NCF-Envirothon Test
Writing Workshop

Goal: To encourage Envirothon organizers, resource professionals and teachers (at all levels) to develop questions and test that are in keeping with the goals of the NCF-Envirothon.

I.   Common problems: Match the following test items with problems that can occur in test development.

_____1. Welcome to the NCF- Envirothon test at Gorgeous   A. Test not matching the goals
Gorge Park. Everything you need to answer the questions
is found on your paper… from time to time enjoy the view.   B. Trivial Pursuits

_____2. Use the key to identify 20 rare plants. We   C. Confusing Questions
only have one key so share it with the other 10 teams at
the station.   D. Lack of hands-on/problem solving

_____3. What toothpaste is recommended by most foresters?   E. Unequal access to materials

_____4. Choice g states: a and b, sometimes c when d is present.   F. Questions with an agenda
        (usually unintentional)
_____5. Use your knowledge of birds to identify the following frog calls.

_____6. Which is the best approach to the problem? The one proposed by the rabid environmentalist
or the one proposed by the greedy business conglomerate.
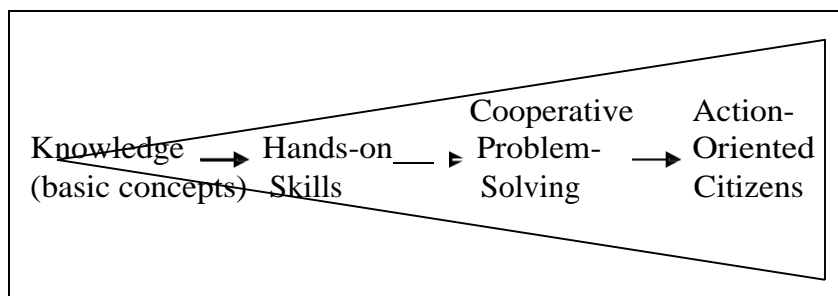
Discussion:
Others: List at least one other problem that you have encountered with Envirothon test writing?

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What topics would you like to see addressed in this workshop on Envirothon test writing?

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II.   Keep an Eye on the Goals and Objectives
(Also see NCF-Envirothon Goals and Objectives at www.envirothon.org)

Knowledge ⟶ Hands-on ⟶ Cooperative ⟶ Action-
(basic concepts)   Skills   Problem-   Oriented
                               Solving   Citizens

Each of the NCF-Envirothon goals builds on one another with increasing emphasis. The diagram above uses an inverted triangle to symbolize the increasing emphasis on upper level learning skills.

Teachers are becoming increasingly accountable to local and state/provincial standards based on national recommended standards. We need to show how our programs help teach the skills and knowledge covered in these standards.

Key standards documents:

National and/or North American Standards:
Excellence in Environmental Education: Guidelines for Learning(K-12)
http://www.naaee.org (North American Association for Environmental Education)
This document is also correlated with National Science Education Standards (National Association of Science Teachers- www.nsta.org), And Benchmarks for Science Literacy (American Association for the Advancement of Science- www.aaas.org), Geography, History, Social Studies, Economics,Civics and Government, Mathmatics, English Language Arts standards.

Where can you find state/provincial and local standards?

Practical Suggestions:
- Make sure you have clear goals and objectives reflecting the goals of Canon Envirothon.
- Make sure that the students have access to resources that reflect these goals.
- Structure your test with the appropriate emphasis on these goals and objectives with the foremost emphasis placed on hands-on cooperative problem solving.
- You may wish to have suggested percentage of each kind of learning to reflect the goals of the NCF- Envirothon. (NCF-Envirothon encourages 33.3% site specific questions on each test.)

Discussion: How well do our objectives match the NCF- Envirothon goals? Do your tests reflect your goals and objectives? Are your Goals and Objectives correlated with national/provincial, state and local standards? How can we convey this to the teachers and administrators of schools our area?

