Environmental Education Materials: Guidelines for Excellence Workbook

Bridging Theory & Practice

North American Association for Environmental Education

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Environmental Education Materials: Guidelines for Excellence Workbook represents another in a series of documents published by the North American Association for Environmental Education (NAAEE) as part of the National Project for Excellence in Environmental Education.

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Environmental Education Materials: Guidelines for Excellence Workbook was funded by the United States Environmental Protection Agency through the Environmental Education and Training Partnership (EETAP) under agreement number EPA-NT90289701-3 with NAAEE.

Additional funding and support for this project have been received from Northern Illinois University and the National Environmental Education and Training Foundation.

Additional copies of this book can be obtained by contacting:
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ISBN#: 1-884008-80-1

10/2000

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INTRODUCTION

Why a Workbook?

In 1996 *Environmental Education Materials: Guidelines for Excellence* was developed to provide recommendations for selecting, evaluating, and producing quality environmental education lesson plans, curricula, and other instructional materials. Through workshops, conferences, and presentations, National Project for Excellence in Environmental Education staff have trained environmental educators across the country in the use of these guidelines.

These workshops have been received well by both formal and nonformal educators. However, scheduling conflicts, trainer and audience availability, funding, and other logistical challenges limit the number of presentations we can give. This, in turn, limits the number of educators prepared to use these materials.

To overcome this obstacle, we have developed this Workbook to lead educators, step by step, through the process of using the *Environmental Education Materials: Guidelines for Excellence*. The *Workbook* is intended to extend the reach of the Guidelines to a much broader audience.

THE ROOTS OF EE

The Belgrade Charter was adopted by a United Nations conference in 1976 and provides a widely accepted goal statement for environmental education: "The goal of environmental education is to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward the solutions of current problems and the prevention of new ones."

A few years later, the world's first intergovernmental conference on environmental education adopted the Tbilisi Declaration. This declaration built on the Belgrade Charter and established three broad objectives for environmental education. These objectives provide the foundation for much of what has been done in the field since 1978:

- To foster clear awareness of and concern about economic, social, political, and ecological interdependence in urban and rural areas;
- To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment;
- To create new patterns of behavior of individuals, groups, and society as a whole towards the environment.

Why Environmental Education?

Environmental education (EE) is rooted in the belief that humans can live compatibly with nature and act equitably toward each other. Another fundamental belief is that people can make informed decisions that consider future generations. EE aims for a democratic society in which effective, environmentally literate citizens participate with creativity and responsibility.

EE often begins close to home, encouraging learners to understand and forge connections with their immediate surroundings. The awareness, knowledge, and skills needed for this localized learning provide a basis for moving out into larger systems, broader issues, and a more sophisticated comprehension of causes, connections, and consequences.

EE is good education. It is learner-centered and provides students with opportunities to construct their own understanding through hands-on, minds-on investigations. Engaged in direct experiences, learners are challenged to use higher order thinking skills. EE provides real-world contexts and issues from which concepts and skills can be learned. Quality EE programs are multidisciplinary and facilitate teaching of science, civics, social studies, mathematics, geography, english language arts, economics, the arts, and history.

Workbook Goals and Objectives

This workbook is intended for use as a companion to the *Environmental Education Materials: Guidelines for Excellence*, hereafter referred to as the *Materials Guidelines*. The *Materials Guidelines* contain 28 recommendations, organized into six Key Characteristics, for creating effective environmental education materials. The *Workbook* demonstrates applications of these guidelines.

Structurally, the *Workbook* is divided into six sections that correspond to the six Key Characteristics found in the *Materials Guidelines*. Each section includes activities and examples that together clarify the 28 *Materials Guidelines*.

Summary of the
Environmental Education Materials: Guidelines for Excellence

#1 Fairness and accuracy: EE materials should be fair and accurate in describing environmental problems, issues, and conditions, and in reflecting the diversity of perspectives on them.

- 1.1 Factual accuracy
- 1.2 Balanced presentation of differing viewpoints and theories
- 1.3 Openness to inquiry
- 1.4 Reflection of diversity

#2 Depth: EE materials should foster an awareness of the natural and built environment, an understanding of environmental concepts, conditions, and issues, and an awareness of the feelings, values, attitudes, and perceptions at the heart of environmental issues, as appropriate for different developmental levels.

- 2.1 Awareness
- 2.2 Focus on concepts
- 2.3 Concepts in context
- 2.4 Attention to different scales

#3 Emphasis on skills building: EE materials should build lifelong skills that enable learners to address environmental issues.

- 3.1 Critical and creative thinking
- 3.2 Applying skills to issues
- 3.3 Action skills

#4 Action orientation: EE materials should promote civic responsibility, encouraging learners to use their knowledge, personal skills, and assessments of environmental issues as a basis for environmental problem solving and action.

- 4.1 Sense of personal stake and responsibility
- 4.2 Self-efficacy

#5 Instructional soundness: EE materials should rely on instructional techniques that create an effective learning environment.

- 5.1 Learner-centered instruction
- 5.2 Different ways of learning
- 5.3 Connection to learners' everyday lives
- 5.4 Expanded learning environment
- 5.5 Interdisciplinary
- 5.6 Goals and objectives
- 5.7 Appropriateness for specific learning settings
- 5.8 Assessment

#6 Usability: EE materials should be well designed and easy to use.

- 6.1 Clarity and logic
- 6.2 Easy to use
- 6.3 Long lived
- 6.4 Adaptable
- 6.5 Accompanied by instruction and support
- 6.6 Make substantiated claims
- 6.7 Fit with national, state, or local requirements

Workbook Objectives	Corresponding Materials Guidelines
Fairness and Accuracy	
1) Assess materials for current, factual information and appropriate language.	1.1
2) Identify potential bias in environmental education materials.	1.1, 1.2
3) Evaluate materials in terms of cultural and ethnic diversity.	1.3, 1.4
Depth	
4) Distinguish the factors contributing to environmental awareness.	2.1
5) Demonstrate an understanding of conceptual frameworks and concepts in context.	2.2, 2.3
6) Recognize the relevancies and relationships of various scales..	2.4
Emphasis on Skills Building	
7) Classify curriculum materials according to their support of higher-order thinking skills.	3.1
8) Distinguish the skills necessary for issue analysis and action.	3.2, 3.3
Action Orientation	
9) Choose strategies that encourage learners to reflect on the consequences of their action(s).	4.1
10) Distinguish patterns that contribute to learner empowerment.	4.2
Instructional Soundness	
11) Classify instructional methods and ways of learning.	5.1, 5.2, 5.3
12) Evaluate the use of various instructional environments.	5.4, 5.5, 5.7
13) Differentiate the role of goals, objectives, and assessments.	5.6, 5.8
Usability	
14) Recognize the necessary structural elements for quality environmental education materials.	6.1, 6.2
15) Identify characteristics that contribute to longevity and adaptability.	6.3, 6.4, 6.5
16) Assess the validity of claims and degree of correlation.	6.6, 6.7

The *Workbook* addresses 16 objectives (above), that enable the user to bridge any gaps between theory and practice and apply the *Materials Guidelines* in a variety of educational settings.

Sections can be explored in sequential order or as independent modules.

Navigating the Workbook

The Key Characteristics

The first page of each section is divided into three distinct parts. One part includes a brief statement of the key characteristic followed by a list of the related guidelines, from the *Materials Guidelines*. The second part lists the objectives and contents for the section, and are denoted by the following graphics:

Objectives—Lets you know what each example or activity focuses on. Helps you to know if you're "on target."

Contents—Lays out and organizes the chapter by providing activity/example titles and page numbers.

The third part, entitled "Things to Think About...," is a general discussion of the concepts and considerations included under the key characteristic.

Activities and Examples

Following the Key characteristics page, activities and examples are used to achieve the section objectives. As shown in the box to the right, the introduction to each activity and/or example indicates the corresponding Key Characteristic, Materials Guideline(s), and *Workbook* Objective. They are distinguished by these icons:

Activity—Denotes an activity for you to do.

Example—Indicates an example is provided.

The activities and/or examples included in the *Workbook* were created specifically to illustrate the concepts and skills highlighted in the *Materials Guidelines*, and are not drawn from existing curricula or programs. No endorsement of particular approaches or activities is implied.

Activity and example structure.

ACTIVITY / EXAMPLE

TITLE

KEY CHARACTERISTIC #

GUIDELINE:

OBJECTIVE #:

GLOSSARY TERMS:

•

•

Other helpful Items

Several elements also help to further your learning and understanding of the concepts and to make the workbook more useful. These include:

Answer Key—Appears only on the answer page for activities.

Bringing it Home—Revisits the major thoughts and concepts of the example or activity.

- Glossary Terms—Words or phrases defined in the glossary are in boldface type the first time they appear in the text. They are also highlighted in the side-bar introducing each activity and/or example. The glossary begins on page 55.
- Selected References—This is a list of documents which supplement the information presented in the workbook.

Key Characteristic

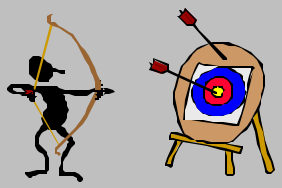
1

Fairness and Accuracy

EE materials should be fair and accurate in describing environmental problems, issues, and conditions, and in reflecting the diversity of perspectives on them.

GUIDELINES

1.1 Factual accuracy
1.2 Balanced presentation of differing viewpoints and theories
1.3 Openness to inquiry
1.4 Reflection of diversity

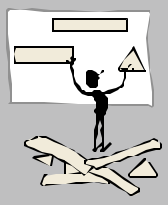


Objectives

1) Assess materials for current, factual information and appropriate language.
(Guideline 1.1)

2) Identify potential bias in environmental education materials.
(Guidelines 1.1, 1.2)

3) Evaluate materials in terms of cultural and ethnic diversity.
(Guidelines 1.3, 1.4)



Contents

Things to Think About...

As educators on environmental topics, we sometimes walk a fine line between **education** and **advocacy**. A line that can be crossed without even being aware of it. Education involves giving students access to information, opinions, and interpretations so they can develop their own conclusions. This may require the presentation of information, data, or views with which the instructor does not agree or that the instructor would rather not acknowledge. Advocacy involves giving students access to information with the intent that students reach a specific conclusion or develop a particular opinion.

An educational curriculum must present different viewpoints, such as the pros and cons of forest fires. Different perspectives also need to be presented in a balanced way—one that does not **bias** the student toward any one perspective. It is important to understand that, depending on their personal interpretations of information, reasonable people can hold different but equally valid views. In addition, environmental issues affect people differently; some of the consequences of a decision or action might be invisible to someone who is not aware of or open to the opinions or experiences of others.

Although it is important to maintain balance in presentation, it is also important that educators be aware of the relevance, timeliness, and accuracy of the information they provide. An instructor looking at possible instructional material may sift through large amounts of information to determine the material's relevance and accuracy. Questions asked might include: Is this information current? How much of this is based on the writer's subjective opinion, rather than research or fact? Is the writer trying to influence me with the choice of words used? Are these primary sources of information, or did the writer dilute or edit someone else's work? These questions can help indicate if and how the material should be used, what supplemental materials might be needed to help balance the presentation, and what extra tools or skills the students might need to understand or make sense of the information.

ACTIVITY

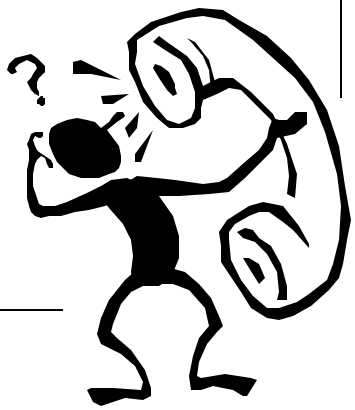
Going to the Source's Mouth

KEY CHARACTERISTIC #1
Fairness and Accuracy

GUIDELINE: 1.1

OBJECTIVE 1:
Assess materials for current, factual information and appropriate language.

GLOSSARY TERMS:
- biased
- objective
- primary source
- propagandistic
- referenced
- secondary source
- tertiary source



BACKGROUND:

The topic being addressed dictates how current information must be. For example, data regarding the boiling point of water does not change over time, and a very old source is acceptable. However, information about private use of government lands or global climate change may no longer be accurate or relevant in just a few years' time.

