Addressing Sunshine State Standards in Elementary School Teacher Professional Development Workshops

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Introduction

In public schools across the nation, teachers are faced with the challenge of ensuring all students in their classrooms end each school year with a certain level of knowledge in order to pass to the next grade. In the State of Florida this knowledge is presented in a set of standards called "Sunshine State Standards" (SSS), recently renamed The Next Generation Sunshine State Standards. Since 1996, the SSS have set expectations for student achievement in seven subjects. The Florida Comprehensive Assessment Test® (FCAT) is given to measure achievement in the SSS for students in grades 5, 8, and 10 in Writing, in grades 3–10 in Reading and Mathematics, and in grades 5, 8, and 11 in Science.

The standards set high expectations for student achievement, and teachers are expected to facilitate this goal (Florida Department of Education 2007). Classroom schedules revolve around FCAT tests and the SSS. In addition, student performance on the FCAT is tied to school funding by the Florida Department of Education. Principals are motivated to ensure strong student performance. Aligning classroom curricula with SSS can prepare students to perform well on the FCAT. After testing, principals receive reports on student performance by grade and by standard. Low scoring standards become target areas for increased attention in the following year. In this way, teachers are encouraged to incorporate new, innovative teaching techniques in designated target areas.

During the school year, administrators encourage teacher attendance at events targeting the SSS in need of improvement. For professional development programs aimed at classroom teachers, incorporating the SSS is imperative to encourage teacher attendance and subsequent use of program materials. Making this connection when marketing workshops helps to ensure that teachers will attend those workshops. Continuing to make this connection during the workshop helps teachers understand how to enhance their teaching, build student interest, and improve their repertoire of teaching materials. In this fact sheet, Project Learning Tree (PLT) workshops are used as an example of how anyone conducting professional development workshops can improve attendance and enhance program use by public school teachers.
Breaking the Code

The state standards are often identified using a shorthand code. The code gives the subject, grade level, strand or body of knowledge, standard or big idea, and benchmark. Each subject is abbreviated (i.e., Language Arts = LA, Science = SC, Social Studies = SS, Mathematics = MA). The strand (also called Body of Knowledge in Science and Mathematics) is the overarching topic being taught, such as reading process or algebra. The standard (also called Big Idea in Science and Mathematics) is one component of the overarching topic. Lastly, the benchmark is the specific content the teacher should teach at each grade level or grade cluster. The codes for the new Mathematics and Science standards are written a bit differently than the new Language Arts and Social Studies standards. Table 2 shows an example breakdown of two codes.

Workshop Objectives and Agenda

A good workshop should focus on enhancing both teaching methods and content knowledge. The first step to aligning a workshop to better meet teachers’ needs is to address specific objectives or learning outcomes. Here are two examples:

• Teaching method: Participants will be able to lead five activities that support fourth grade Mathematics standards in the classroom.

• Content knowledge: Participants will be able to classify flowering and nonflowering plants into major groups according to their physical characteristics (SC.3.L.15.2).

You can use your objectives to emphasize that the workshop complements the teachers' classroom goals. Make sure to select workshop objectives that are tailored to the particular needs and interests of your audience.

Build your agenda around the activities that meet workshop objectives. Include the skills and background information that teachers will need to increase their comfort and familiarity with your program. For PLT, that often means helping teachers understand urban forest concepts, tree identification, or multiple perspectives on an environmental issue. Table 1 is an example of including workshop objectives within the agenda designed for third grade. In this instance, all of the activities in this workshop will assist educators in meeting the listed Math Standard.

When planning a workshop, consider the grade level your audience works with and whether or not emphasizing a particular subject area (i.e., Science, Mathematics) is appropriate. If the workshop attendees are from a school focused on increasing students' Math test scores, then the workshop agenda may have more math-related activities. On the other hand the teachers attending may be interested in learning ways to incorporate outdoor activities into their overall lesson plans. In this case, a mixture of activities focused on a variety of subject areas may be the best option. Review the relevant SSS for target grade levels and subject areas. A good rule of thumb is to emphasize at least two subjects during the workshop. The Florida PLT Web site lists the pre-2007 SSS that can be addressed by each PLT activity. Revised correlations will be posted on the Florida PLT Web site as they are completed. Go to http://sfrc.ufl.edu/plt/correlations/index.html to download appropriate standards.

Now that you have the objectives, activities, agenda, and standards, it is time to determine how to incorporate them into your marketing materials and the workshop itself.

Ways to Incorporate

In PLT workshops, teachers need to be able to link the featured PLT activities to the SSS and their current curriculum. The following sections provide ideas for visually and experientially incorporating the standards into a workshop.

Visual Flyers

When marketing the workshop, list the standards that will be covered on the flyer. If the workshop is entitled "Learning about Trees with Literature" include Science and Language Arts standards. Teachers often look for this information before registering for an event.
Agenda

On the agenda list the SSS codes (i.e., LA.K.1.1.1) associated with each activity you will be modeling. This is a quick reference sheet for the teacher to refer to when remembering how the workshop activities relate to SSS.

The Florida Department of Education has a SSS search feature to find standards by keyword in any subject area or grade level (http://www.floridastandards.org/index.aspx). Enter the "Go to Florida Standards" box and select the "Keyword Search" tab. If you are interested in finding Science standards for specific second grade energy activities, type "energy" into the keyword box and select "Science" and "grade level 2" in the search engine. Two standards and associated benchmarks are found. It is up to the facilitator to determine if these standards are appropriate for the activities. In this search, benchmarks related to how people use energy and how the sun's energy warms surfaces are given as options. These may not be the best match for your program.

State Standard Note Cards

Print out the specific standards and benchmarks identified for all the workshop activities you will be leading. Cut out each standard with associated benchmarks. Glue these onto 5- by 7-inch cards.

