it into four sections.



Students will draw four scenes from the book on the circle and then attach it to the inside front cover of the book. A pie piece will be cut out of the cover to display one scene at a time. At the bottom of the front cover will be pages explaining what each scene is about. Example: Walter had a dream (scene 1); there was a lot of garbage (scene 2); the duck couldn't find a place to rest (scene 3); there was a lot of smog (scene 4); but the future could look like this (scene 5). Notice there are only four sections on the circle. The last scene is drawn and mounted inside of the book. To assemble: the pages describing the scenes are attached on the outside cover. The circle with the scenes drawn on them is attached from the front to the inside of

the cover. The final scene is drawn and mounted on the inside of the back cover.

Math: Read The Lorax by Dr. Suess (1971). Discuss how the recycling of the thneeds could have saved the truffula trees. Then, have students keep a record for week of how many paper products are thrown away. If possible, the record should include items thrown away at home and at school. After a week compile the results. Make a prediction of how many tons of paper this would make. How many trees does all the waste paper represent? Could recycling make a difference? What other options are available? (Reduce-make less waste; reuse waste paper.) Point out the picture in Just A Dream where all of the trees are being chopped down. How does this relate to the concept and to the theme of The Lorax?

Point out that both stories end with a feeling of hope for the future.

As an extension to the math activity, students can collect and display paper products in various stages of manufacturing: tree branch, wood shavings, wood pulp, paper.

To impress upon students how reduction plays a part in the ongoing battle of landfills, have them bring in assorted aluminum cans. Measure the height of the cans and record on a sheet of paper. Crush the cans with a can crusher or by placing it on the floor and stepping on it. After the can is crushed, measure the height again. Record. What is the difference? How can reducing the size of items put in the landfill help in the long run? What are other alternatives to landfills? Students should hopefully respond with: reduce, reuse, and recycle.

Social Studies: For primary and upper grade students. Reread Just A Dream and discuss the environmental topics that are in the book. Have students develop a questionnaire having the questions on the topics. Students then take the questionnaire home and ask their family and friends to complete it. Discuss the answers at school. What do the answers imply about the attitudes of people towards the environment?

For upper grade students. Discuss the following statement: The next 500 years are likely to be a better time to live than the past 500 years. Have students respond by stating their opinion--agree, somewhat agree, disagree, or strongly disagree. To prepare students for this discussion, have them research important events that have occurred within the past 500 years and possibly to predict where the

future is going as seen through technology, medical advances, etc. How do the opinions of today foreshadow the ideas of the future?

Science: To give the students a clear understanding of the concept, read and demonstrate "A Fish Story." All of the information needed is located on the story page itself (Student Activity #3).

For primary and upper grades. Life cycle of the bottle. Ask the students where glass comes from. Is it dug up? Do people make it? Accept all answers and then tell the students how glass is made: sand and other materials are mixed together at high temperatures. Then discuss with students the life cycle of a bottle. It is made at the glass factory, then is sent to the bottling plant. The bottle is then filled with soda and shipped to the store where people buy it and take it home. When empty, the bottle is thrown away, and eventually ends in a landfill where it can last forever. This, however, is one cycle the bottle can make. There is another cycle that the bottle can follow. Have students draw the first cycle in the shape of a "U," beginning with the glass factory and ending with the landfill. Then, have your students think of an alternative to the landfill. Recycling should be the answer. Using the "U" they have already drawn, have the students convert the letter into an "O" by drawing a curved line from their home back to the glass factory. Students might even want to draw a truck with the recycling symbol on it driving from home to the glass factory. Discuss which is better for the environment. How could Walter's dream of the landfill have been changed? When students color their picture, have them color the "U" and "O" in two different colors to differentiate between the two cycles.

Science and Art: For all grade levels and ESL students. Review Walter's original dream of the future and how he felt. Then, discuss what the dream had changed to after Walter began taking responsibility. Record some of the answers. Explain to the students that they are to make a pollution/solution board. Materials needed: Styrofoam cut into 6" squares, tooth picks, crayons, glue, and the Student Activity #4. (Students page can be copied on to tag board for durability.) Student's begin by cutting out the shapes on the student page and folding them in half. They should have three "T" shaped pieces of paper. On one side only, they should draw pictures of pollution, referring to the scenes in Just A Dream. After the pollution pictures are drawn, discuss how the future could look if everyone took responsibility as Walter did. Have students then draw on the opposite side of the paper their goal for a cleaner future.

Relate this activity to the concept. Why are the actions of people essential for protecting or destroying the environment?

After allowing time for the students to complete their boards, give them time to discuss them. Have students explain the reasons they chose the scenes they did. Discuss the environmental effects of the scenes they chose. How could human effects be changed to be more positive? Is there a company or committee regulating environmental issues such as those displayed on the boards? In what ways can everyone benefit from a healthy environment?

Music: To enable the students to visualize their future, or to understand how a composer views the environment, play the following pieces: "Appalachian Spring" by Aaron Copeland, "Grand Canyon Suite" by Ferde Grofe, "Afternoon of a Fawn" by Claude DeBussy, or "Quintet in A Major" (Known as "The Trout") by Franz Schubert. For more contemporary pieces, students might enjoy listening to various tapes using classical music as the foreground with natural sounds such as birds, storms, or coyotes in the background. These tapes can be found at local music stores.

Science Concept 2: Values of a society affect the utilization of its natural resources.

Reread or review the story with students. Discuss how the environment was used and affected in Walter's first dream. Point out that at some time in the future we could run out of essential resources. Given this general statement, how do students feel about it? Why are values of a society important? Have students recall problems from the story and choose one to role play; one student could be part of the problem, one part of the solution.

Integrating science concept into the curriculum

Language Arts: Have students do a story pyramid, recalling the main character, setting, problem, and solution (Student Activity #5). Using the story pyramid as a reference, primary students can draw a picture incorporating all aspects of the pyramid. Upper grades can make a story board on construction paper. Divide the paper into eighths. The first two squares are for the new cover of the story. The next two are for the description of the characters. Events of the story and the conclusion are drawn in the last four squares.

