Environmental Stewardship in Early Childhood

by Pamela B. Blanchard and Teresa K. Buchanan

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Upper elementary, middle school, and high school educators often teach their students why and how we can protect the environment (e.g., Barnett et al., 2006; Messina & Blanchard, 2004). While early childhood educators often teach science using concrete activities (e.g., Clemens, 1996; Flogaitis, Daskolia, & Agelidou, 2005; Kokoski & Patton, 1997), little evidence indicates that they teach science in ways that intentionally and actively protect the environment (Tu, 2006; Yoon & Onchwari, 2006). Yet helping very young children learn about being responsible stewards of their environment can increase the likelihood that they will be more environmentally conscious throughout their lives (Cohen, 1992; Davis, 1998; O’Brien, 2007).
Effective and intentional instruction about the environment—that which promotes environmental stewardship—is consistent with professional standards in early childhood education. For example, the concept of culturally appropriate practice describes teaching decisions that are based on "the social and cultural contexts in which children live to ensure that learning experiences are meaningful, relevant, and respectful for the participating children and their families" (Copple & Bredekamp, 2009, p. 10). As another example, ACEI’s elementary standards for science instruction (2007) specifically endorse the importance of promoting environmental literacy among young children. Environmental stewardship is a type of culturally appropriate teaching that reflects the physical environment, which is a large part of a community’s identity. For example, people who live in southern Louisiana, where wetlands abound, frequently use such words as “pirouge,” “swamp,” “bayou,” and “airboat,” and such phrases as “down the bayou,” in conversation.

Environmental Stewardship
Environmental stewardship may be defined as:

the responsibility for environmental quality shared by all those whose actions affect the environment, reflected as both a value and a practice by individuals, companies, communities, and government organizations. Positive stewardship behavior demonstrates acceptance of this responsibility through the continuous improvement of environmental performance to achieve measurable results and sustainable outcomes. (U.S. Environmental Protection Agency, 2005, p. 8)

Worrell and Appleby (2000) define environmental stewardship as "the responsible use (including conservation) of natural resources in a way that takes full and balanced account of the interests of society, future generations, and other species, as well as of private needs, and accepts significant answerability to society" (p. 269).

Teachers can help children become environmental stewards by constructing environmental literacy through a continuum of competencies with regard to prerequisite understandings, skills, and actions. Environmentally literate people are more likely to become better stewards of their environment as they progress through the stages of awareness, concern, understanding, and action (Roth, 1992) (see Table 1).

Roth’s four stages of environmental literacy are consistent with constructivist learning models that have emerged over the last 50 years. These learning models (e.g., Atkin & Karplus, 1962; Bybee, 1997; Kolb, 1984) suggest that teachers should sequence instruction into a series of learning stages. While the number of stages vary from three to five across the various models, all the frameworks describe a constructivist teaching and learning model that involves exploration, explanation, and elaboration (for a review of the history of the learning cycle, see Lawson, 1995, and Lawson, Abraham, & Renner, 1989).

The four-part learning cycle proposed by David Kolb (1984) has its roots in the ideas of Dewey and Piaget and is based on the concept that learning begins with concrete experience. For learning to be complete, the learner moves through four phases, beginning with concrete experience and then progressing to reflective observation, abstract hypotheses, and finally the active testing of abstractions (Kolb, 1984). In summarizing neuroscience research on learning, Zull (2002) suggests that “learning is physical” (p. 5), in the sense that the “learning cycle is the natural result of the structure of the brain” (p. 19). Zull suggests that each phase of Kolb’s learning cycle takes place in a particular physical structure in
the brain and that learning remains "inert, without life, until it is tested" (p. 206). He argues that the learning cycle is complete only when we have tested, or acted upon, our ideas.

A similarity of form can be found between Roth's stages of environmental literacy and Kolb's Learning Cycle (see Figure 1). Both Roth's stages and Kolb's phases begin with concrete experiences, lead to increased understanding and knowledge, and culminate as the learner acts on new knowledge by taking action. Kolb's cycle begins with concrete experience, mirroring Roth's awareness stage. In this first phase of Kolb's cycle, learners are introduced to issues in concrete ways that raise their awareness of an issue and bring to mind prior knowledge and experiences. For example, after someone on the playground is stung by a bumblebee, children in a classroom might develop an interest in bees.

