

INTRODUCTION

An environmental investigation should be designed so that all participants can take an active part at their own level of ability and interest. The investigation should have opportunities for participants to observe, collect, record and interpret data and summarize of how those interpretations relate to the topic.

The following lessons are designed to provide the participant with the necessary background for understanding education by involvement and experience in constructing simple environmental investigations. They are designed for use with groups of teachers and/or resource personnel interested in producing environmental investigations.

THE ACTIVITIES

The Value of Teaching Process Skills: Survival Values in Learning. A major goal of teaching process skills is to develop the persons; ability to think for themselves.

Developing Activity Cards: Activity cards can promote small group and individual investigations with a minimum of teacher direction. Each participant can move independently at his/her own learning rate.

Developing Instructional Objectives: Today, educators are being urged to clarify educational outcomes they hope to achieve through their instructional efforts.

Use Questioning Strategy in Environmental Investigation: The use of certain kinds of questions can help establish a learning climate that will encourage participation, discussion, and interaction during the investigation.

A Basic Question Sequence for the Interpretation of Data Process: This question sequence can allow the group to interpret their own observations and recorded data about the topic.

Developing a Lesson Plan for an Environmental Investigation: If you put all the above pieces together, you can come up with the start of a lesson plan for an environmental investigation.

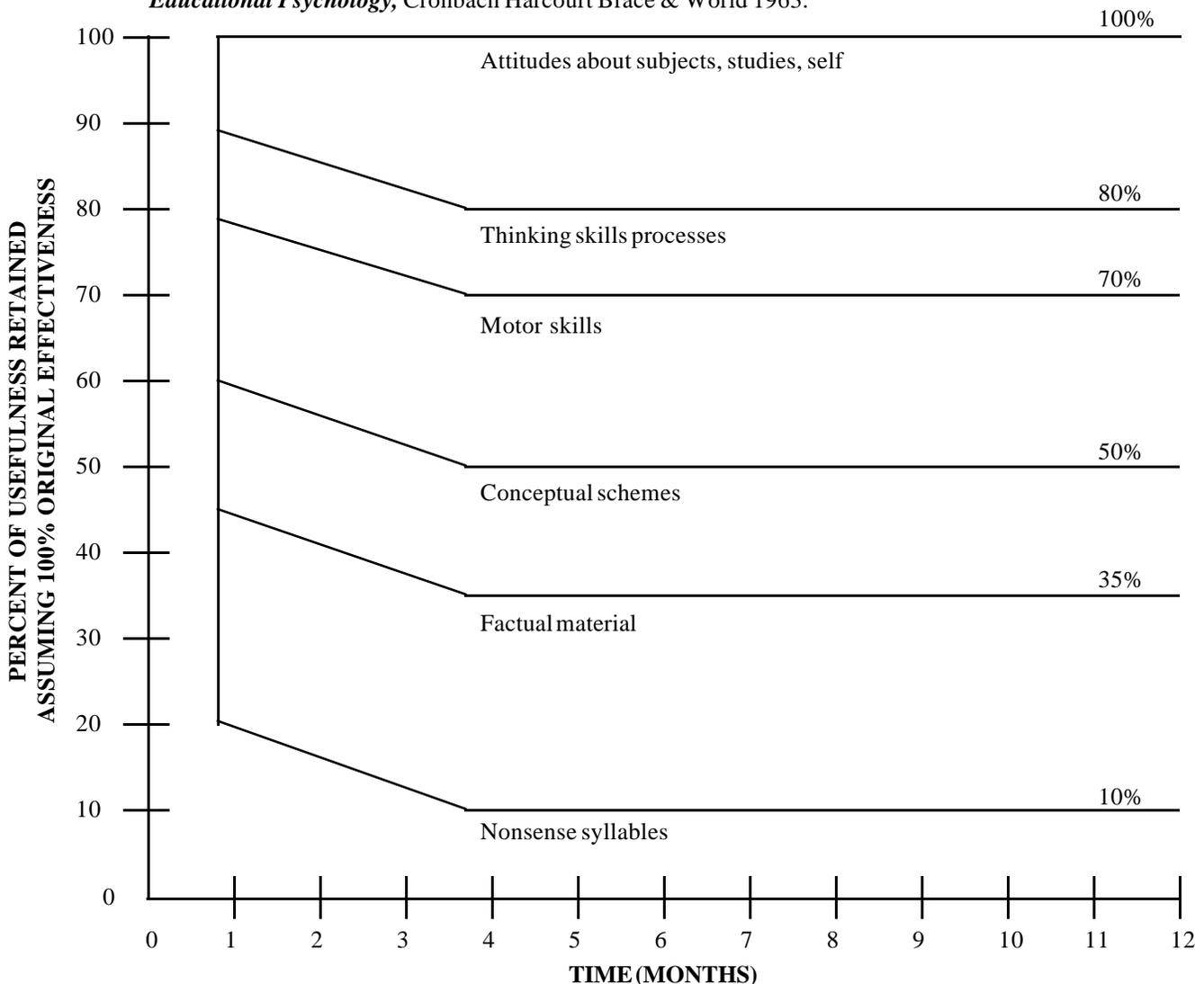


THE VALUE OF TEACHING PROCESS SKILLS

A major goal of teaching process skills is to develop the ability within each individual learner to function autonomously at the inquiry and proof level; i.e., the ability to obtain, organize, translate, interpret, and apply bodies of knowledge and to present proof of the validity of the process.

Survival Values in Learning

Used in the Higher Level Thinking Ability Course - N.W.E.R.L. - as an interpretation from *Educational Psychology*, Cronbach Harcourt Brace & World 1963.



This chart shows the retention rate of different categories of learning. In small groups discuss and answer the following questions.

1. What does this chart say about the retention of learning?
2. What are the implications of this chart to the way we plan learning experiences?



Some Implications about the Chart: Survival Values in Learning.

- This chart relates to what you learn, not to how you learn it.
- Learning some content may not be a very productive use of our time. According to the chart, after 3 months we only remember about 35 percent of the facts and 50 percent of the conceptual schemes.
- We retain up to 70 percent of the ability to manipulate and operate things (machines, tie shoes, write, etc.) 3 months after the learning experience. If the learning experience was designed for us to develop thinking skills and processes (gather, sort, analyze, interpret and provide alternative solutions about problems), we could retain those skills at the 80 percent level of usefulness.