Just as the age of the information is important, so is the source. How well a given set of materials is referenced, e.g., how thoroughly the sources of information are cited, tells you how readily the data can be verified or further explored. Generally, **primary sources** are preferred over **secondary** or **tertiary sources** because they reflect an original, firsthand rendering of the event or situation. It should be noted, however, that any source of information (primary, secondary, or tertiary) can be biased or unbiased.

Even curriculum materials with accurate information may not be **objective** in their presentation. They can be both biased and accurate. For example, the language used to express facts may be **propagandistic**, that is, the author may choose to present only the facts that favor one perspective over another. Language that is very emotional, that relies heavily on superlatives and extremes, or that belittles or minimizes certain ideas or points of view may be present in a work that is otherwise factually accurate and well researched. Comments or statements such as "always a problem," "everyone believes," and "absolutely no evidence," are examples of such types of writing.

Even a flawed set of materials may have educational value. An instructor may choose two conflicting pieces to give students exposure to different viewpoints. Opinionated but accurate information may be used as a reference, with attention given to the author's perspective and slant. Information that is dated may be used for historical purposes and supplemented with more current data.

INSTRUCTIONS:

Review the selections and indicate if you would use the information in teaching about air pollution. In the space provided, explain your reasoning. Be attentive to whether the information is accurate, well referenced, current, and objective or propagandistic. Answers can be found on page 12.

Information	Would you use this information as is? (Yes/No)	Observations and/or Concerns
EXAMPLE: **"A study funded by the National Indoor Plant Association showed that house plants improve indoor air quality."**	**Yes**	**Referenced but source may not be objective and no date is given.**
1) "Steps to curb air pollution were incorporated in a law called the Clean Air Act in the 1970s."		
2) "Science has confirmed that Mr. Ford's new internal combustion horseless carriage produces gases which may be unpleasant to some gentlemen, and distasteful to cultured ladies." —*Car and Chauffeur*, 1914		
3) "A double-blind study ('Residual Toxicity of Nicotine Exposure in Dieffenbachia amoena', *Botanica Domestica,* volume 4) has shown that second-hand smoke is actually good for house plants. From this we can conclude, it must be OK for humans."		
4) "Electric cars are preferable to all other modes of transportation. They are inexpensive and don't pollute the air in any way, shape, or form."		
5) "Electric cars are expensive playthings for wealthy celebrities that want to be known for their pro-environmental stance. They will never be of any value to average working-class Americans."		
6) "Technological innovations in the last thirty years have reduced but not eliminated sulfur emissions from coal burning power plants." —*Journal of Amps & Volts*, 1996		

BRINGING IT HOME:

The activity "Going to the Source's Mouth" demonstrates some of the different challenges that educators may face in trying to select curricula. Any of the quotes presented could be used successfully in a unit about air pollution. Some of the examples include language that is very objective and evenhanded; others put a "spin" on the information they present. Some present facts; others present opinions. How one would use these quotes depends on the age and developmental level of the students, the availability of complementary materials, the time allotted for study, and the instructor's skill and comfort level.

ACTIVITY

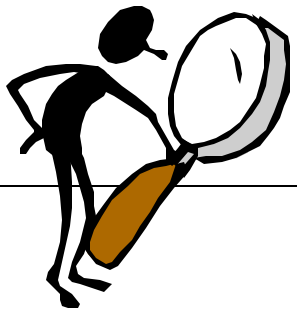
To Skew or Not to Skew

KEY CHARACTERISTIC #1
Fairness and Accuracy

GUIDELINES: 1.1, 1.2

OBJECTIVE 2:
Identify potential bias in environmental education materials.

GLOSSARY TERMS:
• bias



BACKGROUND:

No material is completely free of **bias**. Bias appears in the way statements are worded, in the kind of data chosen for analysis, and from the source of the information. Some bias can be unintentional, for example, information that is simplified for younger or less sophisticated audiences can appear biased by virtue of ignoring complexities.

Information also needs to be evaluated in terms of the language and tone used in its presentation. Emotional or judgment-based language (such as the terms evil, bleeding heart, tree hugger, exploitation, cold-blooded, heartless) can slant or prejudice a reader's perception of the issue. Similarly, language involving extremes, or making sweeping generalizations can be inaccurate (for instance, "No scientists believe that..." or "All the major industries..."). Finally, educators should be alert for casual or sloppy use of statistical terms, such as confusing "most" with "average." (e.g."The average number of children in a family is 2.2," versus "Most families have 2.2 children.")

INSTRUCTIONS:

Read the following passages relating to population. Underline the words or phrases that skew or slant the information. Answers can be found on page 12.

EXAMPLE:

The death of excess populations from disease, famine, natural disaster or other causes are predictable events. They are the natural way of cleansing the globe of unwanted and unproductive masses.

- **World population continues to increase at unacceptably high rates. In many developing areas of the world, birth rates have remained constant. Yet population increases because of advances in medicine that minimize infant mortality. Despite the high costs of maintaining large families in these increasingly urbanized societies, many cultures stubbornly cling to ancient notions that value large numbers of offspring.**

- **America is incapable of absorbing unlimited numbers of illegal immigrants. While Americans value growth and welcome diversity, our cherished way of life is threatened by invaders from beyond our borders. Even today, our social, health, educational, and legal systems are creaking under the weight of hordes of trespassers who cross our borders in violation of the law, breed large families, and expect the hard-working taxpayers of our country to support them.**

- **Experts are divided on the consequences of the recent decline in the population of the lesser tribble. Although this obnoxious and invasive animal has been the bane of farmers and ranchers since its introduction 25 years ago, the 40 percent population drop in the last year has even some tribble-haters worried. It is feared that this decline could foreshadow the extinction of this irresistibly cute yet horribly destructive species. This would be disastrous for manufacturers of tribble houses and designer tribble food. Additionally, red-tailed hawks and feral cats have come to depend on wild tribbles for their food supplies in recent years; their decline could spell doom for these predators.**

BRINGING IT HOME:

Children are well aware that names and words can be hurtful. Even adults need to remember the power that words can have to change our minds, fire our emotions, summon strong sensitivities, or simply leave a bad taste in our mouths.

EXAMPLE Cultured Ivory

KEY CHARACTERISTIC #1
Fairness and Accuracy

GUIDELINES: 1.3, 1.4

OBJECTIVE 3:
Evaluate materials in terms of cultural and ethnic diversity.

GLOSSARY TERMS:
• cultural perspectives

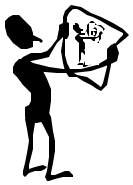
BACKGROUND:

To be accurate and complete, materials should be inclusive of different **cultural perspectives** and experiences. This should go beyond including an ethnic story or legend as a token nod toward diversity. There must be recognition that each culture has legitimate viewpoints that may conflict with each other, and that these differences can play a role in students' understanding of and decision making about environmental issues. Materials should encourage discussion of differences and assist learners in considering varying viewpoints while developing their own opinions.

A well-rounded set of materials reflects some or all of these perspectives:

- Are the views and interests of people of various economic status expressed?
- Are the views of indigenous peoples included?
- Are different cultures' use of and relationship to the natural world explored?
- Are the materials and activities sensitive to the needs of persons with disabilities?
- Do the materials encourage learners to open their minds to different ideas and perspectives?

Obviously, no single set of instructional materials can incorporate all possible opinions or perspectives on a topic. The number of viewpoints included depends on the complexity of the subject, the age of the audience, and the availability of accurate and current information about divergent views.



ABOUT THE EXAMPLE:

In the following example, pay attention to the ways that the center staff make reference to different cultures and groups, and how their interests in the elephant differ and, at times, collide.

At the Ivory Park Nature Center, the interpretive guides discuss ways different civilizations have thought about elephants. First, they share the natural history of elephants with visitors (what elephants look like, where they live, and how they survive). While discussing elephants' strength and intelligence, the interpreters highlight use of elephants in historical military efforts, such as Hannibal's crossing of the Alps, and in agriculture and logging in Asia today.

The discussion then turns to elephants as a source of ivory. The guides employ photographs and artifacts (such as piano keys) illustrating ways in which ivory has been used. The advantages of using ivory are also discussed. The guides then explain the population decline of wild African elephants in the twentieth century and the role that poaching has played in this decline. Maps and charts show where elephants live and where populations have decreased; they also show areas such as Botswana, Zimbabwe, and Namibia, where populations are currently increasing.

In discussing conservation efforts, the guides point out that many of the countries where elephants live are poor and do not have the resources to commit to protecting them. They add that elephants can damage crops and that farmers often have a financial incentive to help poachers. To illustrate this, the guides explain that a farmer could make three times their typical yearly wage by poaching a single elephant.

Having given this background, the interpreters discuss the importance of making elephant conservation a viable economic activity. Among the strategies they discuss is ecotourism, where visitors from foreign countries pay for excursions to see elephants and other animals in the wild. The guides point out that this industry provides local people with an economic incentive to maintain wild elephant populations and to discourage or end poaching.

BRINGING IT HOME:

Why would American students be concerned about cultures in Africa or any culture different from their own? It is important for students to be exposed to a multitude of perspectives and ideas. However, in examples such as this, cultural diversity provides more than diverse viewpoints. Culture influences how individuals see themselves in relation to the natural world, and therefore helps them understand the different types of decisions people make about environmental issues. Thus, a student in Kansas might understand the concept of poaching, but would not appreciate the complexity of the issue without information on the economic conditions of those living near elephants or the reasons some people traffic in ivory.

ANSWERS Key Characteristic #1—Fairness & Accuracy

Going to the Source's Mouth page 7

Any one of these passages could be used in a lesson on air pollution. The following are not necessarily "right" answers, but indicate aspects an educator should consider.

Information	Observations and/or Concerns
1. "Steps to curb air pollution were incorporated in a law called the Clean Air Act in the 1970s."	**Objective, but lacks source.** The statement does not pass judgement on the Clean Air Act but the source of the information is not identified.
2. "Science has confirmed that Mr. Ford's new internal combustion horseless carriage produces gases which may be unpleasant to some gentlemen, and distasteful to cultured ladies." —*Car and Chauffeur*, 1914	**Data dated, but objective.** Here the source is identified but the information is quite old. It would still be useful in teaching about the history of the issue.
3. "A double-blind study ('Residual Toxicity of Nicotine Exposure in Dieffenbachia amoena', *Botanica Domestica,* volume 4) has shown that second-hand smoke is actually good for house plants. From this we can conclude, it must be OK for humans."	**Propagandistic but well referenced.** Again the source is cited but the intent is clearly to support a particular point of view.
4. "Electric cars are preferable to all other modes of transportation. They are inexpensive and don't pollute the air in any way, shape, or form."	**Propagandistic, not well referenced.** This is a statement of personal opinion without supporting evidence or references. The author uses language that directs the reader to a particular perspective.
5. "Electric cars are expensive playthings for wealthy celebrities that want to be known for their pro-environmental stance. They will never be of any value to average working-class Americans."	**Propagandistic, not well referenced.** Another statement of personal opinion without supporting evidence or references.
6. "Technological innovations in the last thirty years have reduced but not eliminated sulfur emissions from coal burning power plants." —*Journal of Amps & Volts*, 1996	**Accurate, well referenced.** Source of the information is cited. Information is presented in a balanced, unemotional manner.

To Skew or Not to Skew pages 8-9

Words and phrases that skew the information are underlined.

- **World population continues to increase at unacceptably high rates. In many developing areas of the world, birth rates have remained constant. Yet population increases because of advances in medicine that minimize infant mortality. Despite the high costs of maintaining large families in these increasingly urbanized societies, many cultures stubbornly cling to ancient notions that value large numbers of offspring.**

- **America is incapable of absorbing unlimited numbers of illegal immigrants. While Americans value growth and welcome diversity, our cherished way of life is threatened by invaders from beyond our borders. Even today, our social, health, educational, and legal systems are creaking under the weight of hordes of trespassers who cross our borders in violation of the law, breed large families, and expect the hard-working taxpayers of our country to support them.**

- **Experts are divided on the consequences of the recent decline in the population of the lesser tribble. Although this obnoxious and invasive animal has been the bane of farmers and ranchers since its introduction 25 years ago, the 40 percent population drop in the last year has even some tribble-haters worried. It is feared that this decline could foreshadow the extinction of this irresistibly cute yet horribly destructive species. This would be disastrous for manufacturers of tribble houses and designer tribble food. Additionally, red-tailed hawks and feral cats have come to depend on wild tribbles for their food supplies in recent years; their decline could spell doom for these predators.**

Key Characteristic

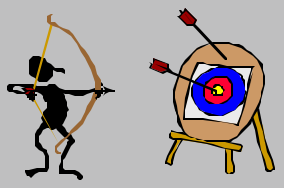
2

Depth

EE materials should foster awareness of the natural and built environment, an understanding of environmental concepts, conditions, and issues, and an awareness of the feelings, values, attitudes, and perceptions at the heart of environmental issues, as appropriate for different developmental levels.