New Cover		Character Description	
Event 1	Event 2	Event 3	Conclusion

Review the concept and discuss the difference between Rose and Walter at the beginning of the story, and then at the end of the story. Students should be able to point out the changes in Walter's value system. Then, take students outside for a mini observation activity. Have students find a spot and sit down. Tell them to notice animals, different sounds (both natural and artificial), the area they are in, and smells. Give students 3-5 minutes to relax and enjoy this activity. After students have had the opportunity to observe, bring them back into class (or weather permitting, remain outside) and discuss how they felt about the different smells or animals or sounds observed. Do we, as a society, value our natural resources? Are we using them wisely? Have students write about their feelings concerning the environment. Their papers can be made into a book and placed in the library to allow other students the opportunity to read and reflect on this issue.

Math: This activity is for primary students and can be played in or out of the classroom. The instructor will need 50 unifix cubes or math counters and to make a copy of Student Activity #6 for each group of students playing. On the floor of the classroom or concrete outside, mark off a grid that is 2'x 4' wide. Divide the grid into eight boxes. Cut student page 8 into squares. Tape these squares randomly, one inside each box of the grid. Divide students into teams of four. Each team is given ten counters to begin the game. There are two teams per grid. Students sit on the floor or ground near a grid. To begin the game, decide which team goes first and then toss a math counter on to the grid. Depending on the box the counter lands on students add or subtract from their given amount of counters. The first team to reach 30 counters wins the game. (Have extra counters available near each grid for students to add to their total amount.)

For upper grade students: To get students thinking, play this game of analysis. Begin by drawing a large "T" on the board. On the upper left side of the "T" write IN, on the upper right side of the "T" write OUT. Explain that since they have been learning about the environment, you would like to challenge them to a game of wits. It is their job to discover what is IN and what is OUT and why. You will be filling in the IN column with ways people conserve energy, and the OUT column with ways that people don't. Give students an example: "This is IN," and write an example. "This is OUT." Write an example. Students begin adding their answers to the lists. If they haven't figured out that the lists deal with energy, give them that hint. Keep filling in the columns until someone guesses why the items were categorized the way they were. If no one figures it out, stop the game and review the answers given so far. What does the IN side have in common? Discuss the answers on both sides. This should help students solve the problem.

Have students reflect on the activity and discuss why conservation of energy is so important. Also discuss that the use of fossil fuels leads to air pollution which also affects the environment. Have them brainstorm all of the possible ways they use electricity in one day. Then, have them come up with alternatives to using so much energy. Students can also research alternatives to fossil fuels: wind turbines, solar energy, biomass (energy from the sun that is stored in plant and animal products), hydroelectricity, etc. The instructor might also want to invite a guest speaker from a local power company to explain ways in which energy is made and measured.

Social Studies: For all grades. Have the students take a trip to lands they have never been to before: Pesticide Palace, Refuse Ravine, Wasteland; or canoe down Acid Rain River. (Students can also come up with their own places to travel.) Students should create a travel brochure about their destination stating why people should visit and the history of the area. On the back of the brochure, students can explain how people's actions and values directly and indirectly affect the places they visit. Fold brochures and display in or out of the room.

Also, take a ride on Spaceship Earth (from Teachers PET Term Paper, Fall 1992; with permission from Zero Population Growth, Inc., 1400 Sixteenth Street, N.W., Suite 320, Washington, D.C., 20036). Read the first two paragraphs and then discuss with the students how the astronauts should deal with the Uoy. Record their answers. Then, read the final paragraph. When the true identity of the H.T. Rae is

revealed, students should express a greater understanding of the need to respect and preserve the environment.

Taking A Ride On Spaceship Earth

The H.T. Rae is a spaceship that contains everything required for a long mission to explore the universe. Garden plots with fertile soil provide enough food for all the astronauts for the length of their voyage. The ship also has the ability to continually purify air and water, recycling these elements for the astronauts' use. The H.T. Rae is fully equipped to support everyone on board, but each of its systems must be carefully maintained, as there is no extra air, water, soil, or food. The functioning of the life support system as a whole depends on a fragile balance of each of its elements.

On board the H.T. Rae are many groups of astronauts. One of these groups, the Uoy, is well-known for wanting more food than their plot of soil can produce. They buy, and sometimes take, some of the other astronauts' soil. Then the excess food is thrown into the clean water supply, burned (which pollutes the air supply), or thrown into the other soil plots. What should be done?"

Discussion: "H.T. Rae is Earth spelled backwards, and the spaceship represents Planet Earth. Uoy is "you" spelled backwards--this is to point out that we, as human beings, are often guilty of using more natural resources than we need. All of the air, water, and soil we will ever have is on the Earth now. We breathe the same air the dinosaurs breathed and drink the same water they drank. We are the astronauts on Spaceship Earth, and it's our responsibility to keep the ecosystem in balance for future generations of inhabitants."

Science: For all students. Save some remains of lunch in a large bowl. Take the students, a shovel, and the bowl outside to an unused area of the playground or nature center. Dig a hole (with student's help) about three feet deep and dump the lunch remains in the ground. Cover the hole with the dirt and pack down. Students can discuss what they think will happen with the items buried. Are some items biodegradable? Non-biodegradable? Wait about three to four weeks and then return to the sight where the lunch was buried. Dig up the items and discuss what happened during the time they were in the ground. Relate this to garbage dumps and landfills. How is trash affected by soil, water, and insects? What prevents decomposition in the landfill? Do the values of our society have an effect on the amount waste placed in landfills? How or will this have an impact on us

in later years? The leader of this activity may want to get permission from an administrator before digging. Also, a record could be kept of what was buried and what was dug up.

Physical Education: Students can recycle milk containers and coffee cans, using them for a bean bag toss. Coffee cans can also be filled with plaster of paris and used as markers for indoor or outdoor games. Recycled bicycle wheel rims can be used outside for students to push with a stick to make them roll.