- Therefore, we might assume that people who have developed the ability to think for themselves can collect and analyze factual data, develop a line of reasoning or contribute to the interpretation or solution of a problem or decision. Many times the learning experience deals only with memorizing facts and other information or concepts with no chance for putting that knowledge to work.

Before planning a workshop or other learning experiences, ask yourself:

1. Why am I doing this? (To help people memorize facts, learn concepts or to think for themselves?)
2. How can I structure learning experiences to ensure participation and the development of thinking processes along with the use of factual data, etc?

We are now recognizing that if we develop thinking skills, and processes of investigation, we may begin to change behaviors. Only by actually involving people in environmental learning experiences can they begin to think about their role in environmental management. We must be concerned with developing environmentally literate persons who can think for themselves.



DEVELOPING ACTIVITY CARDS

In developing an Environmental Investigation Lesson Plan, self-directed activity cards can be a useful tool.

Activity cards are not new and have been used in many ways. An activity card can simply be a card on which you write directions for a learning experience.

Some reasons for using Activity Cards include:

- Allows for different levels of ability to participate at once.
- Easily adjustable - can add or delete activities.
- Can promote small group interaction and accomplishment.
- Teachers do preparation ahead of time.
- Don't feel bound to manual.
- Can tailor-make investigations to fit needs of students.
- Makes the learning student-dependent and not teacher-dependent.

Activity cards can also have the following characteristics:

- Sequential, programmed, assorted, self-directed, personalized, task-oriented, etc.
- Provide for a variety of kinds of involvement, communication, feedback.
- Provide alternatives and choices for the learner.
- Can be laminated for wet weather.



Using the following criteria, evaluate the sample task cards below:

1. Does the activity actually *involve* the student with the *environment*? How?
2. Is the activity relevant to the learner in his or her world? (age, level, topic, culture etc.)
3. Does the activity include opportunities for problem solving?
4. Does the activity include opportunities for the learner to collect and record data based on his or her own observations?
5. Does the activity include opportunities for the learner to make his or her own interpretation about the collected data?

SAMPLE TASK CARDS

Circle the # for the criteria present on card

(From an assortment of task cards for a nature trail walk)

Here are two leaves. Make a list of all the similarities you find. Make a list of all the differences you find. (Staple leaf here) (Staple leaf here) <div style="display: flex; justify-content: space-around; margin-top: 5px;"> Leaf 1 Leaf 2 </div> Similarities: Differences:

- 1
- 2
- 3
- 4
- 5

(From a sequence of task cards on “Sounds”)

Find a noisy place and stay for a little while. How do you feel in a noisy place? Write a few sentences or a poem to tell how the noisy place makes you feel.