III.   Not Environmental Trivial Pursuits (choosing different kinds of questions)

There are many different kinds of questions that you can choose in writing your test. There are advantages and disadvantages to each kind. It is important to choose questions appropriate to what you are trying to test. It is also important to make sure that you structure each question to keep the questions clear, fair and consistent with N.A. Envirothon goals. It is key to remember the NCF- Envirothon goals.
Remember… the NCF-Envirothon is NOT Environmental Trivial Pursuits!

Knowledge Questions   Critical Thinking Questions

-True and False*   -ShortAnswer
 (*NOT RECOMMENDED)   - Site Specific/Assessment
- Multiple Choice   - Case Studies
- Matching and Completion   - Problem solving
                                    - Performance Test

Easier to score objectively -7 More difficult to score
                                objectively

**It is recommended that the test writing and review teams for each test should consist of BOTH RESOURCE PROFESSIONALS and EDUCATORS. This is a good mix to insure the results are relevant and accurate and also educationally sound. ** Have one person as the key contact for ease of communication and set up clear deadlines and benchmarks to keep the process moving.

Key Points:

- Use language that encourages upper level thinking skills (See Bloom's Taxonomy)

- Develop clear performance indicators or rubrics for more objective scoring

- Use common sense and have someone check and test the questions to make sure they are clear, fair, appropriate, and allow reasonable access to materials.

BLOOM'S TAXONOMY ranks cognitive learning skills in different categories listed below. To make your questions less based on memorization and more involving critical thinking skills use terms further down the chart to emphasize thinking skills.

Knowledge:	define, identify, list, name, select, describe, label, match, reproduce.
Comprehension:	convert, distinguish, explain, paraphrase, rewrite, defend, give examples, and summarize.
Application:	change, demonstrate, modify, predict, produce, solve, compute, manipulate, operate, prepare, relate, use.
Analysis:	break down, distinguish, select, diagram, discriminate, relate.
Synthesis:	Putting together information to construct something new - categorize, compile, devise, explain, organize, revise, create, design, plan.
Evaluation:	Judge the effectiveness of the practice, evaluate the results.

<u>Test Writing Exercise:</u>
 (Refer to the notes, Bloom Taxonomy)

1. Pick a topic on which the participants can develop questions.

2. Develop a trivia or trick question related to this topic using lower level thinking skills (See Bloom's taxonomy section on knowledge or comprehension.)

3. Put a big "X" over the question and mark it with the work "TRIVIAL PURSUITS", "TRICK" or "CONFUSING".

4. What would be some of the essential <u>concepts</u> for this topic. (Overriding themes essential to the understanding and application of the topic. These are ideas that are not isolated facts that could be looked up in a reference book.) The test should <u>always start with identifyng the goals and objectives</u> and then work to the resource materials, learning activities, and the evaluation method.

5. Write a multiple choice question that focuses on one of the concepts. Use upper level thinking skills. (See Bloom's taxonomy for application, analysis, synthesis, and/or evaluation.)

6. Write an open-ended question for one of the concepts. (Try and stretch your test writing skills by experimenting with a style you do not use very often.) Use upper level thinking skills. Include the attributes for a complete question (Performance indicators or standards describes the level of achievement, quality of performance, or degree of proficiency, ie. include 2 different examples showing different survival needs of animals.). The performance indicators should be part of the question so the student knows what is expected.

7. Devise an objective grading scale and answer key for this question.

8. Share your questions with a neighbor. Have them try and answer the questions without the answer key and then examine the answer key. Have them look for accuracy, clarity, a balanced approach, reasonable grading scale, upper level thinking skills, and any hidden bias. Discuss your findings.

9. Extra Credit: Make a question that has a hidden or inadvertent bias or unbalanced approach and make a version of the question that fixes this problem.

Discussion: What problems have you seen in the construction of questions? What guidelines could be given to improve question construction? Look at one or two questions and discuss how they could be restructured to focus on conceptual or critical thinking skills. Discuss what guidelines a judge could use to objectively judge these questions.

<u>**Examples of Test Writing Questions Using Different Levels of Thinking Skills:**</u>

For example: Let us look at the range of questions one might write related to wildlife.