Art: For all students. Students can make a collage in the shape of the Earth. Have them draw a circle and the general outline of the continents. In the space for water have them arrange pictures of clean water and animals that live in this habitat. Where the space is for the continents, have students paste pictures of people, animals, trees, etc., showing how we all share the planet. Students can title the collage.

Another activity to demonstrate how the values of a society affect the utilization of its natural resources is to have each student draw a picture of their most favorite spot. Stress that it should look as nice as they can make it. When students have finished, collect and display the pictures in or out of the room. While students are at lunch or recess, attach pieces of trash to each picture (easily obtained from the wastebasket). Upon entry to the room, students will notice their "new" picture. Notice their reaction and after the class calms down, discuss how they felt when they saw what had been done to their drawings. Relate this to the use of public areas or nature parks, or simply the street on which they live. This could extend into a journal writing activity.

Reader Theater: Circles on the Earth

Here's a script for you and your friends to perform. You can make it as simple or as elaborate as you like. Five of you can read this aloud in class. Or your entire class can participate--with four or five of you reading the same part together--for a performance on stage. Let your imagination soar as you add dances, songs, scenery, costumes, even dramatic lighting.

Reader 1: At this moment, the earth, our home, is spinning through space.

Reader 2: Rotating on its axis at 1,000 miles per hour.

Reader 3: Revolving around the sun at 65,000 miles per hour.

Reader 4: As it travels through space, the earth gives us the things we need to survive.

Reader 1: Air and water. . .

Reader 3: Soil and sunlight. . .

Reader 4: Food and warmth.

Reader 5: And the earth will always give us the things we need to survive, if we remember this.

Reader 2: The earth moves in circles.

Reader 3: The earth moves in circles.

All: The earth moves in circles.

Reader 1: Air is a circle. We breathe oxygen-

Reader 4: And breathe out carbon dioxide.

Reader 5: Plants take in that carbon dioxide, use it to make food. . .

Reader 4: And breathe out oxygen.

Reader 2: Air is a cycle, a circle, that flows from the animals. . .

Reader 3: To the plants. . .

Reader 2: And back again.

All: The earth moves in circles.

Reader 3: Water is a circle too. Water rains down on the land. . .

Reader 5: Moves through rivers, lakes, streams, and oceans. . .

Reader 3: And evaporates back up into the sky, only to rain down once again.

Reader 1: Water is a cycle, a circle, that flows from the sky. . .

Reader 4: To the land. . .

Reader 1: And back again.

All: The earth moves in circles.

Reader 2: Even soil is a circle.

Reader 5: Plants grow from the soil, die, and decompose.

. . .

Reader 2: Decay. . .

Reader 5: To become new soil from which new plants grow.

Reader 4: The atoms in our bodies come into us from our food.

Reader 3: Our food got those atoms from the soil.

Reader 2: So we are from the soil.

Reader 1: And when we die, we decompose. . . .

Reader 2: Decay. . . .

Reader 5: To become new soil from which new animals grow.

Reader 1: So soil is a cycle, a circle, the circle of life. . . .

Reader 2: And death.

All: The earth moves in circles.

Reader 3: But people didn't understand this law, and now we have some problems with the environment.

Reader 4: Problems that arose because, unlike the earth.

. . .

All: People move in straight lines.

Reader 1: They make something, use it once, then throw it out.

Reader 1 & 2: They make it, use it once, throw it out.

Reader 3 & 4: They make it, use it once, throw it out.

All: They make it, use it once, throw it out.

Reader 5: They throw away diapers and light bulbs...

Reader 2: Rubber tires and TVs...

Reader 4: Cars and cameras

All: They make it, use it once, throw it out.

Reader 1(Pause first): What happens when they run out?

Reader 3: Run out of materials to make new things from?

Reader 5: Run out of places to throw things away?

All: What happens when we run out?

Reader 2: The solution might be that people should work

in circles, too. . .

Reader 4: Just like the earth.

Reader 1: They'd make it, use it. . .

Reader 3: Recycle and reuse it.

Reader 1: Make new paper from old, new bottles from old.

Reader 2: Reuse metal, and glass, and rubber in cars.

Reader 5: Make things that last. . .

Reader 3: And are not thrown away.

Reader 4: Because there's no "away" anymore.

Reader 1: Make it. . .

Reader 1 & 2: Use it. .

Reader 1, 2, & 3: Recycle. . .

All: and reuse it.

Reader 5: And live in the circles of the earth.

Reader 4: Dance in the circles of the earth.

Reader 3: Play in the circles of the earth.

Reader 2: Celebrate the circles of the earth.

All: Know the circles of the earth.

Reader 1: (very slowly) The circles of the earth.

(Quoted from Learning, March 1991, permission to duplicate.)

A Fish Story

(A story of people's effect on water quality and the things that live in water.)

Materials Needed:

- large jar, 3/4 filled with water
- plastic fish suspended on string or wire
- handful of soil-pancake syrup
- salt -pieces of paper
- detergent-hot water
- food coloring

Before you begin, hook the fish into the jar.

Imagine a river as it meanders through the countryside, past the farmers' fields, widening into a lake, but narrowing again as it passes through the city. In this river lives a fish. (Point to the fish in the clear water of the jar.) HOW DOES IT FEEL TO BE THIS FISH?

The fish swims down the river past an eroding bank. When it rains what will happen to the bank? What if it rains a great deal? (Put soil into the water.) HOW DOES IT FEEL TO BE THIS FISH?

Suppose part of the soil eroding into the water came from some farmland. The farmer has just put fertilizer on his field. Instead of staying on the fields and helping the crops, the fertilizer rides "piggy-back" on the eroding soil and goes into the river. What effect will the fertilizer have on the plants in the river? If plants grow too abundantly and too fast the river can't continually support them and supply the necessary nutrients. They die, fall to the bottom, and start to decompose. Decomposing things use oxygen. What else in the river needs oxygen? HOW DOES IT FEEL TO BE THIS FISH?