- 1
- 2
- 3
- 4
- 5

(From a sequence of task cards on “Spaces”)

Walk around your classroom. How do you feel in this place? Write or tell about how it makes you feel. Go outside and stand near the school building. Do feel different here than you do inside? Write or tell how this space makes you feel.

- 1
- 2
- 3
- 4
- 5

(From a unit of study for a “Supermarket Survey”)

In your backyard or schoolyard, bury different kinds of packaging materials. Dig them up at specified intervals of time and compare decomposition rates.																														
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Construct at least two activity cards on a topic of your choice.

Some suggested Instructions for Cards:

1. Select a topic, theme, or a particular environment.
2. Decide on your purposes.
3. Select some activities to accomplish those purposes.
4. Construct activity cards below about the topic or theme you chose.
5. Consider including a variety of:
 - a. Types of involvement
 - b. Sizes of groups
 - c. Lengths of time
 - d. Methods of recording or communicating information.

Other considerations:

- a. Have one specific goal.
- b. Keep activity brief enough to maintain interest and sequence.
- c. Color code them by areas of study or ability.
- d. Keep directions simple.
- e. Should fit within a time limit.
- f. Some form of self-evaluation statement.
- g. Use processes of observing, collecting, recording, and interpreting data.



DEVELOPING INSTRUCTIONAL OBJECTIVES

We must be able to distinguish between instructional objectives that are well formed and those which are not. Well formed objectives possess a tremendous advantage over other objectives in that they reduce confusion. Clarity leads to significant dividends in planning, instruction, and evaluation. The less confusion that surrounds an educational outcome statement, the more cues we have regarding what kind of instructional sequence will prove effective. The less ambiguity, the more readily we can devise precise measures to reflect that outcome. Well formed objectives thus constitute a useful mechanism for improving instruction and evaluation.

SOME GUIDELINES FOR DEVELOPING OBJECTIVES OR PERFORMANCE OUTCOMES

1. An objective describes an expected change in the learner's behavior.
2. When the learner has DEMONSTRATED this behavior, the objectives have been achieved.
3. An objective is a group of words and symbols which communicate your expectation of the learner so exactly that others can determine when the learner has achieved it.
4. A meaningful stated objective, then, is one that succeeds in communicating your expectation for the learner.
5. The best objective is the one that excludes the greatest number of possible alternatives to your goal. (No misinterpretation)

CRITERIA TO EVALUATE OBJECTIVES

1. Have you identified who the learner is?
2. Have you described the behavior the learner will demonstrate as evidence that he has achieved the performance task?

Is it measurable action or performance by the learner? (see list of Action Words)

3. Have you stated the conditions you will impose upon the learner when he is demonstrating his mastery of the performance task?

Examples:

- Using the length of his own step he will demonstrate _____
- Given a list of rocks he will distinguish _____
- Given a set of tree samples he will construct a dichotomous key _____
- Using a highway map of his state he will describe _____



OBJECTIVE OR BEHAVIORAL TERMS

The majority of our educational objectives can and should be stated in behavioral terms. There are some meta-objectives which must be more subjectively stated and their performance subjectively measured. The terms listed below represent an effort to formulate a list of the most common and applicable terms which have meaning for the teacher developing objectives related to the areas of knowledge, skills, habits, understanding, and concerns.

- | | | |
|----------------|----------------|-------------------|
| 1. Describe | 14. Locate | 27. Present |
| 2. Interpret | 15. Express | 28. Discover |
| 3. Observe | 16. Analyze | 29. Support |
| 4. Demonstrate | 17. Apply | 30. Question |
| 5. Sketch | 18. Operate | 31. Create |
| 6. Identify | 19. Illustrate | 32. Calculate |
| 7. Compare | 20. Diagram | 33. Organize |
| 8. Translate | 21. Perform | 34. Develop |
| 9. Contrast | 22. Listen | 35. Recite |
| 10. Relate | 23. Write | 36. Differentiate |
| 11. Generalize | 24. Read | 37. Construct |
| 12. Formulate | 25. Review | 38. Solve |
| 13. Define | 26. Use | 39. List |

Here are nine action words from the American Association for the Advancement of Science that apply to curriculum-related activities in the environment. Note the ones that are included in the previous list.

