

ACTIVE LEARNING — WATER-QUALITY EDUCATION FOR YOUTH AT THE ANNUAL NATURAL RESOURCES CONSERVATION WORKSHOP FIELD DAY, TIFTON, GEORGIA

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Abstract. The Natural Resources Conservation Workshop is held annually at Abraham Baldwin Agricultural College in Tifton, Georgia. The events of the weeklong workshop for high school students focus on four major areas of Georgia's natural resources and include soil and water, wildlife, coastal resources, and forestry. Although much of the instruction is provided in a classroom setting, a field day is hosted each year that offers hands-on exercises to reinforce classroom lessons. For the past 3 years, interactive exercises in water pollution and aquatic ecology have been used to instruct students about water-quality issues. In the pollution exercise, each student plays a part in a story about a pristine lake that becomes more polluted as development occurs over time. The objective of the exercise is to foster the recognition that everyone contributes to water pollution; and, therefore, everyone is responsible for prevention and clean up. Students also learn more about the complexity of aquatic systems by donning waders and capturing and identifying aquatic invertebrates. This is an eye-opening experience for many students who were not even aware that these animals exist! These exercises increase students' comprehension of water-resource issues, awareness of the roles and responsibilities of each person with regard to water resources, and appreciation for the complexity and diversity of aquatic systems.

NATURAL RESOURCES CONSERVATION WORKSHOP

The Natural Resources Conservation Workshop is an annual natural resource education camp for youth ages 15–18 held during the summer at Abraham Baldwin Agricultural College in Tifton, Georgia. The week-long workshop has graduated more than 10,000 high school students in its 41-year history. The Georgia Chapter of the Soil and Water Conservation Society,

Georgia Association of Conservation District Supervisors, and Abraham Baldwin Agricultural College are the principal sponsors of the workshop with cooperating Federal, State, and local governmental agencies and private organizations providing adult counselors, instructors, and equipment support. The events of the week focus on four major areas of Georgia's natural resources: soil and water, wildlife, coastal, and forestry as well as the important economic links between our natural resources and research and industry. Knowledgeable instructors teach courses in the classroom and field in the four subject areas. Students are introduced to many important aspects of our natural resources and related activities including wildlife, forestry, water quality, water use, mining, soils, land use, resource conservation, and recent environmental issues. There also is time at the workshop for students to have fun; the sponsors provide recreation and nightly entertainment. At the end of the week, students compete for more than \$10,000 in college scholarships and other cash prizes by completing a comprehensive exam, which consists of fifty questions in each of the four major subject divisions relating to the information covered at the workshop.

While much of the instruction is provided in a traditional classroom setting, a field day is hosted each year with outdoor classrooms offering opportunities for hands-on learning experiences in forestry, wildlife, outdoor recreation and safety, and water quality. These stations are set up with various types of equipment, displays or activities and are staffed by persons with experience in and who are knowledgeable in these areas. For the past 3 years, personnel from the U.S. Department of Agriculture Natural Resource Conservation Service and the U.S. Geological Survey have staffed the water-quality station and have utilized interactive, activity-based, hands-on exercises in water pollution and aquatic ecology to enhance the students' learning experience.

BENEFITS OF ACTIVE LEARNING

Hands-on learning can be defined as any educational activity that involves active and direct experience with the natural world. This type of learning provides opportunities for students to address real-life questions and issues individually and collaboratively and to gain understanding from the experience (North Central Regional Educational Laboratory, 1995). Hands-on activities have been shown to enhance the learning of skills, including science concepts and mathematics. Benefits of active or hands-on learning for students include increased knowledge, understanding, enjoyment of learning, independent thinking and decision making, and perception and creativity (Haury and Rillero, 1994). Hands-on learning makes science fun for both the student and the teacher.

At the water-quality station, students are given the opportunity to utilize the concepts they have learned during the week in two interactive hands-on activities. The total number of students attending the water-quality station at any one time generally ranges from thirty to forty. To ensure that each student has an opportunity for hands-on participation, the groups are split, with half participating in the aquatic ecology exercise while the other half completes the water pollution exercise. After 30–45 minutes, the groups rotate between the two exercises. With several instructors present to assist with each of the exercises, the student to teacher ratio at the water-quality station is approximately five to one.

AQUATIC ECOLOGY AND INVERTEBRATE IDENTIFICATION EXERCISE

The aquatic ecology component of the field-day exercises provides a brief introduction to the complexity of aquatic ecosystems, the concept of trophic levels, and the detrimental effects of pollution on lakes and streams. The objectives of this component are to give students hands-on experience collecting and identifying aquatic invertebrates and to instill upon the students the idea that a pond or stream is not just a physical body of water, but also a diverse community of living creatures.