GUIDELINES

- 2.1 Awareness
- 2.2 Focus on concepts
- 2.3 Concepts in context
- 2.4 Attention to different scales

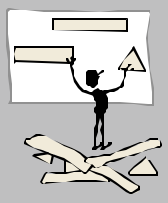


Objectives

4) Distinguish the factors contributing to environmental awareness. (Guideline 2.1)

5) Demonstrate an understanding of conceptual frameworks and concepts in context. (Guidelines 2.2, 2.3)

6) Recognize the relevancies and relationships of various scales. (Guideline 2.4)



Contents

Things to Think About...

Students need to develop an awareness of the world around them as a basis for further study. As they gain more experiences, they increase their understanding of their surroundings, as well as how elements of the environment function, how these elements interact, and how students' actions affect and are effected by the environment. Students should develop **critical thinking** skills and not simply collect environmental facts. Materials should be developed within a **conceptual framework** that allows students to place information in **context** and to construct new knowledge throughout their lives.

Awareness should include both the natural world and the **built environment,** as well as the relationship between the two. **Environmental literacy** requires that students learn how they interact with and are affected by these two aspects of their world. Additionally, students must understand that environmental factors and concerns occur on different scales, from local to global, short- to long-term, past to future.

Environmental literacy also requires teaching with both **breadth** and **depth**. In studying a forest, for instance, teaching for breadth could include cataloguing the forest's contents, the varieties of trees, ground cover, plant and soil types, and animal life. But studying the forest at this level may mean looking at isolated facts and elements without connection. To fully understand the forest ecosystem, students have to take a closer look. This "in depth" look reveals the connections and processes of the forest environment (photosynthesis, predation, decomposition, reproduction) and the forest's relationship with surrounding habitats and communities. Breadth provides the basics and a place to begin study. Depth carries the process further, linking those basics within the forest ecosystem context.

EXAMPLE

Becoming Aware of Awareness

KEY CHARACTERISTIC #2
Depth

GUIDELINE: 2.1

OBJECTIVE 4:
Distinguish the factors contributing to environmental awareness.

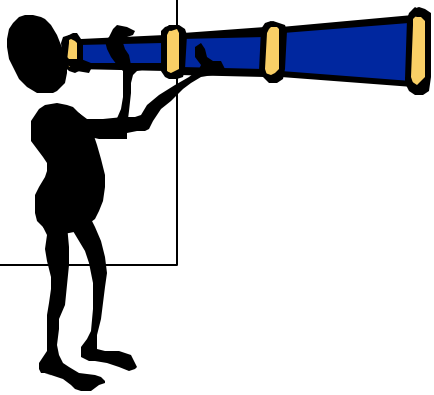
GLOSSARY TERMS:
- attitudes
- beliefs
- environmental awareness
- perceptions

BACKGROUND:

Environmental awareness begins with a basic acquaintance with what is around us: sky, air, soil, trees, grass, sounds, and so forth. However, it is not solely cognitive or informational. All of the information we receive about the natural and built environments is filtered through our personal **beliefs**, **attitudes**, and **perceptions**. For example, a student whose preconception is that natural spaces are dirty and uncivilized will experience a field trip to a natural area differently from the student who considers wild spaces to be pristine and beautiful.

Awareness is the start of a continuum that builds to an understanding of the complex web of natural forces and phenomena. Awareness of the trees around them is important, but if students are to be able to make decisions regarding forests they must also understand how one tree differs from the plant next to it, how the tree fits into the forest ecosystem, how it is valued in different cultures and economic systems, how the tree is affected by sun, wind, and rain, and how the forces that affect the tree also affect other parts of the ecosystem as well as the students themslves.

Once students begin to see, hear, touch, and smell what is around them, they can advance to other observations. They can begin to ask questions, to appreciate questions asked of them, and to understand the significance of the answers they give and receive.



ABOUT THE EXAMPLE:

The following example illustrates the importance of awareness in the development of students' understanding of the environment. Pay attention to how the instructor initiates and nurtures the students' awareness of and interest in their schoolyard.

Mr. Smith's elementary class spent several days talking about the different things plants and animals need to survive: sunlight, water, soil, shelter, and so on. To help the students understand how these ideas apply in their own urban neighborhood, he had his students draw pictures of the small open space next to the playground. Students were instructed to include all of the plants and animals, if any, that they would expect to find there. The following day, he took the students to the open area and had them compare their drawings with the actual space. Many students were disappointed; they claimed to see nothing: no birds, no rabbits, no plants, just weeds, litter, and crumbling concrete. Mr. Smith then divided the students into four teams. Each team was assigned one quarter of the lot and was asked to draw their area, putting in as much detail as possible. Predictably, most of the drawings were rather empty.

Back in class, Mr. Smith asked the students to discuss why they found so few things to draw. During the discussion, it became clear that some students found things that others did not. Mr. Smith proposed that perhaps the students were not looking closely enough or didn't know what to look for. They returned to the yard, armed with hand lenses and note paper. Mr. Smith prompted them to look for insects, differences between plants (reminding them that weeds are plants too), signs of animals feeding on plants, and places where plants may grow in the future (cracks in concrete, patches of dirt). The students made new drawings based on their observations and compared them to their two prior illustrations.

Amazed by their discoveries, the class frequently asked to return to the school yard for further study. They guessed they would find different things at different times of day, after storms or temperature fluctuations, and as seasons changed. Each discovery helped them to be alert for others, and helped them to understand how the different parts of the school yard ecosystem interact. Mr. Smith made use of the students' familiarity with the school yard as he introduced new biology concepts such as migration, camouflage, habitat, and the energy cycle.

BRINGING IT HOME:

Awareness is a dimension of environmental education that is appropriate for more than just the very young. Older students, regardless of their age or background, can benefit from having the opportunity to explore and discover what is around them.

EXAMPLE & ACTIVITY

Building the Framework

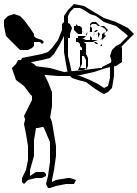
KEY CHARACTERISTIC #2
Depth

GUIDELINES: 2.2, 2.3

OBJECTIVE 5:
Demonstrate an understanding of conceptual frameworks and concepts in context.

GLOSSARY TERMS:
- breadth
- concepts
- conceptual framework
- context
- depth

BACKGROUND:
A framework, in its literal sense, is an organized series of beams used to support and guide construction. Likewise, a **conceptual framework** is an organized set of ideas, concepts, or principles that an educator uses to give structure and shape to educational experiences. Frameworks allow educators to pursue both **breadth** and **depth** by clearly organizing ideas. They ensure that students are given the skills needed to understand relationships and connections between pieces of information, and not just a laundry list of environmental facts or opinions. By focusing on **concepts**, educators provide learners with the opportunity to generalize, to draw connections among different disciplines, and to consider differing opinions and perspectives. Teaching without a conceptual framework is like putting together a model airplane without glue: initially it may hold, but eventually it falls apart. Additionally, if concepts are taught out of **context**, they can be misunderstood or quickly forgotten because they are without relevance to the learner.



ABOUT THE EXAMPLE:
In the following situation pay attention to the concepts being taught and the order and context in which they are delivered. You will be asked to put them into a framework in the following activity.

Ms. Fong's social studies class was preparing to do a unit on food and agriculture. She approached the subject by asking the students to consider the origin of their own food. As this was a part of the country where hunting and fishing were common, she pointed out a distinction between foods that are deliberately grown or raised for human consumption and those that are taken from the wild. With this distinction in mind, the students broke into two groups. The first group looked at features of wild harvest, while the second considered the features of agriculture. Special attention was paid to the risks, advantages, economic factors, and environmental impacts of each. The two groups shared and compared their findings at the end of the class.

INSTRUCTIONS:
Using the example on the previous page, arrange the headings on the right into a logical framework. Answers can be found on page 22.

EXAMPLE:
The following concepts/topics are arranged from most general to most specific:

I. Money
A. Paper currency
1. Foldable
2. Lightweight
B. Coinage
1. Unbending
2. Heavy in large quantities

FRAMEWORK

I. _____

A. _____

1. _____
2. _____
3. _____

B. _____

1. _____
2. _____
3. _____

CONCEPTS / TOPICS

1) Cultivated products
2) Dependent on humans for reproduction
3) Self-seeding
4) Maintains genetic diversity
5) Crop is completely harvested
6) Wild harvest
7) Potential for overharvesting
8) Predominantly hybrids or controlled genetically
9) Food resources

BRINGING IT HOME:
In the activity and example above, the students could have been given a series of facts about agricultural practices. This would have been an example of teaching toward **breadth**. By arranging the information in such a way that the connections between the ideas were made clear, the instructor has given the students a tool to help them make sense of the information and establish a knowledge base on which to build in future lessons, thereby teaching toward **depth** as well as breadth.

EXAMPLE

Tipping the Scales

KEY CHARACTERISTIC #2
Depth

GUIDELINE: 2.4

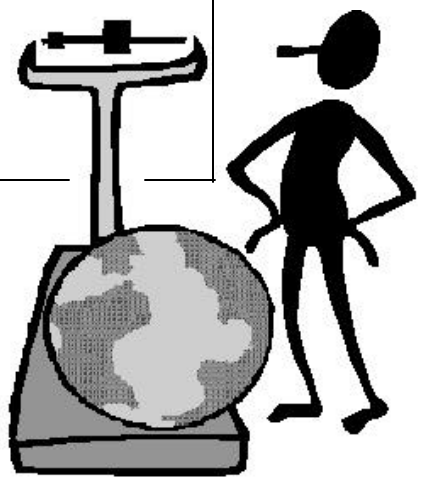
OBJECTIVE 6:
Recognize the relevancies and relationships of various scales.

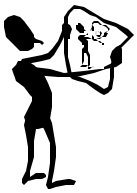
GLOSSARY TERMS:
- geographical scale
- temporal scale

BACKGROUND:

The world's economy is becoming increasingly globalized. Products and services bought in one country may be manufactured half a planet away. Changes in the rate of inflation, unemployment levels, or interest rates in a single country can send ripples of uncertainty throughout the world. These impacts are not limited to economics. An increase in lumber prices or higher demand in one region might promote overlogging in another. A change in government in one nation could spur a relaxation of environmental protection policies there and elsewhere. Because of the movement of air and water across borders, the contamination of the air or water in one country or region can have lasting impacts in another area. These are examples of issues that span regions, nations, and continents. Understanding these issues requires attention to the **geographical scales** of the issues.

Another type of scale is **temporal**, which refers to the persistence of an environmental concern over time. For example, the use of the pesticide DDT in North America was abandoned in the early 1970s; however, the effects of this chemical remain with us today and will continue to affect ecosystems for years. When considering environmental issues, the long-term impacts on ecosystems, economics, and human societies are just as important to consider, as are the other circumstances which inform those issues.





ABOUT THE EXAMPLE:

In the following example, students discover that they have interests in common with students in other places. The students also recognize that decisions made in their community may impact wildlife populations hundreds of miles away.

During the autumn months, Ms. Garcia's students observed and recorded the types of birds that came to the feeder located outside the window of her middle-school science classroom. As the year progressed and winter approached, some of the students noticed different birds appearing, and previously common ones not appearing. They raised the question of what birds do in the winter. Ms. Garcia entered into a discussion of the different ways that animals deal with weather changes, noting that some hibernate, some become dormant, some die off, and some migrate to other climates.

The students became interested in knowing where their favorite feeder birds went during the winter and researched the birds' migration routes and wintering territories. As a way of building on the data they already collected, Ms. Garcia arranged for the class to have Internet contact with two other middle school classes: one in south Florida and one in Panama City, Panama. The students compared notes and arranged to compile data in similar ways regarding what birds they observed, how many, and when. By the end of the spring, the students put together a map showing approximate travel routes of most of the species and began to look out for others that had not yet visited their feeders.