- | | |
|--------------|---|
| Identify | • The individual selects a named or described object by pointing to it, touching it, picking it up. |
| Name | • The individual specifies what an object, event, or relationship is called. |
| Order | • The individual arranges three or more objects or events in a sequence based on a stated property. |
| Describe | • The individual states observable properties sufficient to identify an object, or relationship. |
| Distinguish | • The individual selects an object or event from two or more activities which might be confused. |
| Construct | • The individual makes a physical object, a drawing or written or verbal statement (such as an inference, hypothesis, or a test of any of these). |
| Demonstrate | • The individual performs a sequence of operations necessary to carry out a procedure. |
| State a Rule | • The individual communicates, verbally or in writing, a relationship or principle that could be used to solve a problem or perform a task. |
| Apply a Rule | • The individual answers a problem using a stated relationship or principle. |

Terms to avoid when stating behavioral objectives.

- | | | |
|------------|------------|-------|
| Enjoy | Understand | Know |
| Appreciate | Like | Grasp |
| Faith | | |



USING QUESTIONING STRATEGY IN ENVIRONMENTAL INVESTIGATIONS

One objective in learning is to help people develop thinking skills and processes that will allow them to interpret the data they collect. A lively discussion and a good learning experience will develop if appropriate questions are asked. The use of certain kinds of questions can help establish a learning climate that will encourage individual participation, group interaction, and interpretation of the information collected in the investigation.

Get into groups of 3-4 and answer the following questions about the four questions below.

- A. Which of the four questions below did you feel most comfortable answering?
1 2 3 4 Why?
- B. Which question did you feel least comfortable answering?
1 2 3 4 Why?
- C. Which question allowed for greatest participation?
1 2 3 4 Why?

Questions asked:

- Question #1 What would happen if the rainfall doubled in your state next year?
- Question #2 How many acres of land in your state?
(What is the highest mountain in the United States?)
- Question #3 Why are recreation lands in your state important to the economy?
(What are the reasons for the location of major city?)
- Question #4 What are some things you think should be done in Environmental Education in your state?
(In your opinion, what is the major problem facing the environment today?
Tell why.)



Question 1 - What would happen if the rainfall doubled in your state next year? This divergent or open type of question provides the opportunity to consider many different systems and try out many answers.

If you ask a question that allows a wide variety of responses, the participation will be more free. This allows more opportunity for creativity and imagination. (What would happen if...? How might....? What do you see....?) Everyone can participate at his or her own level and, since the response depends on the viewpoint of the individual, there are no wrong answers.

Question 2 - How many acres of land are in your state? This memory type question calls for remembered content, rote memory, or selective recall.

If you ask a question that has one correct answer, then people will go after the correct answer or the answer they think the leader is looking for. The kind of thinking that is going on is the recall of previously learned information and facts. (Who is...? What is...?)

Question 3 - Why are recreation lands in your state important to the economy? This convergent type of question represents the analysis of given or remembered information. It leads to one set of expected end results or answers.

If you ask a question that focuses on solving a problem or putting several pieces of data together, then the audience has to reason, using given or remembered data. (Why are these things so...? How do you account for...?)

The participant becomes a problem solver in which the activity is to apply the proper operations at the proper time.

Question 4 - What are some things you think should be done in Environmental Education in your state? This evaluative type question asks the participant to use judgment, value, and choice, and is characterized by its judgmental quality. However, since it also asks for the learner's opinion, there is no one right answer or set of answers. The participant will take the knowledge previously gained in the lesson and relate it to or process it through his or her own frame of reference and set of values.

The type of question you ask then, can affect the learning atmosphere and restrict or motivate the participants to become involved in the discussion. Which of these types of questions have the greatest survival values (of their answers) as we discussed in Activity A.



1. Identify the following questions that are similar in the kinds of responses they would receive.

- _____ A. What is a nuclear reactor?
- _____ B. Why are the demands for energy doubling every 10 years in the U.S.?
- _____ C. How do you account for the decreasing amount of open space in your community?
- _____ D. What do you think is the best use of this land?
- _____ E. Name the largest city in your state?
- _____ F. Should number of coyotes be controlled? Why or why not?
- _____ G. What would happen if all automobiles were banned within your city limits?
- _____ H. How much land has been taken out of agricultural production in the U.S. in the last 5 years?
- _____ I. What effect do trees and shrubs have on noise abatement?
- _____ J. What factors contribute to the traffic congestion problem in your community?
- _____ K. In your opinion, what are the 3 most important problems in your community?
- _____ L. What is the relationship between population density and natural resource allocation?