Farm fields aren't the only source of fertilizer in a river. Homes may also be a source. Where the river has widened into a lake several families have built their homes. Perhaps their septic systems drain into the water or some of the fertilizers they've put on their lawn has washed into the water.

As the lake narrows back into the river, our fish continues downstream past a city. Even though the city people don't pollute the water directly, what they do at their own homes or subdivisions can affect the quality of

the river's water. Have you seen a car leaking oil? Where does the rain wash this oil? (Put pancake syrup representing oil in the jar of water.) HOW DOES IT FEEL TO BE THIS FISH?

In the winter what do we put on our roads to make it easier to drive? (Put salt into the water.) When you eat or drink something salty, what do you do? Can this fish get some fresh water to drink? HOW DOES IT FEEL TO BE THIS FISH?

Suppose the city has a park next to the river. People litter in the park and some of it blows into the water. (Put pieces of paper into the water.) HOW DOES IT FEEL TO BE THIS FISH?

As the river leaves the city there are several factories that are located along it. Although regulations are strict, perhaps they are still dumping some chemicals, detergent, or hot water into the water. (Put detergent and hot water into the jar.) HOW DOES IT FEEL TO BE THIS FISH?

The waste water treatment plant for the city is also located along this section of the river. Rules aren't quite as strict as they are for factories, and perhaps the treatment facilities aren't as thorough as they could be. The plant does its best but still has to put some polluted water into the river. The river has a large volume of water though and the plant only puts a small amount of pollution in it. It shouldn't cause too much problem. Right? It would be like putting 2 drops of food coloring into this jar of water (stir it). HOW DOES IT FEEL TO BE THIS FISH?

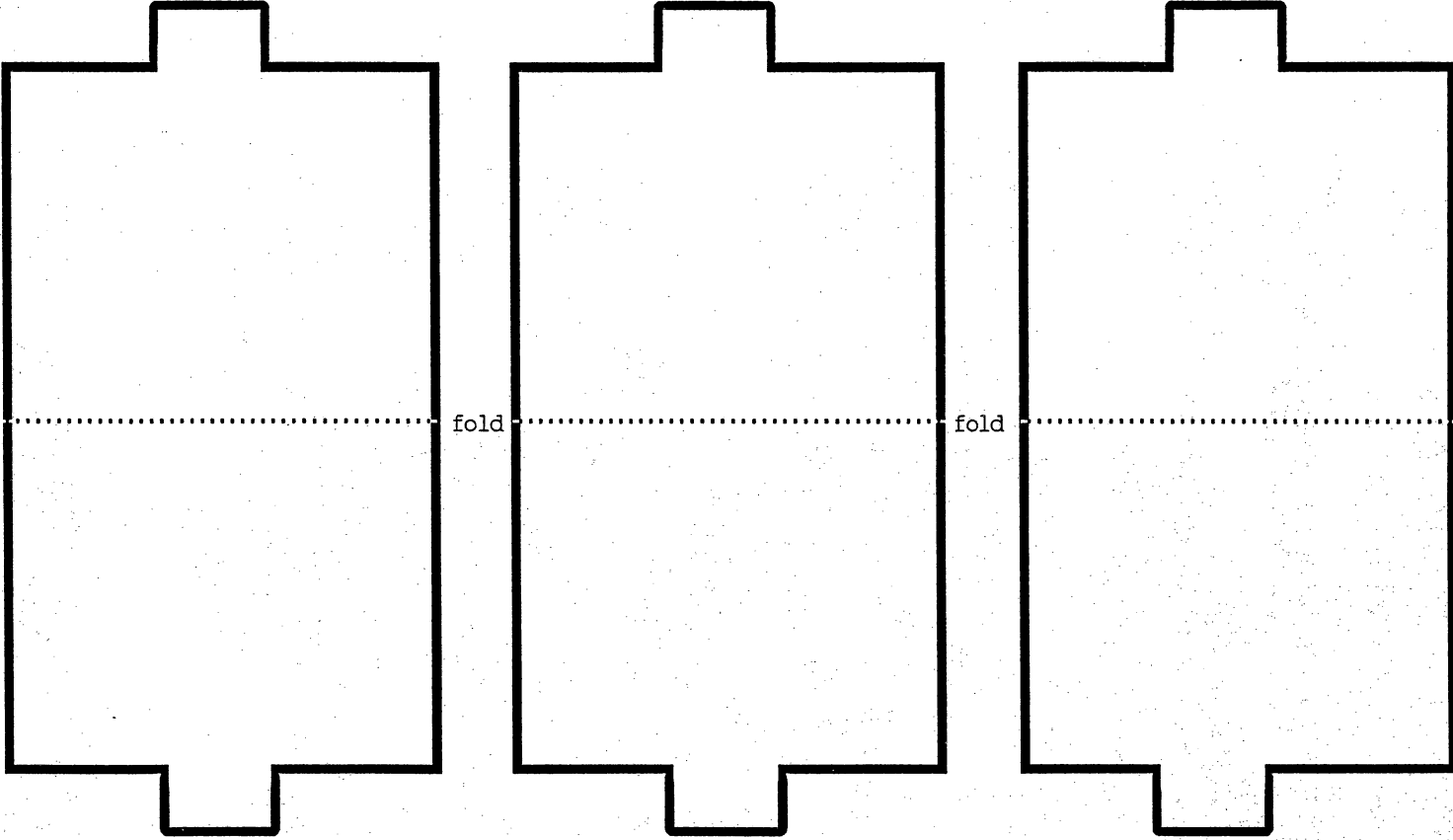
The End

Go back through the story, deciding ways you can help solve some of these problems.

Developed by: Patricia Chilton, Educational Coordinator,
Kalamazoo Soil Conservation District, 6127 Sprinkle Road,
Kalamazoo, Michigan, 49001. July, 1979.