At the start of the workshop, hand a card to each participant. After each activity, ask the participants if the activity could help meet the standard and benchmarks on their card. The great thing is that there will always be more than one correct answer! Usually more than one benchmark can be addressed by an activity. Classroom teachers will often share ways benchmarks can connect to an activity based on their teaching experience. If someone hasn't spoken, they may be seeking for ways to meet a more challenging benchmark. For these more challenging benchmarks, ask all participants to brainstorm how the activity could be adapted to address that benchmark. Reviewing the benchmarks will help teachers realize how PLT activities can enhance their existing curricula.

If your group of teachers represents a variety of grade levels, you can make cards for each level and give the appropriate ones to each teacher. For example, a third-grade teacher would receive the third-grade benchmark cards.

Table Posters

Table posters can showcase an activity and the benchmarks for which it applies. It is wise to incorporate a visual aid to highlight and make teachers aware of any activities that may be useful to them but that are not actually demonstrated during the workshop. Each table poster should include the activity name, its objectives, the grade levels for which it is intended, and correlating benchmarks. Pictures or clipart can be used to make these more visually appealing. This information can be typed in a word processing program, printed, and glued to a sturdy file folder. Lamination is optional. Stand the open folders on each workshop table to display them. Examples of table folders can be viewed at http://sfrc.ufl.edu/plt/facilitators/workshop_materials.html, select "Table Posters."

Printable Standards

Make sure teachers understand where to find the SSS correlations. Provide the information on your program materials, paper, and poster, as well as on your Web site. Make sure the PLT Guides have a sticker with our URL: http://sfrc.ufl.edu/plt/correlations/index.html and draw attention to the sticker as you distribute the books. If your workshop site has an Internet connection, consider showing teachers how to navigate to the proper site and find the standards for an activity they select.

Experiential

FCAT-like Prompts

Throughout the year, students practice taking their state standardized tests with sample booklets. The questions are in the same format as the real FCAT test. Most FCAT items are multiple choice with limited writing involved. The Science test includes few short answer essay questions; the "Florida Writes" test incorporates longer essay
prompts. Florida PLT created FCAT-like prompts that mimic the reading, writing, mathematics, and science questions on the test. This addition to an activity will enhance PLT's usability in the classroom.

During workshops, demonstrate how to incorporate FCAT-like prompts. After completing an activity, instead of using the provided assessment option, ask the participants to answer an FCAT-like writing prompt. The writing prompt could relate to the concepts covered in the activity and ask students to write a descriptive or persuasive letter. Similarly, the prompt could be a Mathematics problem, a short reading followed by questions, or a set of multiple choice questions.

Another way to include FCAT-like prompts in a workshop is to set up prompt stations. There may be four stations: Mathematics, Reading, Writing, and Science. After completing an activity, have each participant go to one of the four stations and follow the directions for that particular prompt. Examples of PLT FCAT-like prompts are found at http://sfrc.ufl.edu/plt/correlations/FCAT_like_prompts/index.html.

**Skills and Concepts Connection**

After leading each activity, discuss which skills participants practiced and which concepts they learned. Activities often develop skills to improve mental strategies (e.g., decision making) and specific cognitive operations (e.g., contrast and compare). Often these are the same skills and concepts students need to learn at that grade level. For example, PLT Activity #43, Have Seeds, Will Travel is designed for a first-grade class. Students gather seeds from the school grounds, then work in groups to classify the seeds and answer a series of questions.

To help demonstrate the connection to SSS and reinforce the premise that this PLT activity will help teachers meet SSS, use questions to prompt discussion after modeling the activity. A good question might be, "What skills were used during this activity?" or "What concepts did learners grasp?"

- Skills: SC.1.P.8.1: Sort objects by observable properties, such as size, shape and color.

- Concept: SC.1.P.8: The student understands that objects and substances can be classified by their physical and chemical properties.

Review how teachers will know if students understood the concepts. Point out the assessment options provided within the activity. For this example, students can create a display of local seeds that fit different categories of dispersal.

**Worksheets**

Often, teachers use worksheets to help students practice a variety of skills—from math problems to reading comprehension questions. You can create worksheets that mimic those found in text workbooks that teachers often use in the classroom. Your worksheets, however, should be based on PLT activities. Design worksheets that allow students to practice SSS skills and learn SSS concepts. A vocabulary worksheet that is based on the activity students just completed will probably interest them more than one with a list of unrelated words.

For example, many elementary schools use a reading curriculum with worksheets to accompany specific reading or trade books. In 2006, Florida PLT created reading worksheets for a few trade books that relate to PLT activities and illustrate how the activity can support the development of reading skills in the third and fourth grades. Examples of these worksheets can be found at http://sfrc.ufl.edu/plt/literacy_and_nature/index.html.

**Planning Time**

During the workshop, set time aside for teachers to brainstorm ways to use the new materials to support concepts in their curriculum. If possible, contact participants ahead of time and encourage them to bring their lesson plan books and textbooks. During the designated time in the workshop, teachers can look through their lesson plans and add new PLT activities that they think will be relevant.

Another possibility is to supply teachers with a sample completed lesson plan sheet that uses a PLT activity and then have them complete one on their own. Some school districts require the use of a
in particular form. If this is the case, obtain a copy of this lesson plan sheet ahead of time. The PLT Guide comes with a lesson plan sheet in the back and can be downloaded to use as an example from http://sfrc.ufl.edu/plt/resources/educator_share_page.html

Conclusion

To increase attendance at your public school teacher workshops, identify the SSS the workshop will address and advertise them. Principals may have money to fund teacher attendance at professional development workshops (paying for substitute teachers or registration fees), but only if they are aligned with the SSS. Remember that communication with teachers about what your program provides to help them is the key! Consider scheduling workshops at convenient times for the teachers (i.e., holding them at a school site immediately after school and breaking the workshop into several shorter sessions over a couple of months). Your program will get attention only if you make it easier for teachers to address their state standards with your resources.