The exchange continued with the students discussing the status of the birds' habitats in the different countries. Ms. Garcia's students noticed that a woodlot near their school had been developed recently for retail establishments, providing jobs for local workers. The students in Panama observed a similar event in several of the natural areas near them. The students decided to research the relationship between habitat and development through continued conversations and to determine what effects these developments might have on future bird migrations.

BRINGING IT HOME:

It is common for lessons about ornithology to consist primarily of information about bird adaptations and anatomy. In the lesson described above, the instructor has included this information but went beyond it to address the local and regional aspects of bird migration. The extent to which this can be done is tied to grade level and developmental ability. Elementary students may not be able to grasp concepts beyond the local area, whereas senior high students have the ability to comprehend regional and global ramifications of local environmental decision making.

ANSWERS Key Characteristic #2—Depth

Building the Framework page 19

Frameworks are organized from the most general to the most specific subheadings. In this case there were two subheadings, but there could be many more depending on the complexity of your topic. Specific points naturally fall under the subheadings. For example, wild harvest is not dependant on humans for reproduction.

FRAMEWORK

I. Food resources (9)
- **A. Cultivated products (1)**
  - **1. Dependant on humans for reproduction (2)**
  - **2. Predominantly hybrids or controlled genetically (8)**
  - **3. Crop is completely harvested (5)**
- **B. Wild harvest (6)**
  - **1. Self-seeding (3)**
  - **2. Maintains genetic diversity (4)**
  - **3. Potential for overharvesting (7)**

Key Characteristic

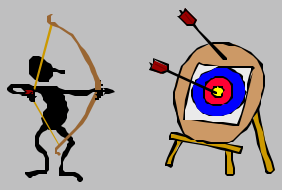
3

Emphasis on Skills Building

EE materials should build lifelong skills that enable learners to prevent and address environmental issues.

GUIDELINES

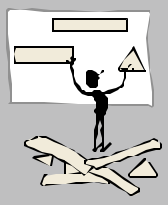
- 3.1 Critical and creative thinking
- 3.2 Applying skills to issues
- 3.3 Action skills



Objectives

7) Classify curriculum materials according to their support of higher-order thinking skills. (Guideline 3.1)

8) Distinguish the skills necessary for issue analysis and action. (Guidelines 3.2, 3.3)



Contents

Things to Think About...

In the introduction to Key Characteristic #1: Fairness and Accuracy, the need to identify bias and to determine the degree to which information is useful or questionable was discussed. In this section of the workbook **critical thinking** skills helpful in recognizing bias and evaluating the quality of information are examined.

Critical thinking is a process that involves digging below the surface and thoroughly analyzing an issue or problem. Critical thinking skills allow students to dissect information and recognize such features as reliability, fairness, timeliness, completeness, and relevance. Using these skills, students can connect new information to their existing knowledge and experiences, and therefore evaluate issues and their solutions in a sound and logical manner.

The skills needed to apply knowledge in new and useful ways constitute **creative thinking**. Students must be able to recognize connections between seemingly unrelated issues, and look for solutions in many places from many angles. However, more than critical and creative thinking is required; learners also need skills for applying new information and knowledge to everyday life such as oral and written communication, group cooperation, leadership and conflict resolution.

Environmental Education Materials: Guidelines for Excellence calls for the development of critical and creative thinking skills. This section presents a look at a model that can be used as a basis for building educational materials and the **higher-order thinking skills** students must develop in order to act upon their own environmental ethic.

ACTIVITY

"Tax"ing Your Brain

KEY CHARACTERISTIC #3
Emphasis on Skills Building

GUIDELINE: 3.1

OBJECTIVE 7:
Classify curriculum materials according to their support of higher-order thinking skills.

GLOSSARY TERMS:
- abstraction
- critical thinking skills
- educational objective

BACKGROUND:

There are a variety of models for classifying levels or types of learning. These models, or taxonomies, categorize types of learning in a hierarchy ranging from simple to complex. For example, analysis is a different level of learning than is application. Use of these levels is helpful in determining the potential for development of **critical thinking skills**. One of the best known models is the *Taxonomy of Educational Objectives* developed in 1956 by Benjamin Bloom and his colleagues. Bloom identified six levels of learning that range in difficulty from the simple (such as recall of facts) to the complex (such as **abstraction**). Certain verbs describing learning processes are associated with each level. For example, "categorize," "distinguish," and "recognize" are more readily associated with analysis than with any other learning level. These verbs can be used by educators when developing **educational objectives** for their lesson plans. Educators can also look for these verbs in the objectives of existing curricula to determine the level of learning that is expected of the student. For instance, this activity calls on the user to "classify" (see objective in box at left), and is therefore a synthesis-level activity in Bloom's Taxonomy.

A Limited List of Bloom's Taxonomy

Learning Level	Relevant Verbs
Knowledge	arrange, identify, recall, recognize
Comprehension	demonstrate, differentiate, discuss, locate
Application	apply, choose, interpret, schedule, solve
Analysis	analyze, categorize, contrast, distinguish,
Synthesis	classify, construct, create, develop, propose
Evaluation	appraise, assess, evaluate, judge, predict

INSTRUCTIONS:
For each objective, fill in the relevant verb (from the beginning of each chapter, the beginning of each activity or example, or the summary on page 2) and the corresponding learning level (from the table on page 24). Objective 7 is filled in as an example. Answers can be found on page 28.

Objective Classification Worksheet

OBJECTIVES	OBJECTIVE VERB	LEARNING LEVEL
Key Characteristic #1		
Fairness & Accuracy		
Objective 1		
Objective 2		
Objective 3		
Key Characteristic #2		
Depth		
Objective 4		
Objective 5		
Objective 6		
Key Characteristic #3		
Emphasis On Skills Building		
Objective 7	***Classify***	***Synthesis***
Objective 8		
Key Characteristic #4		
Action Orientation		
Objective 9		
Objective 10		
Key Characteristic #5		
Instructional Soundness		
Objective 11		
Objective 12		
Objective 13		
Key Characteristic #6		
Usability		
Objective 14		
Objective 15		
Objective 16		

BRINGING IT HOME:
Scanning down the right-hand column of the completed chart reveals the diversity and range of learning levels employed in this workbook. Educational materials do not need to utilize all learning levels, but some variety in their selection contributes to more effective learning by insuring that higher-level skills are not ignored.

EXAMPLE

Water You Know?

KEY CHARACTERISTIC #3
Emphasis on Skills Building

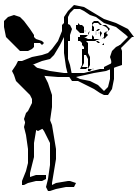
GUIDELINES: 3.2, 3.3

OBJECTIVE 8:
Distinguish the skills necessary for issue analysis and action.

GLOSSARY TERMS:
- action skills
- cost/benefit analysis

BACKGROUND:

One of the purposes of environmental education is the development of a citizenry that is capable of making decisions regarding the environment, and of taking appropriate action on environmental issues. Simply learning a particular **action skill** is different from being told when or how to use it, or what action to take. One can teach public speaking, for example, without dictating what students are to say about any given topic. Similarly, the teaching of skills such as comparing different policies or actions, investigating current issues, and developing **cost/benefit analyses** does not commit the teacher or student to a particular course of action, but provides learners with the tools needed to make an independent and educated decision about the responses to environmental issues they can support.



ABOUT THE EXAMPLE:

This brief description of a unit on water quality issues touches on a variety of issue investigation and action skills. The outline below shows a number of possible activities in which the students might take part to develop or practice these skills. In the box to the right of each section is a relevant skill from the *Materials Guidelines* along with a discussion of the role that skill plays in the total unit. As you read these discussion items, see if you can make a case for other skill development possibilities.

In this unit, high school students will explore current and historic water resources in their community and evaluate existing plans for the future. Through their own research, interviews, and field experiences they will gain an understanding of past and present water resource issues in the community, determine the current state of affairs, decide whether community action is needed, and how they might be able to initiate such activity, if appropriate.

I. Studying Local Water Resources
- **A. Students research municipal and county historical records.**
- **B. Students interview administrators of the local water supply.**
- **C. Students interview a cross section of community members representative of the variety of individuals and businesses served by the local water agency.**
- **D. Students visit local water treatment facility or facilities.**

Students should arrive at their own conclusions based on thorough research, rather than being taught that a certain course of action is best. Direct access to records and individuals involved with water issues builds data collection skills.

II. Learning about Water Resource Problems and Solutions

- **A. Students research the history of water resource development in their region.**
- **B. Students examine the impacts of human activities on water resources.**
- **C. Students investigate various responses to past water resource problems in their own and other areas.**

Students learn to identify, define, and evaluate issues on the basis of evidence and different perspectives

III. Identifying Potential Water Resource Concerns

- **A. Students learn chemical and non-chemical tests for water quality.**
- **B. Students analyze current water consumption and make predictions for future consumption based on population trends and land use predictions.**
- **C. Students evaluate collected data for trends in water availability or quality and land use that might affect local water resources.**

Learners hone their ability to forecast and to plan long-term. To do this, they sharpen basic laboratory and field skills such as experimental design, observation, and data collection and analysis.

IV. Evaluating Water Resource Issues

- **A. Students evaluate existing policies for water quality and supply.**
- **B. Students develop alternatives to existing policies.**
- **C. Students contrast and compare alternative water resource policies.**

Students practice evaluating environmental issues and their potential solutions. They also try their hand at developing their own solutions to issues.

V. Water Resource Action Strategies

- **A. Students explore ways to interact with local government agencies and companies.**
- **B. Students determine if any alternative water resource policies or procedures might be warranted and discuss best ways to present them.**
- **C. Students develop presentations of alternatives for specific audiences.**
- **D. Students plan community action projects.**

Learners are encouraged to practice interpersonal and communication skills, as these are important for data collection, conflict management, and communicating alternatives to others.

BRINGING IT HOME:

Many of the skills included in this example are those that students need to explore and determine a course of action. But developing skills and actually putting them into practice can be two very different things. The ability to formulate a plan of action is essential, but until that plan is carried out, and the results reflected upon, the process is not complete. Key Characteristic #4 deals with this important aspect of the action skills process.

ANSWERS

Key Characteristic #3—Emphasis on Skills Building

"Tax"ing Your Brain page 25

Objective Classification Worksheet

OBJECTIVES	OBJECTIVE VERB	LEARNING LEVEL
Key Characteristic #1		
Fairness & Accuracy		
Objective 1	**assess**	**Evaluation**
Objective 2	**identify**	**Knowledge**
Objective 3	**evaluate**	**Evaluation**
Key Characteristic #2		
Depth		
Objective 4	**distinguish**	**Analysis**
Objective 5	**demonstrate**	**Comprehension**
Objective 6	**recognize**	**Knowledge**
Key Characteristic #3		
Emphasis On Skills Building		
Objective 7	**classify**	**Synthesis**
Objective 8	**distinguish**	**Analysis**
Key Characteristic #4		
Action Orientation		
Objective 9	**choose**	**Application**
Objective 10	**distinguish**	**Analysis**
Key Characteristic #5		
Instructional Soundness		
Objective 11	**classify**	**Synthesis**
Objective 12	**evaluate**	**Evaluation**
Objective 13	**differentiate**	**Comprehension**
Key Characteristic #6		
Usability		
Objective 14	**recognize**	**Knowledge**
Objective 15	**identify**	**Knowledge**
Objective 16	**assess**	**Evaluation**

Key Characteristic

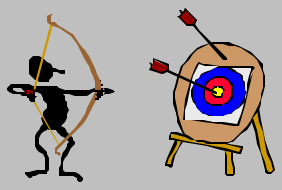
4

Action Orientation

EE materials should promote civic responsibility, encouraging learners to use their knowledge, personal skills, and assessments of environmental issues as a basis for environmental problem solving and action.

GUIDELINES

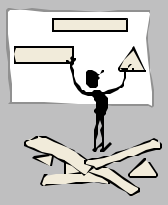
4.1 Sense of personal stake and responsibility
4.2 Self-efficacy



Objectives

9) Choose strategies that encourage learners to reflect on the consequences of their action(s). (Guideline 4.1)

10) Distinguish patterns that contribute to learner empowerment. (Guideline 4.2)



Contents

Things to Think About...