    IV.   Questions that encourage Hands-on Skills

- The Cafeteria Test: If the test can mostly be taken in a cafeteria then there are not enough hands-on questions on the test. Visual: Student sitting at a table in a room looking at a soils pit dug into the floor.
- Test writers should always visit the site prior to developing the test.
- Have students do the tasks that resource managers would do in the field. See page 6-10 from the <u>Envirothon Planning Guide</u>. Tests questions can also be based around a simulation that puts the students in the role of a resource manager.
- Have questions that use various kinds of equipment.
- To focus on upper level learning skills, students can be provided background information to apply in hands-on analysis. This will help reduce the amount of rote memorization needed. Providing keys for identification can be used in this manner. In addition new skills can be taught and then applied by providing background material.
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*****MAKE SURE YOU HAVE AMPLE EQUIPMENT FOR EACH TEAM AND THAT STUDENTS HAVE EQUAL ACCESS TO RESOURCES, EQUIPMENT OR HANDS-ON STATIONS. THE EASIEST APPROACH IS TO HAVE ONE OF EVERYTHING PER TEAM, OR TO HAVE THE TEAMS ROTATE BETWEEN STATIONS WITH AN EQUAL AMOUNT OF TIME.

Exercise:

1. Have the participants either go outside or at least looking out the window depending on time or weather constraints. What kinds of skills would resource managers use in the field?

2. Construct one or several hands-on questions. Make sure to include the attributes of a complete answer (a performance indicator). Try to use upper level thinking skills rather than just a simple identification. Try different styles: ie simulating students a resource managers, question which provides background information to be applied, a question that teaches a new concept and then applies it.

Discussion: Discuss ways to increase the hands-on nature of the test. What problems or successes have you had with hands-on questions?

    V.   Cooperative Problem Solving and Critical Thinking Skills

Problem solving skills bring all the pieces together and encourage students to apply what they learned to real world problems.

The NCF-Envirothon stresses a balanced approach to environmental problem solving. All sides must be looked at and considered. In addition to environmental concerns, economic and social concerns need to be considered. The approach used has been modified from various models of environmental problem solving and is in keeping with recent national standards.

Some of the steps involved include:
- Identify the problems and issues. (including environmental, economic and social issues.)
- Identify the players involved and their interests and positions.
- Collect information on the issues and apply their knowledge of environmental issues and the interrelationships between the various components of the problem.
- Generate alternative solutions to the problems and issues.
- Investigate both short-term and long term consequences of the actions proposed.
- Evaluate the alternative solutions in relation to how well they deal with the various concerns and issue. Develop a plan of action. (environmental, economic, and social)
- Develop a plan for implementation. and a means for evaluating the results to improve the approach to the problem.

These steps are reflected in the NCF-Envirothon Envirothon Goals and the Judging Sheet. When designing problem solving questions or current issue topics you can keep these aspect of problem solving in mind.

Problem solving questions can take many different forms. It can be as simple as a multiple choice question that uses the upper level skills of application, analysis, synthesis or evaluation. They can also take the form of short answer or essay questions or a series of question that focus on a case study or a real world scenario. The current issue presentation problem is the most comprehensive form of this kind of question, especially if it includes a service project component.

When designing such a question try to focus on problems that are interdisciplinary, involve many interrelationships, and have environmental, economic and social components.

Make sure that the students are given a balanced perspective from "all sides of the issue". Without this the problem will become propaganda not education. Focus on the Project Learning Tree dictum of *"Teach students how to think and not what to think."* (Also beware of hidden bias in your questions.)

Develop objective criteria for judging answers. This could be a range of acceptable answers (However you must also allow for novel answers that fit the problem presented. For this reason, it is important to have the tests judged by individuals who are familiar with the subject matter.) You can also use specific criteria for judging each aspect of the answer. Do not use subjective criteria such as "poor, good, or excellent". Instead use observable attributes that can be differentiated.