Tips to Remember

• When targeting elementary teachers, it is helpful to select a variety of subjects to emphasize and to highlight at least one standard for each activity:

• Include the SSS codes you will address on all marketing pieces for the workshop at appropriate grade levels.

Suggested Readings


Monroe, M.C., J. Randall, and V. Crisp. 2001. *Improving Student Achievement with Environmental Education* (FOR 87). Gainesville FL: School of Forest Resources and Conservation, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

Table 1. Project Learning Tree Workshop Agenda Tied to Specific Activities for Third Grade Educators

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30 AM</td>
<td>Welcome/Introductions/Agenda Overview/Icebreaker: Birds and Worms #25* Emphasize the opportunity to use the class data and make a bar graph</td>
</tr>
<tr>
<td>9:30 AM</td>
<td>PLT Background</td>
</tr>
<tr>
<td>9:40 AM</td>
<td>Break</td>
</tr>
<tr>
<td>9:50 AM</td>
<td>Activity, Pass the Plants Please #16 Note Part B, bar graph and spreadsheet opportunities</td>
</tr>
<tr>
<td>10:40 AM</td>
<td>Activity, Every Tree for Itself #27 Add – count the trees that survive and create a line graph</td>
</tr>
<tr>
<td>11:30 AM</td>
<td>Lunch</td>
</tr>
<tr>
<td>12:30 PM</td>
<td>Activity, Soil Stories #70 Add – Part B, tally the results of the perk tests and describe them with frequencies</td>
</tr>
<tr>
<td>1:15 PM</td>
<td>Activity, Pollution Search #36 Note Part A, bar graph of pollutants they find on their hike</td>
</tr>
<tr>
<td>1:50 PM</td>
<td>Break</td>
</tr>
<tr>
<td>2:00 PM</td>
<td>Hike through the Guide and Connecting PLT to the Classroom (Lesson Plan Worksheets) Group discussion about incorporating math objectives in PLT activities and using PLT in math lesson.</td>
</tr>
<tr>
<td>3:00 PM</td>
<td>Wrap-Up/Evaluations</td>
</tr>
<tr>
<td>3:30 PM</td>
<td>Safe Travel Home</td>
</tr>
</tbody>
</table>

*The title and number refer to activities found in the Project Learning Tree Prek-12 Guide.

Table 2. Breakdown of a Language Arts and Science Benchmark Code.

<table>
<thead>
<tr>
<th>Code</th>
<th>LA.K.1.1.1</th>
<th>SC.5.L.15.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject</td>
<td>LA: Language Arts</td>
<td>SC: Science</td>
</tr>
<tr>
<td>Grade Level</td>
<td>K: Kindergarten</td>
<td>5: Fifth grade</td>
</tr>
<tr>
<td>Strand/Body of Knowledge</td>
<td>1: Reading Process</td>
<td>L: Life Science</td>
</tr>
<tr>
<td>Standard/Big Idea</td>
<td>1: The student demonstrates knowledge of the concept of print and how it is organized and read</td>
<td>15: Diversity and Evolution of Living Organisms.</td>
</tr>
<tr>
<td>Benchmark</td>
<td>1: Locate a printed word on a page.</td>
<td>1: Describe how, when the environment changes, differences between individuals allow some plants and animals to survive and reproduce while others die or move to new locations.</td>
</tr>
</tbody>
</table>
Children usually need no encouragement to go outside. The trick in environmental education programs is to create an opportunity for youth to learn outdoors. Ideally, these experiences will help them understand how the world works, be memorable, and support positive attitudes toward the environment.

A walk in the woods can provide an opportunity to explore many concepts associated with natural resources, land use practices, and cultural history. Interactions between air, water, and soil over the eons have created the natural communities of plants, animals, fungi, and bacteria, or ecosystems, that we see today. This document is focused on one ecosystem, the forest. It presents some basic concepts that young people should understand and offers some outdoor activities that youth leaders can use to help bring these concepts to life.

Important Concepts About Trees and Forests

Forest-based educational activities (Figure 1) tend to be built upon the following concepts:

**Tree Growth and Development** - Trees are made of roots, a trunk, and branches with leaves.

**Figure 1.** Rotten logs are often full of interesting insects and other small creatures. Outdoor exploration can be a memorable learning experience.

Different trees can be identified by characteristic bark, shape, branching patterns, fruit and cones, and leaves. Each of these structures performs a job to keep the tree alive. Roots absorb water and nutrients from the soil and send these ingredients up through the trunk and stems to the leaves. Leaves take in carbon dioxide and sunlight and use them to produce energy for the tree. Any creature eating part of the tree gets some of this energy, too.

**Forest Systems** - Forests are complex, dynamic ecosystems. Florida has several forest ecosystems that vary mainly according to water availability and
soil type. Cypress swamps, pine flatwoods, mangrove estuaries, oak and pine uplands, and hardwood bottomlands are some of our forest types. Insects, mammals, birds, shrubs, and herbaceous plants live in these forests ecosystems. Some are specific to one ecosystem (e.g., red-cockaded woodpecker lives only in longleaf pine forests) and some live in several ecosystems (e.g., deer). Nutrients cycle through the forest in producers, consumers, decomposers, and back to producers. Energy flows through the ecosystem, but does not recycle; it is stored as food energy, given off as heat as each organism lives and grows, or changes form, as in a forest fire.

Forests Change - Forests change slowly over time as individual trees grow and die. Trees grow, shade the understory, and change the microclimate. Different types of trees may grow in the shade, waiting for their turn to reach the canopy when large trees fall and create an opening. Trees may die from disease, insect damage, high winds, or lightning. Human intervention can sometimes be used to maintain a forest that would otherwise change. Humans also alter forest areas, often quickly, for recreation, housing, wildlife habitat, and wood production to meet a diversity of wants and needs.