One of the overarching goals of education is to prepare students to become effective decision makers. As consumers, citizens, voters, and family members, students will spend their lives making choices among possible actions. Part of an educator's responsibility is teaching students to identify and clarify their *own* opinions. Educators must help students learn decision-making processes—identifying and evaluating options, selecting a corresponding course of action, taking action, reflecting on their choices, and adjusting as needed to accomplish their goals. A critical component of decision-making is the sense of **self-efficacy**, or developing students' confidence in their ability to affect change in their surroundings. Environmental educators must take care not to direct students to any particular opinions or courses of action, but to empower students to think and act for themselves on environmental issues.

Through the *"Water You Know?"* unit described on page 26 students would develop a series of skills while learning about and evaluating water resources and related issues in their community. The focus in Key Characteristic #3 was on building skills; in Key Characteristic #4, the focus is on applying those skills to real world situations.

The opportunity for students to look back on what was done in an action project is a critical part of the learning process. Students must determine whether their actions achieved their goals, exploring what mistakes where made, what lessons were learned, and what they might have done differently to improve the experience or its results. Students must learn to reflect honestly on what they have done, without self-consciousness or fear of criticism. Evaluation of this type is a crucial step for students to develop self-efficacy.

ACTIVITY

Recycling Reflections

KEY CHARACTERISTIC #4
Action Orientation

GUIDELINE: 4.1

OBJECTIVE 9:
Choose strategies that encourage learners to reflect on the consequences of their action(s).

GLOSSARY TERMS:
- action project
- reflection

BACKGROUND:

Reflecting is more than thinking about something; it involves a careful consideration of one's values, goals, interests, and behaviors. The final purpose of reflection is to ensure that one's actions are consistent with one's intent and, if not, to determine what changes one needs to make. Reflection is crucial to making an **action project** a meaningful experience. If students do not consider the ramifications of the action on their lives and/or the lives of others, or consider the lessons learned from it in terms of future behavior, then their participation has been an exercise, but not necessarily a learning experience.

INSTRUCTIONS:

After much research and discussion, students decide that they want to start a school-wide recycling program. Which of the following questions encourage students to reflect on their project? As in many environmental situations, there may be more than one correct answer. Answers can be found on pages 33 and 34.

EXAMPLE:
Which questions best help students to reflect on their choice of receptacles:

a) What are the cheapest ones to buy?
No—more of a logistics question.

b) Can we paint them the school colors?
No—not really relevant.

c) Will using cans that look like trash cans defeat our purpose?
Yes—it incorporates the students' goals and the success of their choices.

1) When first planning the recycling program, which of these questions will promote reflection?
   a) How many cans do you want to recycle?
   b) What do we want to accomplish here?
   c) Where can we find room to store the recyclables?

2) Which of these might the students consider when reflecting on their choice of what objects to collect?
   a) From whom do we have to get permission to store the objects?
   b) For which materials can we get the most money?
   c) Are there some recyclables that do not have an established market?

3) Midway through the project, you find that the recycling bins are always empty. Which of the following best encourages the students to reflect on their previous decisions?
   a) Should we move these to another room?
   b) What are some reasons the bins might be empty?
   c) Nobody's recycling—should we move on to another action project?

4) The instructor wishes the students to consider a number of consequences of their recycling project. Which questions should students think about early on to be able to consider at the project's completion?
   a) How much energy does it take to transport the recyclables to the community collection center?
   b) What percentage of the school population currently recycles?
   c) Do you know of any books about recycling?

5) When the project is completed, which questions are most likely to inspire reflection?
   a) Did we accomplish what we set out to do?
   b) Did our project encourage others to continue to recycle?
   c) Did you enjoy the project?

BRINGING IT HOME:

Actions taken with the best of intentions can have unforeseen negative consequences. For students to be able to make intelligent decisions regarding the costs and benefits of their actions, they must have a sense of what questions to consider. It is possible for students to discuss, debrief, and process an action for a significant length of time, without addressing questions of substance. While there are a number of different types of questions students will have to ask themselves, reflective questions relate to the value and success of their efforts, their sense of self-efficacy, what they have learned, and the possible need to act differently in the future.

EXAMPLE Energy Empowerment

KEY CHARACTERISTIC #4
Action Orientation

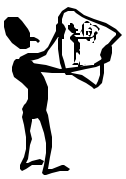
GUIDELINE: 4.2

OBJECTIVE 10:
Distinguish patterns that contribute to learner empowerment.

GLOSSARY TERMS:
• community action

BACKGROUND:

The apathy that some students feel toward **community action**, environmental causes, and in extreme cases toward life in general, is often connected with a sense that they lack the ability to make a difference. People have an innate need to feel that they matter, and that their actions will affect their surroundings and their own circumstances. Students who doubt that they have such power are likely to consider any action project a waste of time. Part of the educator's role is to help students recognize their power to affect the world.



ABOUT THE EXAMPLE:

Educators can help students see the results of changes in their own behavior. Note actions taken by the teacher which were conducive to learner empowerment.

Ms. Wilson's science class completed a unit on electricity, energy, and the mechanics of energy distribution. Once she felt the class had mastered the information, she challenged them to explain to her how this information could be useful or practical to them. As a class, the students decided that it could help them and their families to conserve electricity, thus saving the families money and conserving resources.

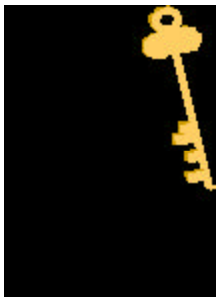
To put this into practice, the students decided to do a thorough energy audit of their homes. Ms. Wilson helped the class divide into teams, each of which took responsibility for examining one room of their homes. With some help from formulas and tables provided by Ms. Wilson, the students were able to estimate the heat energy lost in their homes due to faulty insulation, poor seals on refrigerators, high settings on hot water heaters, and behaviors such as leaving doors and windows partially open.

The students collected their findings in a report, which listed specific ways that families could conserve energy. The students arranged to publish an abridged copy of the report, listing the main suggestions, in the school newspaper and put it on the school's website. Later, some of the students recognized that the same principles could be applied to school buildings and energy practices. They developed a series of recommendations for school energy savings, which they presented to their school principal.

BRINGING IT HOME:

In this example, learner empowerment is demonstrated in a number of ways. The outcome of the study is a list of suggested ways that the families of students can save energy. Hence, the lesson develops students' sense of self-efficacy. The exploration of these methods is made by the students themselves, which strengthens their sense of discovery and decision making. The publication of the information is accomplished using media that the students control or manage and to which they have easy and frequent access.

ANSWERS Key Characteristic #4—Action Orientation



Answers for: Recycling Reflections page 30

**** Indicates the more appropriate answer(s) given the definition of reflection used in this exercise. Other questions could be reflective depending on context and follow-up.**

1) When first planning the recycling program, which of these questions will promote reflection?

A—*How many cans do you want to recycle?*
Assumes a course of action has already been set. It presupposes that cans are the only thing that can be recycled and proceeds to set an arbitrary target rather than exploring the reasons for recycling in the first place.

**** B—***What do we want to accomplish here?*
Encourages students to think about and set goals for their project. If this isn't discussed, students will have difficulty knowing if they addressed what they set out to accomplish.

C—*Where can we find room to store the recyclables?*
Deals with logistics. It is, however, an important step in determining if they have the resources to conduct the project.

2) Which of these might the students consider when reflecting on their choice of what objects to collect?

A—*From whom do we have to get permission to store the objects?*
Deals with logistics. It is a planning step, and would only be a matter of reflection if they find out too late that the person who gave permission was not authorized to do so. Additionally, space is at a premium at most schools.

B—*For which materials can we get the most money?*
Unless fundraising is the main purpose of the activity, the monitary value is a secondary consideration.

**** C—***Are there some recyclables that do not have an established market?*
Addresses the choices they've made and the further implication of the choices.

Answers for: Recycling Reflections Continued

3) Midway through the project, you find that the recycling bins are always empty. Which of the following best encourages the students to reflect on their previous decisions?

A—*Should we move these to another room?*
Recommends an action without assessing the situation. Moving to another location might be pursued as an experiment to determine if the location is the problem.

**** B—***What are some reasons the bins might be empty?*
Reflects on different aspects of the problem.

C—*Nobody's recycling—should we move on to another action project?*
Gives up without looking at a different course of action. Students would become more empowered if they could identify and overcome the obstacle to their program.

4) The instructor wishes the students to consider a number of consequences of their recycling project. Which questions should students think about early on to be able to consider at the project's completion?

**** A—***How much energy does it take to transport the recyclables to the community collection center?*
Performs a type of cost-benefit analysis on the value of the students' recycling effort.

**** B—***What percentage of the school population currently recycles?*
Helps to establish a baseline, so students can determine if their project is having any effect on the school community.

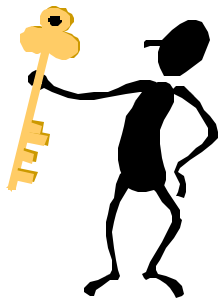
C—*Do you know of any books about recycling?*
Doesn't deal with consequences of actions, but could help with research. The use of books can be a very effective (but not limited to) springboard into a unit.

5) When the project is completed, which questions are most likely to inspire reflection?

**** A—***Did we accomplish what we set out to do?*
Looks at goals in comparison to final outcomes.

**** B—***Did our project encourage others to continue to recycle?*
Examines whether the project has a far reaching effect.

C—*Did you enjoy the project?*
Invites an emotional response but does not address goals, choices, consequences, or outcomes. Other ways of asking the question might be: What did you get out of it? What parts were difficult or challenging for you? Did this change how you feel about environmental action?



Key Characteristic

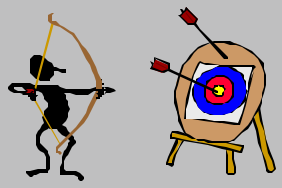
5

Instructional Soundness

EE materials should rely on instructional techniques that create an effective learning environment.

GUIDELINES

5.1 Learner-centered instruction
5.2 Different ways of learning
5.3 Connection to learners' everyday lives
5.4 Expanded learning environment
5.5 Interdisciplinary
5.6 Goals and objectives
5.7 Appropriateness for specific learning settings
5.8 Assessment

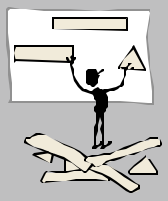


Objectives

11) Classify instructional methods and ways of learning.
(Guidelines 5.1, 5.2, 5.3)

12) Evaluate the use of various instructional environments.
(Guidelines 5.4, 5.5, 5.7)

13) Differentiate the role of goals, objectives, and assessments.
(Guidelines 5.6, 5.8)



Contents

Things to Think About...

Educational materials must be instructionally sound or their purpose is defeated. Understanding instructional soundness and how it is determined requires a firm grasp of educational terminology. This section will look at the difference between **goals** and **objectives**, examine instructional methods and learning settings, and investigate **assessment** methods.

Until fairly recently, many educational settings and materials were largely **teacher-centered**. Students were often viewed as empty vessels into which knowledge from teachers and textbooks could be poured. Assessment demanded little more than the regurgitation of previously learned facts or the reenactment of experiments. Some of the important ideas of education today include: **learner-centered instruction**, **constructivist theory**, **experiential education**, **multiple intelligences**, and **interdisciplinary** education. These approaches view students as active learners who bring something to the table. Learners are capable of creating new knowledge from what they already know through new experiences and active investigation. Subject matter is no longer presented within isolated disciplines, but is linked to other disciplines so that learners see relationships in broader terms and with a perspective more in tune with the real world. All these changes in educational delivery require equivalent changes in the way we evaluate learning.

Traditional assessment methods considered effective in a teacher-centered model of education are inadequate for learner-centered, constructivist, interdisciplinary approaches. The latter are more appropriately assessed through projects, portfolios, presentations or other forms of **authentic assessment**.

ACTIVITY Gardening, Naturally

KEY CHARACTERISTIC #5
Instructional Soundness

GUIDELINES: 5.1, 5.2, 5.3

OBJECTIVE 11:
Classify instructional methods and ways of learning.