The outdoor classroom consists of three large picnic tables set up to overlook a small pond. A group of approximately 15 to 20 students are seated at the tables and are asked to look across the pond and to think about what kinds of animals might be encountered on or beneath the water surface. The instructor entertains student responses and encourages students to think about the specific types of habitats

where these animals might be found. The importance of aquatic macroinvertebrates as a food source for animals higher up the food chain, including fishes and birds and the use of aquatic invertebrates as indicators of water quality are briefly discussed.

After the brief lecture, students are allowed to don waders, select D-frame nets and buckets, and begin sampling along the margins of the pond. The instructor provides brief instructions on collection techniques and provides close supervision while students are sampling. All students are encouraged to participate either by sampling with nets, by holding buckets, or by documenting the activities of their classmates with disposable cameras. After a few minutes of collection, students are asked to remove the waders, return nets, and take the collected invertebrates to the tables.

Magnifying glasses and forceps are used to pick invertebrates from the detritus-laden mixture of water, bugs, and small fishes collected from the ponds. Magnifying glasses and a low-power dissecting microscope are used along with simplified family-level taxonomic keys to identify many of the commonly collected beetles, dragonflies, damselflies, and true fly larvae present in southeastern lentic habitats during the summer. Once a student or group of students has made each family-level identification, the instructor provides general habitat, life-history, and pollution-tolerance information for the particular invertebrate identified. Students are also encouraged to view invertebrates under the low-power dissecting microscope, allowing the complex physiological structures of the invertebrates and fishes to be viewed first hand on a living specimen.

WATER-POLLUTION EXERCISE

In the water-pollution exercise, students play the roles of various characters in a story about the development of land around a pristine lake and increasing human impacts over time. The objective of the exercise is to encourage the students to recognize that everyone contributes to water pollution and, therefore, everyone is responsible for its prevention and remediation.

The setting for the exercise is the shore of a small pond. The 15–20 students are randomly assigned to play characters, each of which will have a role in impacting water quality in this interactive exercise. The narrator stands in front of the group with a small aquarium of clean water, representing an imaginary lake. The students are asked to imagine that they are standing on the shore of a pristine lake, previously unseen by humans. The narrator then begins to tell a story about the history of development around the lake.

As the narrator names the character represented by the student, the student comes forward and is given a small container of a common, nonhazardous substance that represents a pollutant. The student tells the class what is in the container, indicates a pollutant that the substance might represent, and dumps his or her “contribution” into the aquarium. The group observes the effect of each substance upon the lake. Best management practices that can be used to reduce the amount of pollutant are discussed as appropriate. The materials added to the aquarium and the types of pollutants that they represent are listed in Table 1.

Table 1. Materials used to represent pollutants in the water pollution exercise

Cast of Characters	Material	“Pollutant” Represented
River	Sand	Natural Bed Load
Beaver	Wood Chips	Woody Debris
Wetlands	Dry Grass	Vegetative Debris
Shellfish	Crushed shells	Hard Organic Relics
Settlers	Nails	Construction Debris
Farmers	Potting Soil	Soils from Accelerated Erosion
Sewage	Toilet Paper	Human Waste
Parking Lots	Cooking Oil	Motor Oil
Fishermen	Fishing Line	Fishing Line
Boaters	Styrofoam	Litter
Sunbathers	Plastic	Litter
Laundromats	Dish Detergent	Detergents
Lawns	Water Soluble Plant Food	Fertilizers
Ships	Tea or Cola	Bilge Spillage
Factories	Molasses	Factory Waste

Periodically, the students are asked if they would be willing to swim in the lake, eat fish that were caught in the lake, or go boating on the lake. These questions often generate discussion about the water quality in various Georgia lakes where the students do swim, fish and boat, allowing the students to relate the exercise directly to their own lives.

When all of the materials have been added, the narrator asks the students a series of questions about what has happened to the water quality and wildlife

habitat of the lake, as well as how these changes might affect the quality of life for people who live around the lake. The students are asked to identify who is responsible for polluting the water. When they answer that “everyone” is responsible, they are asked to identify who is responsible for cleaning up the pollution. Finally, several ways in which each person can reduce his or her contributions to water pollution are discussed.

CONCLUSION

The Natural Resources Conservation Workshop provides high school students with valuable classroom and field opportunities to learn about natural resource issues, conservation, and management. The water-quality station at the annual field day provides additional opportunities for students to actively learn about water resources through two hands-on activities. In addition to reinforcing material presented to the students during the weeklong workshop, these exercises increase students’ comprehension of water-resources issues, awareness of the roles and responsibilities of each person with regard to water resources, and appreciation for the complexity and diversity of aquatic systems.

LITERATURE CITED

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