Forest Benefits - Trees and forests provide us with a variety of benefits. There are benefits of living near forests and trees, such as shade, songbirds, noise reduction, beauty, and increased land value. There are benefits to having forest landscapes in our state: visual interest, watershed protection, air quality, habitat for wildlife, recreation, and climate moderation. We use many forest products: nuts, fruits, syrup, turpentine, rubber. And finally, there are benefits to harvesting trees: paper, lumber, paint, rayon, medicine, cellophane, cellulose, tannin, ink, etc. We make thousands of products with ingredients from trees, including clothing, carpet, toothpaste, and steering wheels! (See FOR 81.)

Forest Management - Some forests are managed specifically for harvesting trees on a regular basis. There are many ways to manage forests for timber production. Sometimes only a few trees are harvested, leaving the rest of the forest to grow or regenerate new trees. In forests where all the trees are the same age (like a pine plantation), harvesting usually means a clear-cut. With some preparation of the soil, the area will be ready for a new planting of seedlings. When the new trees and other plants are small, these plantations can provide habitat for wildlife and many other benefits. Although the birds and squirrels that nest in the treetops will need to relocate to the adjacent forest when the trees come down, other animals will find food to eat and places to hide and nest in the new growth. These areas usually do not contain the same combination of plants and animals that a natural forest has, but they do support wildlife.

Making Learning Memorable

Children tend to remember the things they do rather than the information they are told. You can capitalize on this by involving young people in measuring, counting, finding, and comparing. Older youth may enjoy games and challenging adventures. Projects are also good learning activities, as they enable students to be creative, to choose their own application, and to work at their own speed.

Supporting Positive Attitudes

It is important to have fun. Once you grab a child's interest, they are more compelled to continue learning. A hike through a woodlot or a scavenger hunt are pleasant activities for a group of youngsters. Planned educational activities can be fun, too. Is there something they can take home, like a bug box, pinecone bird feeder, or picture? Can you serve a tree-related snack from nuts, fruits, or syrup? Can a portion of the activity be completed at home with parents? Conversations about issues may be prompted with open-ended questions. Worksheets can focus youngsters' attention on particular features, tasks, or concepts. Group activities tend to be easy, fun strategies to engage young people who may be unfamiliar with the woods.

A Few Activity Ideas

There are books full of things to do outdoors with youngsters (see page 4). Here are a few ideas to get started in an exploration of trees and forests.
Hunts and Hikes

Young children often enjoy looking for things outdoors. You can ask them to match colors (use a paint-chip sample book), find various textures (smooth, bumpy, sharp), or collect things you specify (a leaf with round edges, or a rock with three colors). Check the area for poison ivy, or identify the boundaries of the “safe” space as you send them off. Older kids may draw or check off the items on a list that is configured to introduce a concept or compare ecosystems. For example, you could send them out to find: evidence of a decomposer, the track of a consumer, something that won't change very soon, the remains of a meal, and something that depends on something else. (See Figure 2)

Figure 2. Hand lenses help youngsters investigate pinecones along their “micro-nature” trail.

Comparing

A favorite forest game is “One of a Kind” (see Resource 1). You can provide a collection of things (cones, leaves, twigs) and ask everyone to pick one. Ask each child to study his or her object very, very well. Then collect all the objects, mix them up, and spread them out in the middle of a circle. One at a time, ask each child to find his or her own special object again. You might add a few extra items if the kids are old enough to do the task well.

Similarly, you can blindfold youngsters and walk each one to a tree (see Resource 2). Encourage them to get to know their tree so well that when you lead them back to the common area and remove their blindfold, they can find their own tree again. Some kids have been seen climbing their tree to discover the first branch. This activity is more challenging in a pine plantation, but not impossible!

Counting, Measuring, and Observation

Ask children to record the temperature of the air inside and outside a forest, or at the ground surface and 5 feet above the ground. You can use a max/min thermometer to record the peak day and night temperatures. Dig a hole and compare the soil at the surface to the soil 1 foot down, in terms of color, texture, and moisture. What might these differences mean to the insects that live there? What can youngsters infer about air movement? Use an increment borer to drill a straw-like tube of wood and count the rings of a tree. Make a leaf collection from one kind of tree and look at differences, or make a collection from a variety of trees. Take pictures of tree shapes or draw silhouettes. Make a collection of bark rubbings. Slice a young tree trunk and compare the growth rings. Ask youngsters why some growth years are fast (larger space between rings) and some are slow. Knots from branches, fire scars, and insect damage, all read from these tree cookies, can help tell the story of life as a tree.

Trees are Homes

Investigate the animals that live in and around a tree. You may not see the animals, but you might find evidence of their passing. Look for feathers, nests, and eggshells. Listen for bird songs and cicada buzzes. Look under the bark for insects, on the bark for moths, and in the bark crevices for spiders and scorpions. Look for curled leaves, leaves with holes, and leaves with tunnels to indicate insects have used the area. Look around the roots for mouse tunnels, earthworms, slugs, etc. Create a mural or stage a play of forest animal interactions. Use tools to extend our range of vision, such as a hand lens or binoculars.

Dead trees also provide homes for animals. While standing as snags, dead trees may be homes for flying squirrels, beetles, and woodpeckers. As rotten logs, dead trees can be a treasure chest of insect activity (Figure 1). Use a bug box to capture and
study a sample of the critters, and remember to release them where they were collected to demonstrate the importance of returning animals to their proper homes.

Trees Give us Wood Products

Everyone knows paper and lumber come from trees, but they are less likely to know the origins of rayon, cellophane, toothbrushes, photographic film, and important ingredients in some inks, paints, perfumes, and foods. Challenge kids to read ingredients on food for vanillin, cellulose, or cellulose gum—they often come from wood and pulp processing. Have them hunt for other tree products in their homes. Trace the story behind one of these wood products. Ask your group to brainstorm the product life cycle, going backward from your ownership (store, warehouse, manufacture, harvest, growing in a forest) and forward through likely stages of reusing, recycling, or decomposing (see Resource 3).

