Instrument Development Framework
Student Environmental Literacy Assessments

I.   AFFECTIVE LEARNING OUTCOMES

   A.   Environmental Sensitivity/Awareness

   B.   Positive Attitudes and Values for the Prevention and Remediation of Environmental Problems and Issues Regarding:

      1.   Air Quality

      2.   Water Quality and Quantity

      3.   Soil Quality and Quantity

      4..   Wildlife and Habitat

      5.   Energy

      6.   Human Population and Health

      7.   Waste

      8.   General Attitude Towards Environmental Problems

II.   PERSPECTIVES ON ENVIRONMENTALLY RESPONSIBLE BEHAVIOR

   A.   Locus of Control

   B.   Assumption of Personal Responsibility

III.   BEHAVIORAL LEARNING OUTCOMES

   A.   Ecomanagement

   B.   Economic Action

   C.   Persuasion

   D.   Political Action

   E.   Legal Action

   F.   Other

IV.   COGNITIVE LEARNING OUTCOMES

   A.   Knowledge of Ecological Principles

      1.   Individuals, Populations, and Communities

         a.   Habitats, niches, and adaptations

         b.   Food chains, food webs

         c.   Population dynamics

         d.   Population and community interactions

2. Change and Limiting Factors

    a.   Change as a natural process

    b.   Biotic and abiotic limits to growth, size, and distribution of populations

3. Energy Flow

    a.   Sun as primary source, other sources and forms of energy

    b.   Transfer of energy through living systems

    c.   First and second laws of energy (conservation of energy, entropy)

    d.   Need for a consistent source of energy by systems and individuals

    e.   Photosynthesis and respiration

4. Biogeochemical Cycling

    a.   Conservation of matter; nutrient and materials cycling

    b.   Hydrologic cycle

5. Ecosystems and Biodiversity

    a.   Importance of biodiversity

    b.   Interdependence of organisms

    c.   Ecosystems

B. Knowledge of Environmental Problems and Issues

1. Air Quality

    a.   Ozone Depletion
    b.   Global Warming
    c.   Acid Deposition
    d.   Air Pollution

2. Water Quality and Quantity

    a.   Water Pollution
    b.   Use and Management

3. Soil Quality and Quantity

    a.   Soil Depletion and Pollution
    b.   Use and Management

4. Wildlife and Habitat

    a.   Habitat and Biodiversity Loss
    b.   Use and Management

5. Energy

    a.   Sustainable and Non-renewable
    b.   Consumption

6. Human Population and Health
   a. Overpopulation
   b. Environmental Health Hazards

7. Waste
   a. Solid Waste
   b. Hazardous Wastes

C. Knowledge of Environmental Issue Investigation and Action Strategies

   1. Knowledge of strategies used to investigate environmental problems and issues
   2. Knowledge of appropriate action strategies for the prevention or resolution of environmental problems and issues

Fifth Grade Environmental Literacy Assessment
Correspondence of Items to Instrument Development Framework

Instrument Development Framework	Item #s
I. AFFECTIVE OUTCOMES	
A. Environmental Sensitivity/Awareness	
B. Attitudes and Values for the Prevention and Remediation of Environmental Problems and Issues	5 - 19, 24
II. PERSPECTIVES ON ENVIRONMENTALLY RESPONSIBLE BEHAVIOR	
A. Locus of Control	20 - 22
B. Assumption of Personal Responsibility	23, 25, 26
III. BEHAVIORAL OUTCOMES	
A. Ecomanagement	27 - 29, 39, 40
B. Economic Action	30
C. Persuasion	31 - 38
D. Political Action	
E. Legal Action	
F. Other	
IV. COGNITIVE OUTCOMES	
A. Knowledge of Ecological Principles	
1. Individuals, Populations, and Communities	41 - 47
2. Change and Limiting Factors	48, 49
3. Energy Flow	50, 51, 53
4. Biogeochemical Cycling	52, 54, 55
5. Ecosystems and Biodiversity	56
B. Knowledge of Environmental Problems and Issues	
1. Air Quality	57 - 60
2. Water Quality and Quantity	62 - 65
3. Soil Quality and Quantity	61
4. Wildlife and Habitat	66 - 68
5. Energy	69 - 74
6. Human Population and Health	75, 76
7. Waste	78
C. Knowledge of Environmental Issue Investigation and Action Strategies	77, 79

High School Environmental Literacy Assessment
Correspondence of Items to Instrument Development Framework

Instrument Development Framework	Item #s
I. AFFECTIVE OUTCOMES	
A. Environmental Sensitivity/Awareness	6 - 9
B. Attitudes and Values for the Prevention and Remediation of Environmental Problems and Issues	10 - 28
II. PERSPECTIVES ON ENVIRONMENTALLY RESPONSIBLE BEHAVIOR	
A. Locus of Control	30-34
B. Assumption of Personal Responsibility	29, 35
III. BEHAVIORAL OUTCOMES	
A. Ecomanagement	36, 39, 43, 44
B. Economic Action	37, 40, 45, 49
C. Persuasion	38, 41, 46, 50
D. Political Action	42, 47
E. Legal Action	51
F. Other	48
IV. COGNITIVE OUTCOMES	
A. Knowledge of Ecological Principles	
1. Individuals, Populations, and Communities	52 - 55, 57, 63, 64
2. Change and Limiting Factors	59, 68
3. Energy Flow	58, 60, 65, 67
4. Biogeochemical Cycling	56, 66
5. Ecosystems and Biodiversity	61, 62, 69
B. Knowledge of Environmental Problems and Issues	
1. Air Quality	70, 71, 76, 79
2. Water Quality and Quantity	74, 78, 80
3. Soil Quality and Quantity	73, 81
4. Wildlife and Habitat	75
5. Energy	82, 85, 84
6. Human Population and Health	72, 83
7. Waste	77
C. Knowledge of Environmental Issue Investigation and Action Strategies	86-90