Student Activity #4

Cards for solution boards



Student Activity #5

Story Pyramid

1. Name of the main character
2. Two words describing main character
3. Three words describing setting
4. Four words telling the problem in the story
5. Five words telling the solution to the problem

Name

1 _____

2 _____

3 _____

4 _____

5 _____

Student Activity #6

Put Recyclables
in trash

-6

Turned off the
lights when you
left the room

+2

Drove a car to
the corner store

-3

Started a recycling
program in your
neighborhood

+6

Picked protected
plant while on
a nature trail

-4

Planted a tree

+4

Left the water
running while you
brushed your teeth

-2

Walked to the
corner store

+3

APPENDIX C:

The Whale's Song by Dyan Sheldon

(1991) New York: Dial Books for Young Readers

Lilly is told a story about whales by her grandmother and how she loved them as a child. Lilly dreams of the whales and longs to see them. She takes them a special gift and waits for them to come. The whales give Lilly a gift of their own.

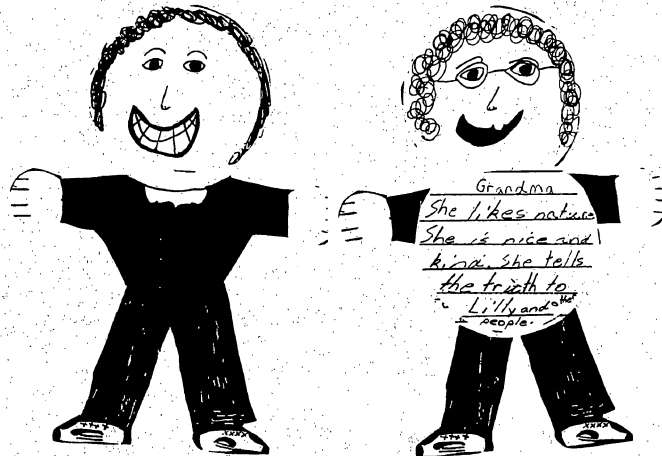
Science Concept 1: Wildlife has intrinsic value, although people often only utilize wildlife to satisfy their needs.

Before reading the story, ask students what they know about whales. Record their answers in two columns on chart paper, one for aesthetic values, one for commercial value. Do not tell the students why there are two lists. After brainstorming, read the story. At the end of the story refer back to the lists. Encourage students to examine the lists and discover why they were written in two columns. If students have difficulty discovering the answer, refer to great-uncle Frederick and Lilly's grandmother and their opposing attitudes on whales. Which column would be supported by Frederick? Grandmother? Lilly?

Integrating science concept into the curriculum

Language Arts: For primary grades. Reread the story. Discuss with students the attitudes of all three characters. After some discussion on the story and its characters, let students role play the characters. Choose three students: one for Frederick, Grandmother, and Lilly. Those three students are asked questions by the rest of the class as to their point of view. The students respond with an answer in character. Do this activity a few times with different students, letting each group answer questions for about five to seven minutes per group.

After students have had the opportunity to question the characters, have them make a Character Doll Book. Students use the doll tracer to make their doll pattern. Once they have drawn and cut out the doll, students attach the doll head patterns to the doll pattern; lined pages being the back of the book. Draw a character on each head; depict Uncle Frederick, Grandmother, and Lilly. The cover can be any character. The cover is then folded down to display the character and the story page about that character. (Student Activity #1 and #2.)



For upper grades. Discuss the differing viewpoints in the story. Have students role play the characters. Choose three students: one for Great-Uncle Frederick, Grandmother, and Lilly. Those three students are asked questions by the rest of the class as to their point of view. Students respond with an answer in character. Do this activity a few times with different students acting out the roles.

Once students role play the characters, have them complete a graphic organizer (see Student Activity #3). The graphic organizer will help students to understand the perspective of both Grandmother and Frederick. The dialogue of Grandmother is written on one side of the organizer, while Frederick's is written on the other. Dialogue can be summarized to fit if needed. Using the graphic organizer, students should draw conclusions about differing viewpoints in the story. Then, divide the class in half: one half supporting aesthetic values of whales as seen in the dialogue of Grandmother, the other supporting commercial values as reflected in the comments of Great-Uncle Frederick. Have students debate their assigned views. Also, students could research their given viewpoint to offer supporting evidence during the debates.

Math: Whales vary in size from the Narwhal (12 feet) to the Blue Whale (100 feet). Many activities can be developed from the measurements of whales. Here are just a few.

To demonstrate visually the different sizes of whales, you will need a rope or piece of string over 100 feet long. Using different colored pieces of yarn, have students measure off the lengths of the whales (listed below). Do this activity outside or in a gymnasium.

Whale lengths:	Porpoise	8 feet
	Narwhal	15 feet
	Pilot Whale	22 feet
	Orca	30 feet
	Humpback	45 feet
	Sperm Whale	60 feet
	Right Whales	60 feet
	Fin	80 feet
	Blue	100 feet

Have students record the different colors of yarn and to which whale the color refers. A color coded chart might be made to record the different types of whales on the rope and their lengths.

Using graph paper, have students draw small scale versions of their favorite whale. Depending on the size of the squares, younger students could have each square represent one square foot. Older students could develop their own scale.

Have students draw life size whales on the blacktop. Then, invite other classes to observe the whales on the playground. Your students can guide the other classes through the drawings identifying the whales and giving pertinent information which has been previously researched.

Social Studies: For primary grades. Refer back to the charts that were made in the language arts lesson. Discuss with students possible reasons why the whale population is endangered: loss of breeding grounds, killing for commercial and scientific purposes, polluted habitats, etc. Have students think of possible solutions that could help minimize the factors that contribute to the endangered whales species. You might also want to show students the migratory route to demonstrate why the breeding grounds are so important to the whale's survival.