Planning Ahead

As with any youth activity, good planning will lead to a more rewarding experience for everyone. You should visit your woods in advance of the field trip, thinking about cautions you will need to explain as the youngsters assemble. Staying on the trail usually minimizes exposure to poison ivy and helps protect the natural area. Is there a nearby shelter, or do you need a foul weather plan? Are bathroom facilities available? Provide drivers with maps clearly showing where they can legally park. If you are meeting anyone at the site, confirm their participation and meeting location. Bring extra water, insect repellent, a first aid kit, and all the props you need for the activities.

As you plan your activities, consider your objectives for the excursion. It might be best to choose one concept for the trip, and construct a series of activities to answer important questions about that concept. Introduce the program by communicating your goals and helping youngsters see how the activities fit together to complete a big picture.

Conclusions

Trees and forests may be everywhere, but they should not be taken for granted. We benefit from having forests in Florida in many ways, both ecologically and economically. Forests can be restful to visit, interesting to study, profitable to own, and vital to maintaining the ecosystem support services that allow life on earth. Trees and forests can be fun to explore, too. You can help young people learn about and appreciate these interesting and important components of our natural world.

Resources for Environmental Education

The ideas mentioned above, and others, can be found in the following books:

1. "One of Kind" is from Steve Van Matre's Acclimatizing. He has several books through the Earth Education Institute.
2. "Meet a Tree" is from Joseph Cornell's Sharing Nature with Children. He also wrote Sharing the Joy of Nature, which includes a helpful model for constructing outdoor lesson plans.
3. Project Learning Tree is available through educator workshops. Call the PLT Office at 352-846-0848. Several 4-H project books also provide activity ideas and background information:

   Adopt a Tree, Florida Cooperative Extension Service, 4H FOM 11 and http://edis.ifas.ufl.edu/FR121.
Use the 4H Forest Ecology web site to learn about Florida's forests: http://www.sfrc.ufl.edu/4h.
Improving Student Achievement with Environmental Education

Martha C. Monroe, Jeanette Randall, and Vicki Crisp

Public education began as a uniquely American idea. The architects of the newly formed democracy trusted the people with the power to maintain a just government and counted on a system of public schools to prepare citizens for this responsibility. Unlike European schools that educated children of nobility, by the mid 1800’s, schools on the American frontier offered reading, writing, and arithmetic to boys and girls of farmers.

Governance for the public school system has always been the responsibility of the state, and in many parts of the country, this responsibility is passed to the local school district. This assures that those paying for public schools are also determining policy and curriculum. In some respects local control provides an important flexibility in school curriculum; it increases the likelihood that content is locally relevant and meaningful.

By the end of the 20th century, however, local control appeared to assure enormous disparity between economically privileged and disadvantaged youth. In some states graduation requirements did not guarantee the most basic of skills. In an age of increased mobility, youth educated in one state should be capable of becoming employed in any other state, and not limited by a poor education to remain in their home community.

Education Reform

In 1983, the National Commission on Excellence in Education reported in A Nation at Risk: The Imperative for Educational Reform that the country needed to standardize our educational curriculum and improve accountability from the classroom to the principal, and from the superintendent to the state board. This launched the long process of developing curriculum goals, curriculum objectives, assessment tests, and reform guidelines in every state. Out of necessity, teachers caught in the transition altered their teaching strategies. One of the most significant changes required many teachers to plan their lessons within the structure of a new standard curriculum framework. This reduced teachers' ability to take advantage of local opportunities to bring meaning to their students' world.

In Florida, the reform process began with the development of Blueprint 2000 that provided the framework for the Sunshine State Standards (SSS).
The Standards are specified for seven subject areas (language arts, mathematics, science, social studies, arts, health and physical education, and foreign languages) in four grade clusters (K-2, 3-5, 6-8, and 9-12). While the standards are broad and consistent from cluster to cluster (such as, “The student understands the process and importance of genetic diversity”), the benchmarks provide objectives that students should be able to meet by the time they progress to the next grade level. The benchmark at the 6-8 level for the previous standard, for example, is “students should know that generally organisms in a population live long enough to reproduce because they have survival characteristics.” High school students should meet the benchmark “understands the mechanisms of change (e.g., mutation and natural selection) that lead to adaptations in a species and their ability to survive naturally in changing conditions and to increase species diversity.” For more information on Sunshine State Standards, search on www.firn.edu/doe.

To ascertain that students are indeed learning the concepts covered in the standards, a series of assessment tests have been developed for several different points in a student’s public education. To date, the Florida Comprehensive Assessment Tests (FCAT) are given in reading (at 4th, 8th and 10th grades), writing (4th, 8th and 10th grades) and math (5th, 8th and 10th grades). Additionally, other students in 3rd through 10th grades are given an abbreviated version of the FCAT covering the same subject areas. Although all subjects are included in the standards, teachers are less likely to cover science, social studies, or art objectives if they must improve student scores on the subjects tested in the FCAT. Science FCAT tests are expected to begin in 2003 and should provide additional opportunities for educators to support these standards. For information about FCAT, go directly to www.firn.edu/doe/sas/fcat.htm.

Not only are students assessed through the FCAT process, but schools are scored as well. Through a complicated formula of student scores, attendance rates, suspension rates, and high school drop out rates, schools receive an overall letter grade. “Failing” schools are given two years to improve their scores, or students are eligible for state-funded vouchers allowing them to attend a different school.

Needless to say, administrators and teachers are working hard to increase student test scores in their school’s weakest area of performance. In some elementary schools, education in science, history, and other subjects has been jettisoned in favor of concentrated attention on the basics. At the secondary level, subject area teachers are encouraged to develop assignments that give students practice in writing, for example, and to score their papers for writing skills. Professional development opportunities for teachers are limited to those that increase teachers’ ability to improve student performance on the FCAT.