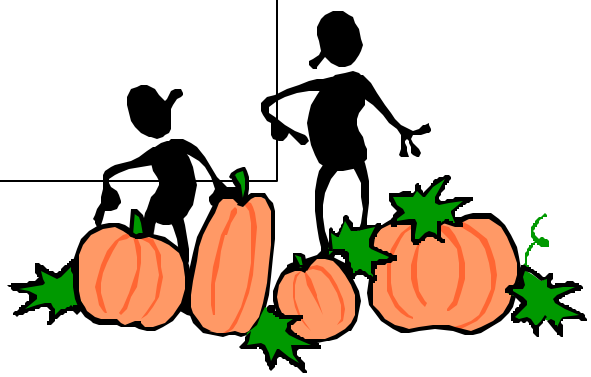
GLOSSARY TERMS:

- constructivism
- learning styles
- learner-centered instruction
- multiple intelligence

BACKGROUND:

This activity addresses **learner-centered instruction**, **learning styles**, **multiple intelligences**, and the connections that should be made between EE materials and learners' everyday lives. Learner-centered instruction focuses on the needs and interests of the students and emphasizes students having an active role in their education. Akin to this model is **constructivism**, in which learners construct new knowledge from what they already know in an experiential, building-block process.

Whether one is designing or evaluating EE materials, a variety of learning styles should be considered. Planning to teach for more than one learning style not only accommodates the needs of a larger audience, it also adds variety to the presentation of the materials. Often, there is confusion between the terms "learning style" and "intelligence." Learning styles describe the ways in which learners receive and process the information. Whether someone learns best by working alone or within a group is just as important a consideration as whether they learn best by reading, listening, watching, or touching. Intelligence, particularly the multiple intelligences (MI) theory of Howard Gardner, has often been mistaken as a learning style. But intelligence, whether MI theory or not, describes a learner's ability to acquire new knowledge, not the way in which they do it. MI theory in particular identifies learners' aptitudes in certain areas such as language, dance, science and math. It is a premise of MI theory that individuals can strengthen any of their multiple intelligences through practice.



INSTRUCTIONS:

This activity asks you to determine the degree to which the instructional methods are learner-centered, support different ways of learning, and/or connect learners to their everyday lives. Review this outline for a unit on gardening with native plants. Following each section are brief descriptions of the three different educational approaches. In the boxes provided, rank the approaches from 1 to 3 to indicate the most relevant (1) to least relevant (3) for that part of the lesson. Answers can be found on pages 44 & 45.

In this activity students will have the opportunity to research, plan, plant, tend, and monitor a garden featuring plants native to their region of North America. The garden may contain food plants as well as decorative species—that decision lies with teachers and/or students. The research, planning, and evaluation of the project can be left, to a certain degree, in the hands of the students, depending on their developmental level. Resources, glossary, and further background information are available at the end of the unit.

I. Preparing

A. Students look up examples of all types of gardens in magazines, books, and newspapers, and bring garden catalogs and pictures of gardens to class.
B. Students visit a local garden center to learn what types of native plants are available in their area, if any.
C. Local garden club members or native plant restoration groups visit the class.
D. Using the pictures they brought in, students give a presentation. Presentations are followed by guided discussion on what the students consider to be a garden and the benefits people gain from gardens and gardening.
E. Students contrast and compare formal, informal, and natural gardens.
F. Students determine if there are local sources for native plants. If not, students research distant sources.

Educational Approaches (rank relevance from 1 to 3)

- ☐ **Learner centered instruction: Activities and projects use learner questions and concerns as a starting point.**
- ☐ **Different ways of learning: Important concepts are conveyed in several ways.**
- ☐ **Connection to learners' everyday lives: Examples are relevant to the learner.**

II. Planning

A. Students determine (through guided discussion, if necessary) the considerations that need to be addressed before planting a garden.
B. Students inspect and discuss potential garden sites.
C. Working from information and materials collected in Section I of this activity, students select native plants suitable for a school garden.
D. Students working in teams plan different gardens and represent the plans in more than one way: e.g., written plant lists, overhead or profile view drawings, murals.
E. Students choose the garden design which they will use.
F. Students determine how they are going to evaluate their performance and the degree of success of the project.

Educational Approaches (rank relevance from 1 to 3)

- ☐ **Learner-centered instruction: Materials encourage learner participation in planning and assessing learning.**
- ☐ **Different ways of learning: Opportunities are provided for students to learn from self-expression and experience.**
- ☐ **Connection to learners' everyday lives: Concepts to be taught are related directly to students' experiences.**

III. Planting

A. Students consult with each other to assign initial tasks for the planting, maintenance, and monitoring of the garden.

B. Students devise a rotating schedule of assignments so all participants can contribute to the project in a variety of ways.

Educational Approaches (rank relevance from 1 to 3)

- ☐ **• Learner centered instruction: Instruction encourages learners to undertake their own inquiry.**
- ☐ **• Different ways of learning: Learners are challenged to learn different skills that reflect their multiple intelligences.**
- ☐ **• Connection to learners' everyday lives: Materials (activities) provide for continuing involvement throughout the year by the learner.**

IV. Pay-off

A. Students track the progress of the plants and tend the garden.

B. At the end of the season and/or year, students report the status of the garden and their project, and devise methods for sharing the information with others through media they determine to be appropriate.

C. Students evaluate the degree of success of the garden and determine:

1. **Which plants succeeded, which did not and why?**
2. **What actions were successful in designing, planting, or tending the garden.**
3. **What actions were unnecessary or not successful.**
4. **What things could have been done differently.**

D. Students reflect on:

1. **The gardening process.**
2. **What they have learned about plants and the roles plants play in our everyday lives.**
3. **Their relationship to the land.**
4. **The influence of the overall experience on their attitude toward human and plant community relationships.**

Educational Approaches (rank relevance from 1 to 3)

- ☐ **• Learner-centered instruction: Activities allow learners to build from previous knowledge.**
- ☐ **• Different ways of learning: Materials and activities are developmentally appropriate for the grade level, yet sensitive to individual differences.**
- ☐ **• Connection to learners' everyday lives: Materials provide for continuing involvement throughout the year by the learner, both at home and at school.**

Note to Teachers: The length of time devoted to this project can vary considerably. Ideally, this activity spans a full academic year (or more) but shorter duration projects in which there is no actual planting at a school site are also possible. Options may include planning at school for home gardens, or planting of small, indoor gardens.

BRINGING IT HOME:

To be truly effective, environmental education materials must meet learner needs. Materials designed with different learning styles, multiple intelligences, and constructivist and experiential principles in mind have the greatest potential to reach the widest audience.

EXAMPLE ForesTree

KEY CHARACTERISTIC #5
Instructional Soundness

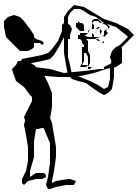
GUIDELINES: 5.4, 5.5, 5.7

OBJECTIVE 12:
Evaluate the use of various instructional environments.

GLOSSARY TERMS:
- concept map
- interdisciplinary

BACKGROUND:

Moving learning beyond the walls of the classroom to take advantage of various settings and real world experiences enhances any learning situation. The strength of these learning opportunities lies in their relevance to learners' lives and the practical application of knowledge. Although an expanded physical setting is important to learning, it is equally important to have an expanded intellectual setting in which learners share their discoveries and observations with one another, draw upon knowledge from a variety of disciplines, and gain new skills and insights in more than one subject area. Additionally, meaningful learning is more likely to take place when students are presented with material appropriate for their age and developmental level.



ABOUT THE EXAMPLE:

This example of a lesson on forest/wood lot ecology reflects a design addressing expanded learning environments, **interdisciplinary** education, and appropriate learning settings. Key elements of the unit are underlined, followed by a short descriptor indicating which guideline (5.4, 5.5, or 5.7) is being addressed.

Not every school has a forest nearby but most are close to some area with enough trees to serve as an outdoor classroom. Studying the plant and animal life in a nearby forest, park, or wood lot, whether off campus or on the school grounds, offers students the opportunity for new ways to experience their surroundings and interact with each other. (Guideline 5.4—Expanded learning environment: diverse learning environment beyond the classroom.)

Learning about Habitats with Trees

- **Set the stage by asking students to discuss the feelings, words, and terms that come to mind when they talk about trees, forests, or woodlands. It might be useful to draw a concept map visible to the entire class. New or unfamiliar terms should be defined so all class members have a common ground from which to do further study. (Guideline 5.7—Appropriateness for specific learning settings: appropriate language level.)**
- **Divide the students into research teams.**

Studying Habitats with Trees

- **Set a time frame for the teams to do general library research on forests, forest types, and other habitats with trees (including tree plantations or farms, corporate campuses, park settings, and so on). They should then share what they learned. (Guideline 5.4—Expanded learning environment: learners are encouraged to share their knowledge and work with others.)**

- **Once the teams finish their initial research they can begin field work on their wooded site. Within each team, individuals or pairs (depending on number of students) can record information and observations. Student teams should record:**
    - **Type and location of site: forest, park, school grounds.**
    - **Size of the site and number of trees of various size ranges. Depending on the preparation of the students, some tree identification to genus or species could be appropriate.**
    - **Number and types of other plant species (shrubs, flowers, grasses). Easily identified species can be listed by name.**
    - **Analysis of soil type and condition.**
    - **Animals observed or heard, signs of animals (tracks, nests, signs of feeding).**
    - **Estimates of the apparent condition of trees and other plants—do there appear to be any stresses to the plants or trees (diseases, pests, human impacts)?**

  (Guideline 5.4—Expanded Learning Environment: Students learn in a diverse environment which includes the school yard, field settings, community, and other settings beyond the classroom.)

Reporting ForesTree Findings

Each team prepares a report on their own observations and evaluations of the site. Students should have a clear understanding of the report evaluation process and know that their grade is based on four distinct elements; 1) the degree to which the main idea is clear and maintained, 2) the degree to which elements are elaborated, 3) the logical flow of ideas and 4) how effectively the product addresses the assignment as a whole. Suggested items for the final report might include, but should not be limited to:

- **Language Arts: reports on the library and field research, expository writing emphasizing some aspect of the study site, poetry describing the site or the experience.**
- **Life Science: evaluations of the health of the study site, plant inventories, etc.**
- **Mathematics: possible computations include: number of trees or other plants per unit area of the site, percentage of various plant types present, ratio of trees to other species.**
- **Art: maps of the site, drawings of specific trees or other interesting features of the site.**
- **Social Science: human uses of the site, regulations involving the site, past and future of the site.**

(Guideline 5.5—Interdisciplinary: The material helps develop skills useful in subject areas such as reading comprehension, math, writing, and map reading and analysis.)

BRINGING IT HOME:

This example illustrates how simple it is to expand the quality of students' learning experience. Here, students were exposed to a multidisciplinary exploration in a new learning environment that did not overwhelm them or stress the resources of the school. Experiences such as these do not require expensive technology or complicated field trips, but they do require planning, organization, and attention to basic educational principles and methods.

EXAMPLE & ACTIVITY

Rubrics Cubed

KEY CHARACTERISTIC #5
Instructional Soundness

GUIDELINES: 5.6, 5.8

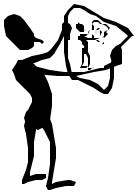
OBJECTIVE 13:
Differentiate the role of goals, objectives, and assessments.

GLOSSARY TERMS:
- alternative assessment
- assessments
- authentic assessment
- goals
- objectives
- rubric

BACKGROUND:

As noted earlier, education has taken on a new look in recent years. Educational methods today demand versatility and power from assessment tools. In answer to that demand, terms such as **authentic assessment, alternative assessment**, and **rubric** have become a part of educational vocabulary.

Goals, **objectives**, and **assessments** are inseparable components of education. Goals point where we want to go, objectives tell us how to get there, and assessments let us know if we actually reached our destination. As one assessment tool, rubrics provide a comprehensive and flexible way to evaluate the success of environmental education materials objectively and efficiently. But good rubrics are challenging to create. In this activity you will gain some familiarity with the construction and use of rubrics.



ABOUT THE EXAMPLE:

The following rubric on Simultaneous Head Patting and Tummy Rubbing (SHPATR—pronounced “shpatter”) is an example of a very simple rubric. If you were to evaluate the performance of individuals attempting this complex psychomotor activity with the rubric, you reasonably could be assured that your evaluation would be equivalent to the evaluation given by someone else using the same instrument. While using the rubric, it is also reasonable to expect that you will be measuring all performances with the same yardstick.