Kolb's next phase is reflective observation. Here, learners connect prior knowledge and experience to new concrete experiences. This might involve making connections between or among phenomena or materials, or identifying words, images, or ideas related to new experiences. At this phase, a teacher might read a book about bees that mentions the fact that honeybees rarely sting. A child might follow that read-aloud with a story about her grandfather's famous homemade honey. Then, the children might begin to wonder why honeybees are a rare sight around their school.

In Kolb's phase of abstract hypothesis, learners synthesize prior knowledge and experiences with introduced experiences and information as they generate new ideas about the subject. They think about and clarify their new understanding. Students interested in bees might begin to conjecture about ways to attract honeybees to their school or home environment.

Similarly, Roth's environmental literacy stages move from the external and concrete to a more personal focus. First, learners recognize and become aware of an environmental issue, and then develop a personal concern about the issue. From here, a learner begins to build personal knowledge about the topic. This movement corresponds neatly with Kolb's phases of reflective observation and abstract conceptualization.

Kolb's final phase, active testing, mirrors Roth's last stage of action. In this phase, learners take action by writing, speaking, acting out, or drawing what they have learned. When children are involved in educational projects that help them build knowledge about environmental issues and provide outlets for environmental stewardship, they may begin adopting behaviors that can reduce negative impacts on the environment or begin actively undertaking responsible stewardship actions. Children might plant special flowers in the hope of attracting honeybees to their schoolyard. Environmental education projects that incorporate all stages of Kolb's learning cycle sequence as well as Roth's stages of environmental literacy can help children become aware of, and knowledgeable about, their environment, make informed decisions about their environment, and become better environmental stewards.

These stages represent a natural extension of good teaching. Many early childhood teachers already address one or two stages in Roth's model as they use plants, animals, and other natural or concrete materials to teach science. For example, Jacqueline Clemens (1996) described an activity that particularly focused on Roth's stage of awareness as she explored the benefits of gardening with children and offered practical ideas about how teachers can bring gardens into their classrooms. The understanding stage can be illustrated by reports of building 3rd-graders' scientific inquiry skills and scientific thinking as they studied an ant colony on their playground (Klein, 1991) or pond life (Warner & Morse, 2001). An animal advocacy project (Pattnaik, 2004) illustrates Roth's action stage. Other teachers send home science backpacks to involve families in their children's learning (Kokoski & Patron, 1997), set up engaging classroom discovery centers (Warner, 2003), and conduct classroom experiments (Abdi, Taylor, & Frelich, 1998). Numerous science kits (FOSS, GEMS, etc.) with teaching ideas that fit within this framework are commercially available to support science teaching (see Table 2).

Teachers can enhance these activities in ways that lead to sophisticated projects, thus promoting environmental stewardship as they help students become aware of and learn about environmental concerns, make informed decisions about their environments, and take concrete action (Karmozyn, Scalise, &
Trostle, 1993). For example, teachers can collaborate with local or governmental experts to identify and design projects to conserve or restore the natural environment. The following three science projects promote environmental stewardship as young children go through the learning stages and work together to meet immediate and authentic needs in their own natural environments.

Wood Duck Boxes
Students in a pre-kindergarten class in southern Louisiana learn about how local residents are working together to sustain the wood duck populations of the Atchafalaya Basin. Over the last 100 years, such factors as natural predators, tree harvesting, and increased farmland acreage have significantly reduced the wood duck population in the Atchafalaya Basin. Wood ducks, which migrate more than 500 miles through Louisiana, normally lay their eggs in naturally occurring holes in trees. Unfortunately, predators, including raccoons, snakes, and humans, find the wood duck eggs easy prey.

In response to this problem, the Louisiana Department of Wildlife and Fisheries, along with many environmentally minded hunters, have built and deployed wood duck boxes throughout the Atchafalaya Basin and most of southern Louisiana to help sustain the wood duck population. The boxes, made from cypress or red ceder, are attached to a pipe and usually have a "collar" attached to prevent raccoons and snakes from climbing up the pole to access the nest in the box.

Maureen Mable, a pre-K teacher in Pierre Part, Louisiana, incorporates this environmental concern into her teaching unit on forest animals. She regularly invites Thomas Blanchard, Sr., a local resident and avid hunter into her pre-K class to talk about the characteristics and habits of the wood duck, describe what he does to help sustain the wood duck population in the Atchafalaya Basin, and explain why he thinks his active stewardship is important (Figure 2).