Environmental Education in the Climate of Reform

Environmental education (EE) has a long history of being a supplemental opportunity for youth—a field trip to the nature center, a week at camp, or a project in the local stream. Although some argued that EE should be included in the national and state standards, it was deemed to be a topic that applied to many subjects, not a subject unto itself.

Environmental education goals can be achieved in a science class studying the movement of groundwater at a landfill site, or in a history class discussing the use of natural resources in the development of a new nation. Since environmental literacy means that youth have the awareness, knowledge, ability, motivation, commitment, and skill to work with others to resolve environmental problems and prevent new ones, environmental education activities can also improve communication, group process, and problem solving skills. These citizenship skills help prepare society-ready graduates and are often a part of a school’s written mission or goal.

Many environmental educators have encouraged subject-based teachers to use environmental studies to keep students’ interest in their lessons. Environmental topics also provide an important connection between the curriculum and the real world, but it has only been recently that evidence exists to justify these claims. Focusing first on forty schools that are using the environment as an avenue to achieve school-wide reform, the State Education and Environment Roundtable (SEER) coined the term Environment as an Integrating Context, or EIC, and launched an exploratory study to document these
schools' efforts. All schools in the study showed improvement in standardized test scores (Lieberman and Hoody, 1998) and teachers commented on valuable outcomes as diverse as an increase in student attendance, improved attention in class, and reinvigorated teachers. A follow-up study compared eight EIC schools to eight non-EIC schools in California and found that the students at the EIC schools scored higher on standardized tests than did the control group (SEER, 2000).

At the classroom level, a host of studies indicate that environmental education programs are successful at building problem solving skills, environmental knowledge, and skill at taking environmental actions, but few measure environmental curricula with a state assessment ruler. If the curriculum is not designed to meet state goals, it is not likely to show student achievement in these arenas. In addition, most state performance tests are more generic than environmental curriculum. For example, if a curriculum improves critical thinking in the context of solid waste management, but critical thinking is assessed in the context of consumer purchases, students may not show a gain on the state test.

Environmental Education in Florida

A recent study in Florida demonstrates that environmental education lessons that are designed to meet state curriculum goals can indeed improve student achievement as measured by the state achievement test (Randall, 2001). A set of biodiversity lessons designed to combine biology and writing skills was tested with 132 ninth and tenth graders in Gainesville, Florida. Students practiced effective writing techniques while learning about taxonomy, introduced and invasive species, and endangered habitats by conducting activities with the Florida Museum of Natural History collection databases. The FCAT writing rubric was used to score the students' first and last writing assignments to measure change. Results indicate that this combination of writing practice and interesting science topics can significantly increase writing test scores (Randall, 2001).

When teachers perceive environmental education as an “extra,” environmental activities will be easily discarded in favor of increasing student knowledge and performance for state tests. When environmental education lessons are developed for state curriculum standards, they will be acknowledged as supporting student achievement in dimensions that educators recognize, such as performance tests, attendance, and interest. Many national environmental education resource materials are developing correlations to state standards.

In Florida, for example, the Project Learning Tree (PLT) Steering Committee is adapting this national, award-winning program to state-specific standards and achievement test goals. Each of the 96 activities have been correlated to the age-appropriate Sunshine State Standards, and the training workshops demonstrate how a PLT activity can be modified to provide students with practice for the reading, writing, and mathematics state assessment tests. For example, the activity “How Big is Your Tree?” engages students in measuring trees in different ways and supports several SSS in math and language arts. With a few simple additions, this activity can launch teachers and students into a host of FCAT-type practice exercises:

In Mathematics

Use a string or tape measure to find the circumference of two different trees outside your classroom. Calculate the diameter of each tree. Check your answers by using the DBH tape (Diameter at Breast Height tape, a forestry tool). Show your work or explain in words how you determined the diameter of each tree. This exercise relates to the Sunshine State Standards: MA.B.1.2.1 and MA.B.1.3.1.

In Writing

Trees range in size from tiny seedlings to magnificent giants. Think about a drawing or painting of a forest landscape that contains a variety of trees. Imagine the landscape is real and you take a walk through the area. Write a story about your walk and describe how the size of the trees seems to change as you walk deeper into the forest. This exercise relates to the Sunshine State Standards: L.A.B.2.3.1.

In Reading
Florida is fortunate to have a great variety of large trees that grow throughout the state. In this text, the author states that among the 290 Florida trees, 172 trees are considered “champion trees.” Using details and information from the article, explain the criteria for being a “champion tree.” This exercise relates to the Sunshine State Standards: LA.A.2.2.1; LA.A.2.3.5.

A variety of additional questions or exercises can enhance existing environmental education resource materials to help teachers use the environment to increase FCAT scores. The enhancements are often modeled in teacher workshops, that support environmental education.

**Summary**

Florida teachers and environmental educators are in the midst of great change. It is without a doubt important to use statewide standards to design classroom learning objectives and to periodically ascertain student achievement. It is also critically important to promote student learning about the world in which we live. Environmental education, fortunately, can do both. Environmental education programs like Project Learning Tree engage learners in interactive lessons to discover and apply concepts. These concepts are relevant to the outdoor world and interesting to students. Environmental education programs can be used to promote a renewal of teacher and student interest in learning and, with appropriate adaptation, can reinforce the skills that are measured in the state achievement tests.

**Literature Cited**


Most people realize that paper and lumber come from trees. If we stop to think about it, we would see paper every day, in checkbooks, cereal boxes, shipping cartons, and toilet tissue, for example. Similarly, wood comes in all shapes and sizes, from construction lumber, plywood, paneling, and flooring to cooking spoons, violins, furniture, and baseball bats. But this is not the limit of the products we use from trees. We do not often include pecans, toothpaste, cork stoppers, cellophane tape, football helmets, activated carbon filters, and artificial vanilla in the list of forest products, but we should; they come from or have ingredients from trees. This publication explores how trees contribute to some of these products. (See Table 1).