For upper grades. Have students research the history of whaling. This could include mapping voyages of the ships and comparing the voyages to migratory routes of the whales. Which whales were the easiest to catch? Did controversy revolve around this type of lifestyle? ("Economists estimate that whale watching in the past twenty years has generated more revenue than whale killing produced in all the years it was carried out." Arms, 1990, p. 318) Have students write a paper on the causes and effects of whaling. Why were whales being hunted? What inventions made harvesting whales easier? (Answer: the harpoon, and then later the factory ship where whales could be processed as

soon as they were killed.) Has whaling affected the attitudes of people? Do people in all countries feel the same way? Did the whalers make contributions? Has the International Whaling Commission been effective? What has society learned as a result of whaling? This could also branch off into a debate of the pros and cons of whaling.

Have students design a poster supporting their point of view on whales. The poster can be based on the story or from the information obtained from research.

Science: How do whales communicate? Play recorded sounds of humpback and orca whale songs. Allow the students time to listen and enjoy the different sounds. Discuss possible reasons for the different pitches and songs: mating, location of pods, etc. Also state that these songs can be heard for miles underwater. After students have had the opportunity to listen to whale songs, play the following game.

Whales find their food by using a type of built-in sonar. They send out a sound wave which bounces off the food source and returns to the whale. Thus, the whale is able to locate the food and judge its distance. This type of sonar system is called echolocation.

You will need some noise makers: rattles, whistles, bells. Use these to produce different sounds: pairs of long and short, loud and soft, high or low. You will also need two blindfolds and a large playing area. Choose two students to be whales. The rest of the class forms a circle around the students (for safety purposes). Give the two "whales" the same noise makers and let them practice with them while you pass out the rest of the noise makers to a few students in the circle. Blindfold the whales and turn them around a few times. (Although whales can see, they use echolocation to find their food source. The students must be blindfolded so they are using their sense of hearing instead of sight.) When the game begins all of the students make noise. The whales must listen for each other and try to find their partner. The game is over when the whales have connected. To make it more difficult, have the students with the noise makers walk around in the circle with the whales.

Discuss with students the possibility of noise pollution and how this could affect the whale's song. Could it cause any problems? Within the last decade, the ocean environment has continually been disrupted by the ever increasing use of motorized water vehicles, sonars use by researchers, etc. Play the game again. This time blindfold the whales but

remove a noise maker from one of the blindfolded students. Continue the game for a minute or two with everyone making noise. End the game and discuss how the whale felt when it could not find its partner. What effect does this have on the whale family structure, breeding, and population?

What intrinsic (genuine) value do the students feel whales possess? After the discussions and research that the preceding activities have focused on, give students the opportunity to express how they feel about the concept. This can be done through drawings, essays, or poetry.

Art: Display different pictures of whales from woodcuts to paintings. Let the students create their own version of their favorite whale. Have available for them: paint, clay, paper, crayons, pencils, toothpicks, potatoes (for printing), and plastic knives (for cutting potatoes). Give the students plenty of time to create and decorate their whale.

Make a stuffed whale! Using a large piece of butcher paper folded in half, draw a picture of a whale and cut it out--cutting on both pieces of paper. Two whales should be cut out when finished. Let the students paint or color the whale cut outs. When they are colored, glue most of the two whales together, leaving the tail portion open. Using shredded newspaper, stuff the whale. Glue the remaining tail portion closed making sure that part is also stuffed. Students not working on the whale can be making a backdrop for it. Have them decorate blue butcher paper with ocean animals and staple to bulletin board or wall. Hang the whale from the ceiling in front of the bulletin board for a three dimensional effect.

Science Concept 2: Humans are the greatest threat to marine mammals.

Whales are amazing, yet mysterious creatures. Humans marvel at their size, behavior, and beauty--ignoring the fact that these endangered animals are declining in numbers due to the greatest threat they know: humans. This unit focuses on a variety of activities stressing how human actions threaten the survival of whales and other marine mammals.

Ask students what they feel can threaten the survival of whales and other marine mammals. Record this list on a piece of butcher paper cut into the shape of a jar (to symbolize the collecting of harmful debris which will be established at the end of the lesson). Some answers are: whaling, chemicals, poisons, discarded trash, and plastic.

As students work through this unit, they can add more answers to the "jar." Post somewhere in room where students can see and refer to the list.

Integrating science concept into the curriculum

Language Arts: For all grades. Reread the story, or only the pages referring to the descriptions of whales given by Grandmother and Uncle Frederick. Is there a threatening statement in the descriptions? Who is speaking? What is the reasoning for the statement made? Students should state that Uncle Frederick made the threatening statement about whales and give the reasons for it. Ask: Did Grandma and Uncle Frederick value whales differently? Use the following guided imagery exercise in order for students to explore and analyze the values of an existing society. The leader might want to have some type of music in the background; that of whale songs or the ocean would be even better. This activity is written simply in order to give examples of what could happen to a whale or other marine mammal.

Begin by asking students to sit in a relaxing, comfortable position. Give students time to get comfortable and then begin.

"You will try to imagine what you hear me describing. Relax, sit quietly, and picture the things I am describing to you. You are in the cool, blue water of the ocean; floating just below the surface. You are an enormous, humpback whale. You can feel the coolness of the water and the pulse of the waves across your back. You breathe. You breathe again, this time taking in more air, preparing for a dive. You descend into the water, your strong tail pushing you forward. Feel the water rushing over your skin. . . your flippers moving gently up. . . and down. Ahead of you there is a pod of humpback whales. Listen to them calling for you. Listen. . . (Loudly and abruptly) Whirrrr! Whirrrr! Above you passes a speed boat, and then. . . it is silent again. The pod has begun to rise to the surface for another breath. You rise also. . . You break the surface of the water, exhaling water vapor, then inhaling, feeling the warm air in your lungs. Feeling hungry, you dive below the surface, releasing air into the water. . . surrounding the plankton and fish above you. . . With your strong, powerful tail you push yourself to the surface, opening your mouth wide to capture your dinner. . . collecting the small fish and plankton. Pressing the water out through the baleen, you begin to taste the tiny morsels in your mouth. As they roll from the front of your tongue to the back, something sharp pokes the roof of your mouth! (Louder) It's plastic! (Slowly) You swallow anyway. Floating just below the surface, you take another breath of air and then descend

down into the dark blue ocean. . . joining your pod. .
.Listening to songs, and singing yourself. . . .You feel the
gentle, cool water surrounding you. . .and you are happy. .
.for now. . . .It is time to come back. Your senses feel
the warmth of the classroom and the place where you are
resting. When you are ready, you may open your eyes."