SHPATR RUBRIC		Proper Head Patting Tempo (PHP)	Circular Tummy Rubbing Motion (CTR)	PHP & CTR Coordination
3	Fully Developed	Maintains coordination while changing tempo	Maintains coordination while reversing motion	Maintains coordination while changing tempo & reversing motion
2	Developed	Maintains constant tempo	Maintains circular motion	Maintains coordination
1	Absent	Tempo inconsistent or irregular	Motion inconsistent or irregular	Coordination inconsistent or irregular

Evaluating a SHPATR performance is a straightforward process. In the sample rubric each column (down) has a scoring range of 1 through 3 (bottom to top). Inconsistent or irregular motion in any of the actions listed in the column headings results in a score of one for that column (the bottom row). An adequate performance in any of the three skill areas results in a mark of two for that column, and an exemplary performance results in a mark of three. The potential scoring range in the complete rubric is from 3 to 9.

This rubric is based on the goal of attaining SHPATR competency, that is, to successfully pat one's head and rub one's tummy simultaneously. Objectives leading to the goal are: to develop rhythm in head patting, to develop speed and proficiency in tummy rubbing, and to develop coordination between the two motions.

The ForesTree Rubric was adapted from materials in *Effective Scoring Rubrics: A Guide to Their Development and Use*, Illinois State Board of Education, 1995.

The rubric on the following page is designed to evaluate the performance of students on the ForesTree unit on page 39. The goal of that unit is for learners to develop a basic understanding of forest or woodlot ecology. Objectives of the unit are to learn to identify plant and animal species, to differentiate between various plant and animal communities, and to evaluate and report on the observable relationships between human and other biotic communities.

INSTRUCTIONS:

The following rubric has been formatted for four elements of the ForesTree final assignment: Reporting ForesTree Findings (column headings) and four score levels (row headings). Beneath the rubric are 16 scoring criteria which must be placed in the appropriate squares of the rubric. Place the appropriate letter or complete phrase in each square. Read each heading and criterion carefully. There is a logical progression within each element and the language describing the score levels for each element is distinctive. The answers to this activity can be found on page 46.

FORES-TREE RUBRIC	FOCUS Degree to which main idea is clear & maintained.	ELABORATION Degree to which elements are elaborated.	ORGANIZATION Degree of logical flow of ideas.	INTEGRATION How effectively the product as a whole addresses the assignment.
4 Fully Developed				
3 Developed				
2 Developing				
1 Absent				

A) Plan noticeable: Digressions
B) Bare Bones: Position clear
C) Fully developed product
D) Some points elaborated
E) No elaboration
F) Barely deals with topic
G) Attempted: Main point shifts
H) Most points elaborated
I) No plan of organization
J) Only the essentials present
K) All major points elaborated
L) All main points maintained; Effective closing
M) Plan is clear; most points connected
N) Main idea absent or unclear
O) All points logically connected
P) Attempts to address assignment

BRINGING IT HOME:
The need for assessments that go beyond traditional multiple choice, true-false, and matching instruments gives special power to rubrics. Many types of authentic assessment can be conducted using a well-constructed rubric as the gauge.

ANSWERS

Key Characteristic #5—Instructional Soundness

Gardening, Naturally page 37

I. Preparing

3 • **Learner-centered instruction: Activities and projects use learner questions and concerns as a starting point.**
Least Appropriate Answer: Although learner questions and concerns are present they are not the starting point of the lesson. For this lesson to be truly learner-centered the students would have had to initiated a garden planning activity on their own.

1 • **Different ways of learning: Important concepts are conveyed in several ways.**
Most Appropriate Answer: Research and investigations encourage learning through a variety of media and resources and thus encourage various learning styles.

2 • **Connection to learners' everyday lives: Examples are relevant to the learner.**
Acceptable Answer: The opportunity for connections to learners' lives is present through local investigations and discussion.

II. Planning

1 • **Learner-centered instruction: Materials encourage learner participation in planning and assessing learning.**
Most Appropriate Answer: The learners design the form and execution of the project as well as planning their own assessment.

2 • **Different ways of learning: Opportunities are provided for students to learn from expression and experience.**
Acceptable Answer: Building on the introductory activities from the Preparing Stage and continuing to the planning and presentation of garden designs, the students are given the opportunity to learn through experience and expression.

3 • **Connection to learners' everyday lives: Concepts to be taught are related directly to students' experiences.**
Least Appropriate Answer: Although students are gaining experience through research, planning, and presentation, this stage, as described, presents no immediate link to their lives.

III. Planting

1 • **Learner-centered instruction: Activities and projects use learner questions and concerns as a starting point.**
Most Appropriate Answer: Instruction encourages learners to undertake their own inquiry.

3 • **Different ways of learning: Learners are challenged to learn different skills that reflect their multiple intelligences.**
Least Appropriate Answer: While different multiple intelligences may be put into play they are really only incidental to this portion of the activity.

2 • **Connection to learners' everyday lives: Materials (activities) provide for continuing involvement throughout the year by the learner.**
Acceptable Answer: This stage of the activity encourages student ownership of the project and sets the stage for continued involvement throughout the school year.

IV. Payoff

2 • **Learner centered instruction: Activities allow learners to build from previous knowledge.**
Acceptable Answer: This step of the activity encourages the learners to construct new knowledge through reflection and evaluation.

3 • **Different ways of learning: Materials and activities are developmentally appropriate for the grade level, yet sensitive to individual differences.**
Least Appropriate Answer: It is not directly addressed here, although the entire lesson itself is adaptable to a variety of levels.

1 • **Connection to learners' everyday lives: Materials provide for continuing involvement throughout the year by the learner, both at home and at school.**
Most Appropriate Answer: While there is no home component specifically addressed in this section the primary intent is to encourage involvement throughout the year.

Answers for: Rubrics Cubed page 43

FORESTREE RUBRIC	FOCUS Degree to which main idea is clear & maintained.	ELABORATION Degree to which elements are elaborated.	ORGANIZATION Degree of logical flow of ideas.	INTEGRATION How effectively the product as a whole addresses the assignment.
4 Fully Developed	L) All main points maintained: Effective closing	K) All major points elaborated	O) All points logically connected	C) Fully developed product
3 Developed	B) Bare Bones: Position clear	H) Most points elaborated	M) Plan is clear most points connected	J) Only the essentials present
2 Developing	G) Attempted: Main point shifts	D) Some points elaborated	A) Plan noticeable: Digressions	P) Attempts to address assignment
1 Absent	N) Main idea absent or unclear	E) No elaboration	I) No plan of organization	F) Barely deals with topic

Key Characteristic

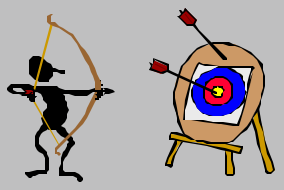
6

Usability

EE materials should be well designed and easy to use.

GUIDELINES

6.1 Clarity and logic
6.2 Easy to use
6.3 Long-lived
6.4 Adaptable
6.5 Accompanied by instruction and support
6.6 Make substantiated claims
6.7 Fit with national, state, or local requirements

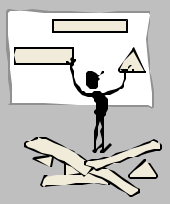


Objectives

14) Recognize the necessary structural elements for quality environmental education materials.
(Guidelines 6.1, 6.2)

15) Identify characteristics that contribute to longevity and adaptability.
(Guidelines 6.3, 6.4, 6.5)

16) Assess the validity of claims and degree of correlation.
(Guidelines 6.6, 6.7)



Contents

Things to Think About...

Compared to the previous five characteristics, it might be supposed that the concept of usability is straightforward and simple. Straightforward it is, but far from simple. The fact that usability is a complex and far too often ignored issue is amply demonstrated by a sample of the comments often heard regarding EE materials. Materials that must be copied for distribution to students but are physically difficult to copy, because of binding or color problems, is one example. Activities that require expensive consumable materials also present problems. Lack of documentation or background information for teachers who are not sufficiently familiar with the subject matter or procedures can prevent EE materials from being used at all. Unfortunately, the list of complaints is probably as long as the list of materials.

"User friendly" is a term that has become well known with the growth of personal computer use. However, the term applies to many other fields as well, including environmental education. There is one overarching question to be answered when judging the usability, or user friendliness, of EE materials. Will it be easy for the educator to include this material or lesson in the curriculum? To answer this not-so-simple question, you must consider many things, from the mechanical (reproducibility of student pages, for example) to the more technical (such as **correlation** to educational **standards** or issues of copyright protection).

Attention to detail goes a long way toward the creation of materials that gather users rather than dust. The following examples will help clarify the range of considerations that evaluators or authors face in determining whether environmental education materials possess usability.

EXAMPLE

Clearing the Waters

KEY CHARACTERISTIC #6
Usability

GUIDELINES: 6.1, 6.2

OBJECTIVE 14:
Recognize the necessary structural elements for quality environmental education materials.

BACKGROUND:

Environmental education materials must be accessible to the people who are to use them. Without such qualities as clarity, logic, and ease of use, it matters little how well EE materials meet the other Key Characteristics. If usability is greatly compromised the materials will sit on a shelf. However apparently simple and straightforward, concepts such as "clarity and logic" and "easy to use" turn out to be rather complex when examined in detail. While authors of EE materials concentrate on more obvious characteristics such as Instructional Soundness or Fairness and Accuracy, the characteristic of Usability can become lost in the shuffle.

Ensuring this does not happen may mean something as simple as using a checklist approach to evaluating or creating EE materials, since incorporating these elements is simply a matter of attention to detail. The following example looks more closely at some of those details.

ABOUT THE EXAMPLE:

In the following example of a water quality assessment lesson, we look at some of the indicators of quality environmental education materials according to Guidelines 6.1 and 6.2. All lines in the example on page 49 have been assigned numbers. The checklist below lists some of the indicators from Guidelines 6.1 and 6.2. Next to each indicator is a number corresponding to the line in the example which demonstrates that indicator. Note, indicators that have physical attributes are difficult to represent in a workbook and have been intentionally left out of this example and the activity on page 51.

Testing the Waters - Usability Checklist

Location	Usability Indicators
Line 2 in Sidebar	• Intended grade level.
Line 19 in Sidebar	• Materials needed.
Line 37 in Sidebar	• Safety precautions.
Line 27 in Preparation	• Instructions for conducting the activity.
Line 0 in Background	• Adequate and accurate background information for educators.
Line 48 in Student Sheets	• Copyright spelled out or permission to copy.

Sidebar

Grade Level: 10-12

Setting: Both Classroom and Outdoors

Class Size: 15-20

Skills Addressed:
analysis, contrasting, comparing, observing

Disciplines & Concepts:
Water quality assessment
Qualitative measurement
Quantitative measurement
Data collection

Equipment:
Nets
Thermometers
Sampling trays
Field guides
Collection jars
Tweezers
Test Kits
- Dissolved oxygen
- pH
- Nitrates
- Phosphates

Time:
Preparation - 45 Minutes
Outdoors - One half day
Indoors - 100 Minutes

Safety:
Students should not work alone or unsupervised. Boots or solid shoes should be worn while in the water-no bare feet. Wash hands after working in the water. Chemical test should be done per instructions and used chemicals disposed of properly.

Background:

Water quality testing falls into two basic categories: chemical testing and biotic index assessment. Each has advantages and disadvantages. Determining water quality based on the presence of macroinvertebrates (biotic index) can be fairly easy and very rewarding if a suitable sampling site is available. If properly maintained, the materials required for this method need only be purchased once, feedback on water quality is immediate, and it is an enjoyable and memorable experience for students.

Chemical testing offers much more specific information on various water quality parameters but requires the use of consumable materials. Certain tests use materials which are not safe for the environment so special consideration must be given to chemical handling and disposal. Most tests require a little time to complete and can be rather complex.

Frequently, only one of these two methods is used in water quality studies. This can leave questions about the relationship between water chemistry and aquatic life unanswered. In this unit, students will use both a biotic index and chemical testing to determine water quality and compare the results of the two methods to see what correlations and relationships might exist.

Preparation:

Select a suitable site. Resource agencies (State Department of Natural Resources, Soil and Water Conservation District, etc.) can be of great help in finding a sampling site if none is immediately near the school. Sites must be easily accessible, offer several locations where working in the water can be done safely, and present a variety of habitat types including at least riffles (fast moving, shallow water) and pools (slow moving, deeper water).