### Food Made by Trees

A host of fruits and nuts are harvested from the same trees year after year. These tree products typically come from tended orchards, managed to provide the juiciest oranges, the largest pecans, the tastiest coconuts, and the sweetest mangoes. In some cases, a hardy variety is used to provide a strong and resilient root system, while branches of varieties that produce more ideal fruit are grafted onto the main stem. Most of the citrus in Florida comes from branches grafted onto sour orange and lemon roots. This practice is used for many other fruits as well.

**Table 1.** Teachers can use this information to enhance the following Project Learning Tree activities. To find out more about Project Learning Tree in Florida, contact Florida PLT Central at 352-846-2329.

<table>
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<tr>
<th>Activity</th>
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Only a few marketable food products come from wild, natural forests. Pine nuts, for example, are often collected from pinyon pine trees in the southwestern U.S. Conservation organizations help create local and international markets for certain rain forest fruits to increase the value of standing forests. If local communities can collect and sell enough tagua palm...
nuts (also called vegetable ivory) for buttons or Brazil nuts for candies, the forest might provide economic stability for the community.

Maple syrup is another tree-produced food. Although many different trees can be used to make “syrup,” the sugar maple tree yields the sweetest and best tasting syrup. The process begins in the early spring, when repeated cycles of sunny, warm days and frosty nights pressurize the woody core, or xylem tissue, of sugar maple trees in the northern U.S. The xylem carries slightly sweetened water containing nutrients and energy stores up to the branches. Because of this pressure, a tap drilled into the tree trunk will produce a steady drip of clear, watery sap. Collectors gather the sap from many trees and boil it down to concentrate the sugars into brown syrup. Once the weather warms, however, the sap loses its sweetness and pressure, and the maple syrup operation closes for the year.

Another sweetener, honey, is made by bees from the nectar of flowers. Some highly prized types of honey are made from nectar of tree flowers, such as orange, basswood, and tupelo. Tupelo honey is known by movie-goers as “Ulee's Gold.”

From Plants to Pulp to Paper

The fibers of many plants can be converted into paper. Specialty papers may include a percentage of cotton, banana leaves, kenaf, or hemp fibers. But the most popular source of paper is trees. In the southeastern U.S., pine trees can be harvested for pulpwood in only 15 years. Genetic improvements and carefully managed plantations may help trees grow even more quickly. Unlike other crops, trees can be harvested at any time of year providing a steady supply of wood to a nearby mill. If the pulp price is too low, the owner may decide to let the trees grow bigger and delay the harvest.

Paper is made from dried fibers that once formed the woody mass of a tree. These fibers are part of the xylem tissue that carries water up the tree and forms the structural component of wood. The walls of the cells in the xylem are composed of cellulose impregnated with lignin, a chemical glue that makes the cells stiff and waterproof. Different trees have slightly different chemical and physical properties of their wood fibers, and some of these features make them ideal for paper production. Hardwood trees tend to have short fibers and a type of lignin that dissolves more easily than softwood lignin, and their pulp tends to produce good writing paper. Eucalyptus trees are an unusual hardwood – they have very long fibers that make strong paper with a smooth writing surface. Softwood trees like pines have long fibers that make a pulp that is very good for cardboard boxes and grocery bags. Paper mills pay attention to the type of trees they receive and may change their recipe for paper accordingly.

For paper-making, the valuable part of the tree is the main stem, so the branches and leaves are left in the forest to enrich the soil. The bark is chipped off and may be burned at the mill to generate electricity or sold for mulch. The wood is sliced into silver-dollar size chips and cooked with chemicals under pressure to dissolve the lignin and separate the xylem tissue into individual fibers. The most common chemicals in the pulping process are sodium hydroxide and sodium sulfide, in a procedure called the kraft process. The pulping chemicals are recovered by washing the pulp and are used to dissolve the next batch of chips. The pulp goes through several additional processes: beating to increase fiber flexibility and bonding strength, and bleaching to brighten and whiten the pulp. Other chemicals are added to improve the paper printability and opacity. A residue of lignin and oleoresins is collected at the bottom of the pulping digester as spent black liquor to be separated and processed into other items or burned as fuel for the paper plant.

If recycled paper is used to make paper, a propeller-like machine mechanically separates moistened paper fibers. Sodium hydroxide aids in ink removal, and the pulp is screened and washed.

A slurry of wood fibers and water is spread in a thin sheet onto a continuously moving screen of the paper machine. The screen races through dryers and compressors until the water is squeezed out or evaporated; in this process the fibers bond together to form paper. As the paper is spooled onto giant rolls it may receive another treatment of clay or starch to give it an appropriate surface. From there it will be cut into sheets or processed into other products.
Paper thickness is determined from the amount of pulp fiber spread onto the screen. Cardboard is made from unbleached pulp that is thicker than writing paper. When one piece of cardboard is crimped and glued to two flat pieces, it becomes corrugated paper for boxes. Thick paper can be saturated with resins to create laminates for countertops, flooring, and wall coverings. Cereal boxes are made from a thin paperboard of pulp that has been bleached so those bright, bold, printed colors look their best.

The Magic of Cellulose

Cellulose, the molecule that gives flexibility and strength to redwoods and kudzu alike, can be dissolved out of the wood fibers and converted into many products. Rayon and Tencel®, for example, are fabrics woven from strands of spun wood cellulose. Chemical additives help purify the pulp, dissolve the fibers, and increase the viscosity of the molasses-like solution. When forced through a showerhead-like nozzle called a spinneret, thin strands of cellulose filament are formed. After hardening in a chemical bath, the strands are twisted into yarn, washed clean of chemicals, bleached, and dried. The yarn is woven into a fabric known for its silk-like qualities.