Description of Item Analysis and Criteria Used for Selection of Items included in the Student Environmental Literacy Assessment Instruments

Item Analysis

A portion of the statistical analysis was performed by Testing and Evaluation Services at the University of Wisconsin-Madison. The resulting report included the following information for each of the pilot assessments:

1. Frequencies of responses for each answer choice for each item.
2. Summary statistics for the three subscales (affective, behavioral, and cognitive) including number of examinees, number of items, mean score, standard deviation, and reliability. Summary statistics for the cognitive subscales also included mean item difficulty, standard error of measurement, maximum and minimum attainable score, and maximum and minimum attained score.
3. A roster of students listing individual scores on the cognitive section.
4. Frequency distribution by total score for the cognitive section.
5. Item difficulty summary for the cognitive section.
6. Item discrimination summary for the cognitive section.
7. Item analysis for each cognitive item (described below).

The item analysis of the cognitive items was done using the individual students' total scores on the cognitive section of each test as the criterion for effectiveness of an individual item. Each student population was divided into five groups based on an even numerical division of the population and the total scores on that section of the test (quintile groups). Therefore, the 20% of the students scoring highest on the cognitive section of the test were in one quintile group, the next highest scoring 20% in another quintile group, etc. The division into quintile groups was done in order to have a manageable number of groups for use in examining the performance of each item on the cognitive portion of each test. The item analysis included individual item correct response curves (by quintile), item difficulties, and point biserial correlation (RPBI). The point biserial correlation statistic for the choices for each cognitive item provided the item discrimination index. This index indicated whether or not there was a tendency for students who selected that choice to have relatively high overall scores in the cognitive section (indicated by a positive RPBI) or for students who choose it to have relatively low overall scores in the cognitive section (indicated by a negative RPBI).

Additional statistical analysis of the reliability of the affective, efficacy beliefs, behavioral, and cognitive subscales of each instrument was carried out by the researcher using the SPSS computer program. The SPSS reliability analysis provided the following statistics:

1. Subscale mean if item deleted
2. Subscale variance if item deleted
3. Corrected item total correlation within subscale
4. Alpha for subscale if item deleted
5. Reliability coefficient (alpha) for subscale
6. Number of items
7. Number of examinees

As described below, portions of both sets of statistics were used in determining which items to include in the final instrument.

After statistical data were obtained on the items and the subscales contained in the pilot instruments, the next procedure was to determine which items should be included in the final instrument. Items were evaluated based on the statistical criteria outlined below. In some cases, the items did not meet all the statistical criteria but were retained because they met the general criteria. That judgment was made by the researchers if the item was considered to contain a concept believed to be necessary to include in an assessment of environmental literacy based on the comments made by the validity panel. In those cases, the items were rewritten to address possible weaknesses in wording or distractors.

<u>General criteria:</u>
1. Items selected should be considered to have importance to environmental literacy as determined by the validity panel and the working group.
2. All major components of the content framework outline should be represented by items in the final pilot instrument.

<u>Statistical criteria:</u>
3. A particular item was excluded in the final pilot if its exclusion from the subscale in which the item was analyzed would have resulted in a higher reliability score (coefficient alpha) for the subscale.
4. Cognitive items should appear to discriminate between students as indicated by the point biserial correlation index (RPBI score). For items that discriminated, a higher percentage of students scoring in the top quintile groups selected the preferred answer (indicated by a positive RPBI score) while higher percentages of students in the bottom quintile groups selected each distracter (indicated by negative RPBI scores).
5. Cognitive items should generally fall into a mid-range of statistical difficulty (50-80% of the students selected the preferred answer).
6. Affective and behavioral items should demonstrate a range of responses as indicated by a standard deviation greater than one (>1)
7. The corrected item total correlation should be greater than 0.25, indicating that the individual item correlated relatively highly with the other items on that subscale.

Demographic Survey Given to Teachers Administering the
Student Environmental Literacy Assessments

To the Administering Teacher:

Please answer the following questions regarding the students taking the Environmental Survey. This information is important in the analysis of the surveys and will be used to compile a final report to various state agencies. Please return this form with the student answer sheets in the prepaid envelope provided. Thank you for your cooperation!

1. What size community do **most** of the students live in? (please circle only one)

    a) rural or small town (population of community is less than 20,000)
    b) small to medium urban (population of community is 20,000 to 100,000)
    c) large urban (population of community is more than 100,000)

2. Do you think the students in this class are representative of the students at this grade level in your district?

    a) yes
    b) no
    c) not certain

3. We are trying to determine if students who are identified by their teachers as being 'environmentally literate' do better on this assessment than those who are not so identified. Therefore, we are asking you to please list up to five or six students in this class <u>by first name</u> <u>and last initial</u> who you would say are particularly knowledgeable and concerned about the environment and environmental issues. These students need not necessarily be the students who are the highest achievers in their normal work. Responses will be anonymous — the identified students will be scored as a group and not as individuals.

    1) _____
    2) _____
    3) _____
    4) _____
    5) _____
    6) _____

Secondary teachers only:

4. Indicate the subject area of this class (please circle only one):

    a) agriculture   g) math
    b) art   h) music
    c) business   i) science
    d) health   j) social studies
    e) home economics   k) technical education
    f) English language arts   l) other_____