Explain to the children that each of them took their own private journey even though they all heard the same thing. Have them close their eyes again and think back to a part of the story that impacted them the most. After students have had some time to think, have them open their eyes. You may want to allow students some time to discuss their feelings and to ask some questions. What value do whales have in today's society? Have art supplies out along with writing paper for students to express their thoughts through words and pictures. Students could also write poems relating to the activity.

Math: To illustrate how much trash endangers the marine environment, students can do this activity. Divide students in to groups of four or five and take them for a short walk outside or around the school campus. Explain to them that they are scientists measuring the amount of pollution, as accurately as possible, in the ocean. (For primary students, the teacher may want to have clip clothespins with tasks labeled on them for better management; for example, Recorder, Sanitation Engineer, Observer, Manager.) Groups should have a note pad, pencil, trash bag, and directions for the specific area they are to cover. As students walk, they record and then collect the trash they sighted "in the ocean." After a short time, gather students together and resume the lesson in the classroom. Students should count and record the number of items they picked up, giving that number to the teacher. The teacher and students then total all of the numbers recorded from each group. How does this represent the amount of waste in the water? Discuss student reactions to the amount of trash on campus to the total area of the ocean.

Science: There are about 80 different species of whales. They are divided into two groups: toothed and baleen. Toothed whales survive using echolocation (like a sonar) to find food such as squid, fish, and other marine mammals. Baleen whales have a type of mustache inside their mouth made of something like a fingernail. This mustache is called baleen. Baleen whales eat zoo plankton (krill) and small fish. To help students understand the reason for clean water, refer to the part of the guided imagery activity where the whale is eating. What does it eat? Explain that the whale ate plastic because it had been

dumped into the water by a boat. Whales can't survive eating plastic. Other marine mammals also get hurt because of plastics and other debris in the water. Over 14 billion pounds of trash are dumped into the ocean every year. Do the following activity to make this idea concrete.

Before you begin this activity, collect six-pack rings, plastic bags, plastic foam popcorn (for packing), and milk jugs cut into pieces. Also, have a large piece of butcher paper available for students to mount their drawings. This will become a mural. Have students discuss how people threaten marine mammals by dumping trash in the ocean. Ask students how plastic and other items such as six-pack rings, netting, and fishing line can harm, strangle, or drown marine life. (Birds, mammals, and fish mistake plastic for food. Sea turtles mistake plastic bags for jellyfish. Fur seals often starve or are strangled due to fishing line and nets.) After discussion, give students the opportunity to draw a picture of a marine animal on an 8 1/2" x 11" piece of paper. Have them cut out the animal. Before gluing the animal on the butcher paper, students should choose and affix a piece of plastic to their drawing. Then, they can paste the animal on the mural. (Try to get all kinds of marine life: sea turtles, fish, sea lions, whales, pelicans, etc.) When the mural is complete hang it in the room, hallway or school cafeteria with an appropriate caption explaining its purpose.

For upper grades. Discuss with students the following statement: Dead bottle nose dolphins have washed up on U.S. beaches so laced with chemicals that the federal government would consider them toxic waste hazards (quoted from The 1994 Information Please Environmental Almanac, Compiled by the World Resource Institute, Houghton Mifflin Company, New York, 1994, p. 324). How did students react to the statement? Do they consider it true/false? How could something like this really happen? Have students discuss and research chemicals that end up in the ocean. Some examples are: city and industry waste, runoff, pesticides, and fertilizer. How do all of these end up in the ocean? (Through air pollution and runoff.) And last, have students discover how a dolphin could be contaminated so critically. Students can make a food chain beginning with the smallest part. A few examples are: plankton to small fish to larger fish to dolphins; plankton to small fish to baleen whales; plankton to small fish to seals to killer whales. What students have to understand is that toxins start in the plankton. As the food energy moves to larger animals, so do the toxins.

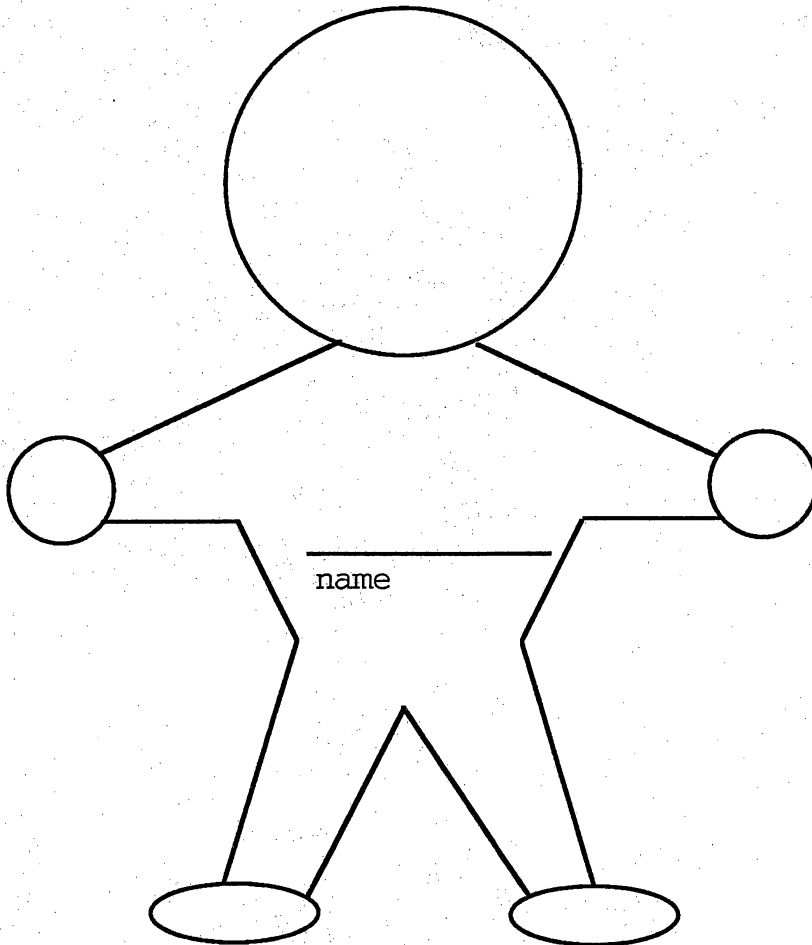
Social Studies: Have students discuss science concept 2 and probe solutions to the dilemma. What relationship do people have with the ocean? What responsibility do people share in affecting the ocean's ecosystem?