By adding other chemicals to the pulp or purified cellulose a variety of products can be created, like cellophane tape, cellulose sponges, cellophane windows in envelopes and pasta boxes, and photographic film. A hardened version of cellulose can be molded into “plastic” items, like toothbrush handles, steering wheels, combs, piano keys, ping pong balls, eyeglass frames, and football helmets. With the addition of nitrates, cellulose can even be used to make explosives!

Cellulose is a long polymer made from thousands of molecules of the sugar glucose. Starch is also a long chain of glucose molecules but connected together in a way that is easily digested by people. When cellulose is processed and purified, it can be used in foods much like starch, though our digestive systems can not break those connecting bonds to utilize the energy stored in glucose. Cellulose gum is a food additive used to make some low-fat salad dressings thicker, some cough syrups smoother, and some ice cream creamier. It is also in toothpaste, hot chocolate mix, and some ready-to-spread frostings. Cellulose makes other things thick, as well, like paint and shampoo. Cellulose is also used to keep powdered foods from clumping together. It is in many brands of grated Parmesan cheese to keep it coming out of the container holes.

Resins and Naval Stores

One of Florida’s first natural resources to be harvested and processed was the oleoresin (also called gum and pitch) that oozed out of long diagonal cuts in pine trees. Initially, the crude gum was cooked to make tar for shipbuilding. Later, the sticky gum was distilled to make turpentine and rosin.

Oleoresin is not sap. It is produced by special resin canals that run the length and breadth of the tree. When a tree is wounded, these ducts exude a sticky resin that helps protect the tree from insects and disease and enables the tree to recover. Because this sticky gum clogs up the wound, tappers must re-injure the tree regularly to keep collecting oleoresin. The chemicals in pine tree resin can be distilled into a treasure chest of other chemicals.

The days of gum tappers are largely gone from Florida, but pine trees are still tapped in other countries. In Florida, these substances are extracted during the papermaking process. When pulp is cooked, turpentine is released from the wood chips and condensed in a distillery above the vats. The waste liquid from the pulp, mostly dissolved lignin and oleoresins, is called black liquor. The black liquor is processed to remove the lignin and concentrate the foamy soaps, which are skimmed off and acidified to produce tall oil. The tall oil is then separated into pitch, rosin, and fatty acids. The term tall oil comes from the Swedish word tallolja, meaning, “pine oil.” Each of these substances has a variety of uses.

- Turpentine, the first byproduct of the pulping process, has many uses in addition to a solvent. It can be processed into two basic chemicals: alpha-pinene (which is used to make pine-scented disinfectants as well as the insecticides toxaphene and strobane) and beta-pinene, which is used to make many
fragrances and flavors such as lemon, lime, mint, and lilac.

- Black liquor is used in drilling muds and animal food pellets. Torula yeast, a nutritional food additive, can be grown on black liquor.

- Lignin can be used to control and trap the air blown into concrete mix, or processed into artificial vanilla, called vanillin.

- Pitch is often burned in the paper mill or distillery as a fuel, which increases the energy efficiency of the plant. It is also used in adhesives, coatings, and sealants. Pitch contains phytosterols that have pharmaceutical uses.

- Rosin is used for adhesives, coatings, inks, paints, varnishes, tackifiers, plasticizers, emulsifiers, and hundreds of other industrial applications. It is the substance that helps make Band-Aids™ stick to your skin, gives a baseball player a better grip on the ball or bat, helps the fiddler's bow pull on the strings to make a rich sound, and enables printing ink to stick to paper. Rosin is also added to rubber and chewing gum.

- Tall oil fatty acids are used in a variety of manufacturing industries, including printing ink, fabric softeners, detergents, soaps, cleaners, lubricants, plasticizers, and asphalt emulsifiers. A new use for tall oil is to produce stanol esters as a margarine substitute that lowers cholesterol.

**Products from Special Trees**

Many trees produce chemicals to fend off insect attacks that can be converted by enterprising chemists into marketable drugs. Willow twigs, for example, were chewed by native people to relieve toothaches. The leaves and bark contain salicin, a compound similar to synthetic aspirin.

A few other trees are making important contributions to the medical community. A drug used in cancer treatment, Taxol®, was first manufactured from the bark of Pacific yew. It too is now available synthetically. Extracts of saw palmetto berries improve prostate function.

Chicle, the boiled gum of sapodilla trees, has been used for many years as the foundation for chewing gum, although trees on every continent have served this purpose for over 2000 years. Gum manufacturers combine sugar, glycerin, and flavoring with the raw material to make soft yet resilient chewing gum.

One of the most useful substances still harvested today from trees is the latex from rubber trees. Each rubber tree can produce commercial quality latex for about 20 years. A spiral groove is cut into the bark and a collection cup is mounted at the bottom of the cut. A thin strip of bark is shaved from the groove every other day to keep the sap flowing from specialized lactifer tissues in the bark. The latex is cooked and processed, then molded into products like tires, boots, gloves, and rubber ducks.

The bark of the cork oak tree is a renewable source of light, airy cork. Cork is still harvested by stripping the bark from the tree, which grows in the Mediterranean region, every nine years. Chunks of bark are cut, dried, cleaned, cut into shapes, and used for cork stoppers, bulletin boards, and flooring.

**Summary**

From baseball bats to bicycle tires, shampoo to Parmesan cheese, a vast array of commonly used products have a tree in their list of ingredients. In some cases, like rayon fabric and coconut milk, trees provide the main or only ingredient. In many of our processed foods, like ice cream and salad dressing, trees provide a few minor ingredients that enhance the quality or attractiveness of the food. And unless we talk to a chemical engineer, we will probably never know the extent to which chemicals derived from wood products are used in manufacturing as dispersing, stabilizing, lubricating, and plasticizing agents.

Many of these tree-derived chemicals compete in the industrial marketplace with petroleum-based hydrocarbons. As petroleum resources become scarce, there will be a growing interest in using renewable trees to maintain our comfortable lifestyle. Many of our southern forests, including pine plantations, will play a key role in producing these important ingredients.