For example the NCF-Envirothon Judging Sheet revision now uses as a <u>general</u> judging guide for the oral presentation:

    0pt   no evidence at all of this criteria
    2pt   Major misconceptions and gaps; ineffective, inadequate, inappropriate.
    4pt   Some misconceptions and flaws; minimally effective, somewhat appropriate. 6- Complete and accurate; effective; adequate and appropriate.
    8pt   Complete, very detailed; logical, ideas well supported and well organized; highly effective, all details appropriate.
    10pt Profound, in-depth, done in an insightful manner; extremely effective, points to a most effective strategy.

(instead of 2- Poor, 4- Fair, 6- Good, 8- Excellent, and 10- Outstanding)

This form of evaluation is known as a "rubric". Use the materials below to help you develop rubrics (adapted from "Scoring and Anchoring Performance Assessment Tasks", Maryland Assessment Consortium, 1994.) and materials developed by the Maine Math and Science Alliance.

SCORING RUBRICS

A scoring rubric is a set of criteria used to discriminate among different degrees of quality or levels of proficiency. Rubrics consist of a fixed measurement scale (eg. Four or six points). The rubric communicates the important qualities in a product or performance.

Rubrics are generic; that is, they provide general criteria for evaluating a student's performance in a given outcome area. A single rubric is designed for use with many related assessment tasks. Scoring rubrics can be holistic (intended to provide an overall impression of the elements of quality and levels of performance in a student's work, analytical or task specific (designed to indicate the level of performance of a student's work on several separate elements of quality or parts of a performance indicator.)

Both rubrics and task specific guides are most effective used for evaluation or instruction when they are accompanied by examples of responses for each score point. These example or anchors provide tangible illustrations of the various points on the scale and help students and judges understand when each point value is appropriate.

In a 4-point rubric system, generally 0 means no evidence of a particular characteristic, 1- Demonstrates serious errors or shows major misunderstandings, 2- Makes some errors or shows incomplete understanding or misconceptions, 3- Demonstrates competent performance or general understanding, 4- Demonstrates exemplary performance or thorough understanding. (Note since the North American Envirothon used a 5 point scale and needs room for outstanding performance a 5th level was added- - Profound, in-depth, done in an insightful manner; extremely effective, points to a most effective strategy.). For task specific rubrics each level would indicate how many examples (or other aspects of the answer) would be needed to achieve a give score.

GUIDELINES FOR WRITING RUBRICS.

- The descriptors for each level use language directly from the instructions or the performance indicator given to the students.
- Begin writing descriptor by describing a "3"- which is the level for adequately meeting the standard.
- Develop the descriptor for "4"- which is a level which exceeds the standard. (If you are using a 5 point scale also describe the attributes of a "5"- which exceeds the standards in an exceptional manner.)
- Write the descriptor for a "2"- which indicates partially completing the task.
- Write the descriptor for a "1" and a "0" – which indicate serious flaws or no evidence of the task being completed.
- The descriptors should focus on the most important aspects of the performance indicator, not those most easily measured. However the test scorer should be able to differentiate clearly between each level.
- Avoid subjective words such as poor, good, fair and excellent.
- Be absolutely clear about the use of "and " & "or" in the descriptor.

Recommended Resource: <u>Environmental Problem Solving </u>, Lisa Bardwell, et. al., 1994, available from the North American Association for Environmental Education. www.naaee.org

When developing a problem solving question keep the following points in mind:
- Environmental problems often require an interdisciplinary approach this should be reflected in your problems.
- Students should be encouraged to look at all sides of the problem (including environmental, economic and social aspects) and identify all the players and aspects. In this way they can completely define the problem and sub-issues and not rush too quickly into designing a plan for dealing with the problem.
- Encourage a collaborative approach to deal with a wide range of issues and perspectives.
- Make sure the materials provided give a balanced view of all the sides of the issue. Be aware of unintentional bias in the wording of the questions.
- Students should be flexible in their approach while going back and forth between fact collection, analysis, and development of options. Implementation of a plan should be linked with evaluation so the plan can be continually improved and modified if needed.
- The problems need to be relevant to the students