Children learn about wood duck nesting habits, their predators, and the efforts that go into helping sustain their Atchafalaya and southern Louisiana populations (Roth's awareness and concern stages). Blanchard brings a wood duck caller, male and female wood duck decoys, and a wood duck box that he constructed. He lets children feel the soft cypress wood shavings that he places inside the box for the female wood duck to lay her eggs in, and shows them how he safely removes a snake from the box using a long pole with a snare at the end. He tells the children that the wood duck hen sits on the eggs to keep them warm and only leaves the nest to eat. He also brings a homemade video of baby wood ducks flying out of the box (Roth's understanding stage).

Then, the children illustrate these activities in their drawings, art projects, dictation, and journal writing in learning centers (Roth's action stage).

This excellent science experience easily could be extended to provide children with an opportunity to actively par-

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Table 2
participate in stewardship. In this area of southern Louisiana, students often fish, hunt, and boat with their families in the Atchafalaya Basin. There, they can see the wood duck boxes deployed in the swamps. The children could help build or decorate a wood duck box in one of their learning centers and then help install it on their school grounds or have a parent videotape the installation of the box as they place it in the Atchafalaya Basin. Because this area is their home, and because students would be able to see their wood duck box actually being used, this would be an example of a meaningful environmental stewardship project that is authentic and culturally appropriate.

**Seedling Project**

Collaboration with experts enhances age-appropriate stewardship projects for young children. One environmental stewardship project operating in Louisiana is the LSU Coastal Roots Program (Blanchard, 2007), in which students, in grades 2-12 and from more than 40 schools across southern Louisiana, grow native seedlings on their school grounds. The following year, the children plant these seedlings at a restoration site to help protect the fragile wetlands and forests of southern Louisiana. Through this project, children learn about how ecosystems are being damaged by coastal land loss and storms (Roth’s awareness and concern stages), how to germinate and grow seedlings that can help restore the damaged ecosystems, and how these plants help protect humans from the effects of the storms (Roth’s understanding stage).

As part of the project, the children make a trip to plant their seedlings in an area in need of habitat restoration (Roth’s action stage). These students are helping to create and sustain marsh habitats, maintain habitat diversity, and provide food for coastal animals and birds. The stewardship project is a year-round, long-term project, one that can make a real difference in learners’ thinking and actions (Barnett et al., 2006; Basile & White, 2000b).

Very young children participate in this project. They help install the plant nursery, plant the seeds each spring (Figure 3), and raise the seedlings. Young children also have supported the Coastal Roots project by decorating tree seedling protectors with drawings depicting coastal land erosion and solutions to the problem. These tree protectors keep young seedlings safe from hungry nutria (semiaquatic rodents) when older students transplant the young cypress seedlings into the swamp.

**Paddlefish Project**

Efforts to promote environmental stewardship through environmental literacy ideally will progress through all four stages, although some projects will not address all stages equally. For the Native Fish in the Classroom project, supported by the Louisiana Department of Wildlife and Fisheries and the Louisiana Sea Grant College Program (Capello, Somers, Bihm, & Smith, 2005), students in central Louisiana help restore populations of paddlefish, a threatened fish species living in the sluggish bayous and streams that cross the upper coastal plain of south Louisiana. In the past, people have harvested the paddlefish for their eggs, considered “American caviar.” Because of over-harvesting and disruption to their nesting grounds, the fish species is now threatened.

Children from schools in central Louisiana, with the help of Angela Capello, a Louisiana Wildlife and Fisheries biologist and educator, raise paddlefish in their classroom. The students are given harvested paddlefish eggs during the spring; the eggs are large enough to see with the naked eye. They place the eggs in recirculating system aquariums, which they maintain in their classroom. Once the eggs hatch, the children feed and maintain the fish in the classroom until they are finger-length in size. At that point, the children take them to the Booker Fowler Fish Hatchery, where the fish finish growing. Eventually Louisiana Wildlife and Fisheries biologists release the fish into local streams to help sustain...
the region's paddlefish populations (Capello et al., 2005). Like children in the LSU Coastal Roots Program, children who participate in this project have an opportunity to progress through all of Roth's stages, culminating with children taking positive environmental action.