For primary grades: Discuss the questions in the previous paragraph. First have students share what type of pets they have at home and their responsibility for being a pet owner: feeding, cleaning the litter box, brushing, etc. Then, tie the responsibility students have to their pets with the relationship and responsibility they have to other animals, namely marine mammals. (To study marine mammals, parks have been established for visitors and scientists in order to develop a better understanding of these animals. How can these parks affect our relationship with the ocean and each other?) Students can illustrate a sentence or paragraph describing a time when they observed a marine animal. (If students haven't had the opportunity to see marine animals, the teacher may choose to show a video with these animals in their natural habitat. Many movies are available through local libraries.)

For upper grades. With all the research students have done incorporating both science concepts, they should be ready to role play a United Nations debate on the threats people pose to whales. Each student or group of students can choose a country, a viewpoint on whales, and be able to defend it. They should also have information ready to debate with other countries: those that still hunt whales, countries that don't support the International Whaling Commission, countries that have started groups to protect whales, etc. Some background on the United Nations may be needed before this activity can be completed.

Art: Students can design a non-threatening environment for marine mammals, namely, a clean ocean environment. This can be done by making a diorama (shoe box design), poster with a caption, or any way the teacher deems appropriate. (I've even had students design and decorate a cake for our culminating activity!)

Student Activity #1



Directions:
Staple the pages to the doll
so when they fold down, the
lines show. Draw a character
on each head. Make sure that
when the pages are folded
down, the story showing goes
with the character head showing.

Student Activity #2

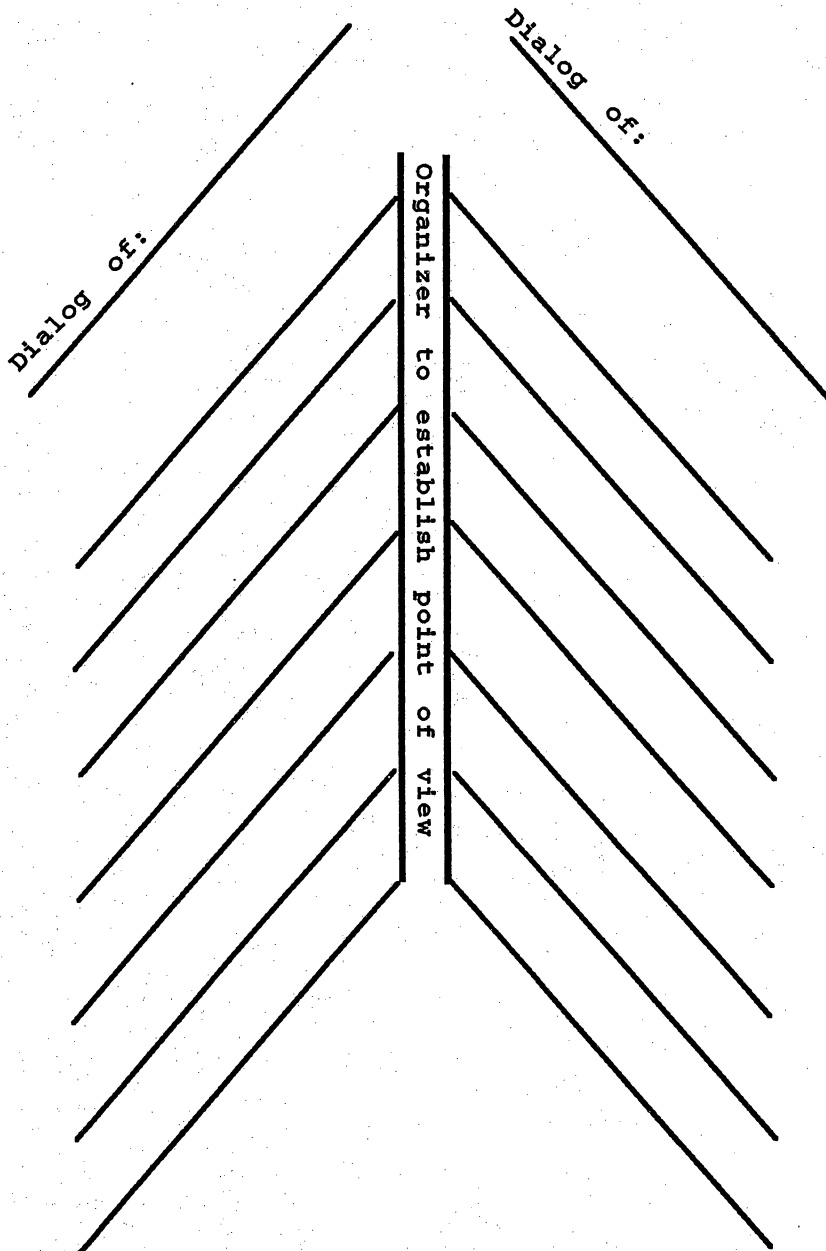
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Name

Whale's Song by Dyan Sheldon



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