Be sure to obtain permission to use the site. Once again, resource agencies can be of great help in getting permission for site visits. Prior to the field work students should practice the use of chemical test kits and learn identification of some of the macroinvertebrates which may be found at the study site. Safety rules for conduct at the site and use of the test kits should also be reviewed.

Student Sheets and Teaching Aids:

Loose-leaf, black line master copies of sampling instructions, student data sheets, invertebrate identification guides, and teacher aids are included with this activity guide. All materials may be freely copied for classroom and field use. All materials in this packet may also be downloaded from the website by registered users or for a nominal fee.

ACTIVITY

Testing the Waters

KEY CHARACTERISTIC #6
Usability

GUIDELINES: 6.3, 6.4, 6.5

OBJECTIVE 15:
Identify characteristics that contribute to longevity and adaptability.

BACKGROUND

Teaching most subjects requires the use of physical objects, from worksheets to chemicals to owl pellets. Some items, such as text books or CD-ROMs, can be used over and over again by successive learners. Others, such as owl pellets, need to be replaced after each use. Some high quality educational materials require consumable supplies. Materials that can be used more than once are generally preferred.

Additionally, materials should be adaptable to the needs of different situations and learners. Other things being equal, activities that can be used on rainy, sunny, and overcast days is preferable to those that requires consistent, direct sunlight. An activity adaptable to large or small groups is preferable to an activity for specific group sizes.

INSTRUCTIONS:

The checklist on the following page lists indicators that contribute to the longevity and adaptability of educational materials. Carefully read through the statements below. For each line of text write the line number next to the criterion to which it applies. *Clearing the Waters* on page 48 serves as the example for this activity. Correct answers can be found on page 53.

0 Student Sheets and Teaching Aids:

Loose leaf, black line master copies of sample instructions, student data sheets, invertebrate identification guides, and teacher aids are included with this activity guide in a supplementary folder. All materials may be freely copied for classroom and field use. Updates and replacements for the materials in this activity guide may be purchased on

5 CD-ROM or downloaded free at our website by registered users. All materials in this packet may also be downloaded from the website by registered users or for a nominal fee. Supplementary materials are available from a variety of suppliers listed in the Appendix. Spanish and German versions are available.

10 Getting the Most Out of It:

If it is not possible for a class to conduct the field work which begins this activity, the chemical and biotic testing can still be completed. Advance preparation for the teacher, in this case, includes collecting water and biotic invertebrate samples from a suitable location and bringing the materials to the classroom. For classes that can spend suffi-

15 cient time in the field, collecting from at least two widely differing sites (woodland stream, urban stream) should yield interesting results. The goal of this unit is the correlation of biotic and chemical testing with quantitative measurements of water chemistry. For younger students not ready for the details and demands of quantitative testing, qualitative testing is an alternative.

Testing the Waters - Usability Checklist

Line #	Usability Criterion
Example: Lines 5-8	Materials include information on where replacements, updates, equipment, and special supplies can be obtained.
_____	Equipment and materials are listed, reasonably accessible, inexpensive, and simple to use.
_____	Nonconsumable materials can be reused by another educator or other learners.
_____	Materials are available in more than one language, if appropriate.
_____	Where appropriate, the materials suggest easy adaptations for different environments, such as indoor and outdoor, formal and informal settings, large and small classes, mixed level classes, or rural, suburban, and urban settings.
_____	Materials offer ideas for adapting to different grade levels.
_____	Continuing technical support for educators is provided.
_____	Materials include lists of essential resources and supporting materials, such as agency contacts, references to videos, information on computer databases, etc.

BRINGING IT HOME:

Like any human activity, education involves the consumption of natural resources. Energy, paper, plastic, and wood all have value to the educator, but they have costs as well. The challenge is in identifying curricula that balance meeting educational objectives with minimal costs while being easily accessible and adaptable.

EXAMPLE

Living Up to Promises

KEY CHARACTERISTIC #6
Usability

GUIDELINES: 6.6, 6.7

OBJECTIVE 16:
Assess the validity of claims and degree of correlation.

GLOSSARY TERMS:
• field tested

BACKGROUND:

Environmental education materials generally contain claims about their effectiveness and the expertise of their authors. Such claims should be well-documented so that potential users of the materials know what they are getting and can be confident that qualified individuals participated in the creation and testing of the materials. Some include actual research testifying to the validity or effectiveness of the curriculum; others indicate where and when the material was **field tested** with students. In a time when educational standards are receiving more attention than ever, it is important for environmental education materials to advertise their alignment with local, state, or national requirements.

ABOUT THE EXAMPLE:

The following example of documentation demonstrates how environmental education materials might substantiate claims and correlate with educational standards.

The following individuals and agencies participated in the design, writing, and revisions of this unit.

- Hannah Asher, Chief Forester, Johnny McGee National Forest, Taos, NM
- Jonas C. Baceous, Science Coordinator, Generic School District, Waltham, MA
- Big Pines Tree Farm, Valdosta, GA
- James R. Boreal, Ph.D., College of Forestry, University of the Woods, Alberta, Canada
- George Branch, Ed.D., College of Education, University of California at Oakhurst
- Margaret T. Hugger, Ph.D., Director, Forest Issues Institute, Chattanooga, TN
- Diana B. Packer, President, Trees Eternal, Washington, DC
- Trees for Teens, Keokuk, IA

Field testing of these materials was conducted by over 150 middle school, junior high, and high school teachers from 27 school districts in 11 states during the 1998 and 1999 school years.

This unit has been correlated to the *Excellence in Environmental Education—Guidelines for Learning (K-12)* of the North American Association for Environmental Education.

BRINGING IT HOME:
Whether grandiose or modest, claims must be backed up. Environmental education materials stand a better chance of use and have greater value if they meet the same standards established for other educational materials and have been field tested with the same rigor.

ANSWERS Key Characteristic #6—Usability

Testing the Waters page 50-51

Testing the Waters - Usability Checklist

Line #	Usability Criterion
lines 5-8	Materials include information on where replacements, updates, equipment, and special supplies can be obtained.
lines 1-7	Equipment and materials are listed, reasonably accessible, inexpensive, and simple to use.
not mentioned	Nonconsumable materials can be reused by another educator.
line 8	Materials are available in more than one language, if appropriate.
lines 11-16	Where appropriate, the materials suggest easy adaptations for different environments, such as indoor and outdoor, formal and informal settings, large and small classes, mixed level classes, or rural, suburban, and urban settings.
lines 18-19	Materials offer ideas for adapting to different grade levels.
not mentioned	Continuing technical support for educators is provided.
lines 7-8	Materials include lists of essential resource and supporting materials, such as agency contacts, references to videos, information on computer databases, etc.

GLOSSARY

Abstraction: Understanding, processing, and combining of concepts or ideas leading to new knowledge or insights.

Action Project: An activity planned and carried out with the intention of creating change regarding an issue.

Action Skills: Observation, evaluation, critical thinking, communication, leadership, conflict resolution, and other skills necessary for identifying an issue and planning and executing the resolution of that issue.

Advocacy: Espousing or pleading for a particular cause or point of view.

Alternative Assessment: Methods which rely on creative demonstration of skills or knowledge to assess learning.

Assessment: Evaluation of skills and knowledge acquired by learners during a learning experience. Assessment can take many forms, from basic testing such as true/false, multiple choice or matching tests to complex performance assessments.

Attitude: Mental state based on personal beliefs.

Authentic Assessment[1]: Methods requiring the use of teamwork and problem-solving skills to produce a high-quality solution to a real problem.

Belief: Acceptance of something as fact whether supported by evidence or not.

Bias: Predilection; imbalanced attitude toward or against a certain person, group, institution, or issue.

Breadth: Comprehensiveness; incorporating a broad range. (See Depth)

Built Environment: Community and its objects and edifices created by humans.

Cognitive Domain: One of three commonly recognized areas of learning, the cognitive dealing with remembering or understanding of concepts, ideas, facts.

Community Action: Community level action project.

Concept: A general idea or understanding, especially one based on common or related attributes of specific instances. For example, the concept of ecological interdependence–that all living elements of an ecological system depend on the others–is based on a knowledge of interrelationships among living things in many specific systems.

Concept Map: A visual representation of related abstractions (ideas, beliefs, etc.).

Conceptual Framework: An organized sequence of ideas that directs teaching towards a focused understanding.

Constructivism: A guiding philosophy proposing that individuals make meaning of situations for themselves through a dynamic combination of knowledge they already possess, new knowledge presented to them, social interaction, and personal reflection and experience. This personally constructed knowledge by the learner evolves throughout the learner's lifetime.

Context: Elements preceding, following, and logically connected to something else, as the context of a paragraph.

Correlation: A mutual, complementary, or reciprocal relationship.

Cost/Benefit Analysis: An examination of a program that seeks to evaluate the resources expended in relation to the outcome, often noted in financial terms.

Creative Thinking: Thinking which results in connections or possibilities previously unrecognized or unknown to the learner.

Critical Thinking: Analysis or consideration based on careful examination of information or evidence. Critical thinking relies on thoughtful questioning and logical thinking skills such as inductive and deductive reasoning.

Cultural Perspective: A "world view" or belief system based on the mores and values embraced by one's culture.

Depth: Focusing on one part or a narrow range while probing into details. (See Breadth)

Education: The imparting or creation of knowledge through any of several means including training, instruction, and facilitation.

Educational Objective: A statement of a specific measurable or observable result desired from an activity.

Environmental Awareness[2]: Awareness of and concern about economic, social, political and ecological interdependence in urban and rural areas.

Environmental Literacy: Possessing knowledge about the environment and issues related to it; capable of, and inclined to, further self-directed environmental learning and/or action.

Experiential Education: Education based on personal experience or observation by the learner, direct experience rather than second hand information delivered through an intermediary such as a teacher or textbook.

Field Test: Trial of educational materials under the conditions and in the locations for which they were developed in order to determine their quality.

Geographical Scale: Representation of some part of, or area of, the earth's surface.

Goal: A desired result from an activity, lesson, or course of study.

Higher-Order Thinking Skills: Skills reflective of more complex thought processes, such as the synthesis of new knowledge or analysis of data vs. less complex processes such as rote recall or simple recognition.

Interdisciplinary: Linking of two or more academic disciplines.

Learner Centered: Instructional methods that are driven by the individual needs of the student.

Learning Styles: The belief that individuals favor particular methods of learning (e.g., oral vs. written, self-taught vs. group-mediated) and can optimize their understanding when such methods are available to them within the learning environment.

Multiple Intelligences. Theory advanced by Howard Gardner (Multiple Intelligences: The Theory in Practice. New York: Basic Books, 1993) that classifies cognitive abilities according to seven broadly grouped aptitudes: linguistic intelligence, logical-mathematical intelligence, spatial intelligence, bodily-kinesthetic intelligence, musical intelligence, interpersonal intelligence, and intrapersonal intelligence. In 1998 an eighth intelligence, the naturalist intelligence, was added.

Objective: See Educational Objective.

Perception: A personal interpretation of an object, event, or situation based on previous experience.

Primary Source: The originating point of information.

Propagandistic: Intended to gather public support for a specific idea, action, or group.

Referenced: Mentioned or alluded to, listed as a source of information.

Reflection: Consideration of the process and implications of an action, activity, or new learning.

Rubric: A scoring mechanism for performance-based tests that provides model answers within an objective framework. See also Alternative Assessment.

Secondary Source: A source of information once removed from the originator of the information.

Self Efficacy: One's ability, or attitude about that ability, to be a catalyst or agent of change in one's own life and in situations involving others.

Standards[1]: Definitive statements of what learners should know or be able to achieve.

Teacher Centered: Instructional strategies in which goals and objectives are set without input from students.

Temporal Scale: Linear representation of events with reference to the passage of time; a time line.

Tertiary Source: A source of information at least twice removed from the originator.

[1] Derived from: McBrien, J.L. and Brandt R. (1997) The Language of Learning: A Guide to Education Terms. Alexandria, VA: Association for Supervision and Curriculum Development.

[2] Derived from: UNESCO (1978) Final Report Intergovernmental Conference on Environmental Education. Organized by UNESCO in Cooperation with UNEP, Tbilisi, USSR, 14-26 October 1997, Paris: UNESCO ED/MD/49.

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For Further References See:

North American Association for Environmental Education. (2000). Guidelines for the Initial Preparation of Environmental Educators. Rock Spring, GA: NAAEE