Guidelines
These examples of environmental stewardship in the classroom follow guidelines suggested by Basile and White (2000a, 2000b), who describe three important components for teaching in ways that enhance environmental stewardship. First, teachers must move beyond simple, passive observation and use the children's immediate natural environment as the context for teaching about science (see also Bredekamp & Copple, 1997; Koralek & Colker, 2003). This ensures that learning is meaningful, authentic, and relevant. They encourage teachers to use their backyards, school playgrounds, and local parks to situate their science instruction. In order to be meaningful and relevant, projects and activities also should meet a real need in the local community. The second component concerns building curriculum connections between the science and other content areas. Children should graph findings, read to find out more about their topics of studies, write about their activities, etc. In this way, many language arts and mathematics concepts that are important in early childhood can be taught through science activities (Britsch, 2001; McCoy, 2003; Monhardt & Mohardt, 2006). Third, Basile and White recommend that teachers communicate carefully, involve children in dialogue about issues, and ask good questions.

Yoon and Onchwarri (2006) recommend that early childhood teachers follow the SE instructional model (developed by Bybee, 1997, based on his work with the Biological Sciences Curriculum Study, 1989) to ask questions “that will challenge and at the same time guide children” (p. 421). Yoon and Onchwarri list specific questions that can help teachers gauge knowledge and scaffold explorations and understandings as children progress through each of the five phases of a learning cycle: (E)engage in the topic, (E)xploration ideas and concepts, (E)xplain their findings using scientific language, (E)elaborate on new understandings, and (E)valu-ate children's knowledge.

In addition to these guidelines, two considerations will promote environmental stewardship. First, if considering an environmental stewardship project that will contribute to habitat restoration or conservation, it is imperative to use native plants and animals. Educators should be careful to grow, raise, or release only native plants and animals into their natural world. Teachers can collaborate with agricultural extension agents or other agencies to ensure that science activities in the classroom contribute positively to the mission of habitat restoration.

Second, teachers can consider longitudinal environmental stewardship activities. One of the most exciting aspects of both the Reggio Emilia approach (Cadwell, 1997; Hendrick, 2004) and the Project Approach (Katz & Chard, 1993) is the long-term nature of projects. In both approaches, young children's projects last from several days to several months. In order for children to appreciate the complexity and long-term effects of human action on the environment, projects designed to enhance children's environmental literacy and environmental stewardship should last longer than a week, so that children have time to observe and discuss, for example, bodies of water or weather patterns. Such projects allow children to partici-pate in activities that have multiple phases and to observe

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<td>The Green Earth Book Awards, sponsored by the Newton Marasco Foundation and held annually at Salisbury University, recognize three books about the environment that inspire children to appreciate and care for their natural environment.</td>
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<td><a href="http://www.15degreeelab.com/givernyawarddescription.html">www.15degreeelab.com/givernyawarddescription.html</a></td>
<td>The Giverny Award is an annual award established in 1998 by Dr. Jim Wanderssee and Dr. Elisabeth E. Schussler for the 15th (15 Degree) Laboratory at Louisiana State University. The award recognizes outstanding children's science picture books that accurately teach at least one important scientific principle, or that encourage the reader toward specific science-related pursuits or inquiry with artwork, illustrations, photographs, or that display graphics that work in harmony with the text to tell an important story well.</td>
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<tr>
<td><a href="http://www.duluth.lib.mn.us/YouthServices/Booklists/OrbisPictus.html">www.duluth.lib.mn.us/YouthServices/Booklists/OrbisPictus.html</a></td>
<td>The National Council of Teachers of English established the Orbis Pictus Award in 1990. The award recognizes excellent nonfiction children's literature.</td>
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the consequences of their actions.

Most examples of environmental stewardship occur in upper elementary grades, middle school, or high school. However, early childhood educators also can teach in ways that incorporate environmental stewardship by using a learning cycle approach to plan stewardship projects—one that begins with awareness and concrete experiences, moves toward deeper knowledge and skills (see Table 3 for listings of children's books that teachers can use at this stage), and culminates in actions that allow children to become good stewards of their local environments. Like the preschool children in southern Louisiana helping the wood ducks, paddlefish, and tree seedlings, young children and their teachers elsewhere can help preserve their own local natural heritage. Culminating activities that highlight environmental stewardship can help generate new awareness of the environment among children and their parents.

References
Biological Sciences Curriculum Study. (1989). New designs for elementary school science and health: A cooperative project of biological sciences curriculum study (BSCS) and International Business Machines (IBM). Dubuque, IA: Kendall/Hunt.