Ways to encourage COOPERATIVE activity-

The NCF-Envirothon is a cooperative learning activity. Because environmental problems are interdisciplinary and often involve a variety of players and perspectives, it is important that students learn to work collaboratively in order to be effective problem solvers. Some of the ways the North American Envirothon encourages cooperative problem solving is to require all the students to be involved in the presentation, present interdisciplinary problems that require using multiple skills. Another way to encourage cooperation is to set up questions that have different role (ie recorders, data collection, analysis) or soils, wildlife, forestry, and water experts. Can you think of other ways to promote COOPERATIVE problem solving?

Exercise: Design a problem solving question or series of questions using the attributes shown above. Write a clear performance standard and develop a rubric for scoring the question(s).

VI. Encouraging the Development of Action-oriented Citizens

This is an area that needs further development in the NCF-Envirothon program. Having students knowledgeable in environmental issues does not necessarily foster citizens that carry over environmental awareness into the rest of their lives and their citizenship. The classic example would be students who are doing a presentation on waste management but continue to litter.

Key factors in this development are making the problems relevant to students and getting them directly involved in developing a supportive environment that encourages students to implement their ideas.

Throughout the NCF- Envirothon program there has been some experimentation by states/provinces that have practices that further encourage action-oriented citizens. Below are some suggestions that may help in this area:

- The NCF-Envirothon encourages the study of real world problems. The more realistic we can make the situation or tie it into current issues in your area, the more likely students will carry this over into their citizenship. (ie. the NCF- Envirothon competition in Idaho involved studying a grizzly bear management plan that was currently open for public comments. The plans of the students were submitted as part of the public comment.)
- Several states (ie Mass.) have the students apply the current issue to their local area and present their findings to the judges AND local official or interested parties.
- Several states encourage their students to develop a service project related to the current issue.
- Many schools have community service requirements and/or job shadowing programs. Students could be encourage to do service projects as part of community service or job shadow resource professionals.

Discussion: How can we encourage carry over from the NCF-Envirothon program to action-oriented citizenship? What approaches have you tried at the state/provincial/local level?

VII. The Test Development Process and Feedback

- Examine the goals and objectives of the program and resource recommendations for students and revise as needed. (Tests should always come from the goals and objectives.) Test writers should all have copies of these materials to refer to.

- Develop a team of Resource people AND Educators to develop each test. Have one person designated as the station captain to facilitate communications.

- Meet with judges and visit the site for the competition. Look for opportunities for hands-on, site-specific questions. (also problem solving opportunities.)

- Develop deadlines and benchmarks for developing the test. Also be clear TOGETHER about the kind of test you are looking for. (It is always easier to make clear recommendations BEFORE the test is developed than try to make drastic modifications after it is written.

- Develop a first draft of the test. Have colleagues and others not familiar with the test check the test for clarity, bias, lack of trivial pursuit questions, and fairness. Also have them judge how long it would take teenagers to do the test and whether it is reasonable and appropriate.
- Review the tests together with resource people and educators TOGETHER. This is best done in person so there can be a good dialogue about the test. Tests should never be presented to students without first being reviewed.

- Produce the final copy and have it ready in plenty of time for the competition.

- Make sure students have adequate materials so access to tools, references, and stations is consistent for each team. Also make sure that the questions are set up so the students can easily flow through the station without a lot of running back and forth.

- Have mechanisms where the presenters can give feedback to the students on their answers (ie mail copies of the test back to the teams). Feedback is a very important part of education. Also have a mechanism where the judges can get feedback on how students did on the test. You may want to check the results for the reliability (consistence of the answers, Was there a question that most every team did poorly?) and the validity (Did it actually test what it was intended to test.) Keep good questions and store them away for use at a later competition.   Use these results to improve the process for next year.

Discussion: What problems do you have in the process of developing the test? Would could be done to make this process more effective and efficient?

Don't forget to make the program FUN
Challenging for the students!
Take the NATURAL CHALLENGE!