2. Put the numbers or letters that represent each group identified in the chart below and label each group.

Groups	Label each group of questions using your own names.
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3. Put your labels in the chart below and describe your groupings.

Kinds of Questions (use the names you gave the groupings)	Characteristics of questions in this group
What does your chart tell you about the use of questions? 1. 2. 3.	



A BASIC QUESTION SEQUENCE FOR THE INTERPRETATION OF DATA PROCESS

Develop a basic question sequence that allows people to interpret their own observations in the interpretation of data process.

There are four basic question categories that can be used in this process. Select a topic (common to all) about which they should write the questions.

1. *Open Questions*: Open questions are designed to provide an opportunity for *all persons to participate* and *to obtain a body of specific data* which will provide the opportunity to focus on significant points.

This type of question provides an opportunity for every person to become immediately involved in the discussion, regardless of his or her ability or background. It is completely free of the element of; guess what's on my mind? The response depends on the participant's viewpoint. There are no wrong answers.

THE CHARACTERISTIC OF THIS QUESTION IS OPENNESS

What do you see as you look at the hillside?

What do you notice about the soil profile?

NOTE: Interpreting data may not necessarily begin with an open type question. You may wish to focus immediately upon specific points in the data. In that case, begin the question sequence with a focus question.

2. *Focusing Questions*: The focusing question is an extremely important element in the interpretation of data process. It *focuses on specific points* that will later be compared, contrasted and related to other points.

Its basic purpose is to focus the attention on specific data as a central point for discussion.

THE CHARACTERISTIC OF THIS QUESTION IS SPECIFICITY

What are some factors that are helping the log decay?

What are some factors that affect water quality?

3. *Interpretive Questions*: Interpretive question are designed to compare, contrast, and seek logical relationships between the specific points brought out in the focusing question(s).

The learner is asked to compare and contrast two or more specific points in the data; two or more groups of data; two or more feelings, concepts, or ideas, and express a perceived or inferred relationship between them.

THE CHARACTERISTIC OF THIS QUESTION IS ITS FOCUS ON RELATIONSHIPS

Are there any of these that seem to belong together?

What can you say about the pH of the water from the aquatic life found there?

How do you account for the differences between these two areas?

Why were the two trees the same age but different in size?

4. *Summary Questions*: Summary questions are designed to obtain conclusions, summaries and closing.

They occur at the close of a particular discussion and call for a statement which summarizes in a generalized form what has been discussed so the generalization or big idea applies to a variety of situations.

THE CHARACTERISTIC OF THIS QUESTION IS ITS CONCLUSIVENESS

How could we summarize our discussion about architecture?

Based on our observation and discussion, what can we say about urban environments?



DEVELOPING A LESSON PLAN FOR AN ENVIRONMENTAL INVESTIGATION

All the elements of a lesson plan--objectives, task cards, questions strategy, and questioning sequence--will help guide you through a successful environmental learning experience.

Use the following outline to help guide you through the steps.

Step 1: Objectives

What will the learner be DOING? Write:	
What CONDITIONS will be imposed?	
How will success be RECOGNIZED?	

Now write the complete instructional objective below, evaluating it with the criteria above.



Step 2: Pre-investigation Questions

Questions designed for maximum group responses and interaction--What can we find out about the rotten log? What might be important to look at? Consider question strategies.

Evaluation: Will the pre-activity question interest and motivate the audience to gather data? Yes No
Are the questions varied? Yes No

Step 3: Task Cards

Directions for gathering data for the investigation:

Data recording for the investigation (type of instruments, charts, graphs, tables, description, etc.):

Evaluation: Does the activity gather data that will help support the purpose? Yes No
Does the activity actually involve learner in collecting and recording data? Yes No
Does the activity include opportunities for learners to make their own interpretations? Yes No



Step 4: Post Investigation Discussion

Open Question to bring out the “What's” (What did you notice? What did you see?, etc.)

1. _____

Focusing Question on specific points to be compared, contrasted, or related to other points of specific data (How do you account for ..?. Why are these things like that?)

1. _____

2. _____

Interpretive Questions to elicit comparing, contrasting, and relating of points within the field of data-What differences did you notice between rotten logs of the two different trees?

1. _____

2. _____

3. _____

Capstone Question for summarizing generalizations-What can we say about..? How can we summarize what we've done and discussed about the rotten log study?

1. _____

Evaluation: Does the question sequence lead people to make generalizations that coincide with the purpose?

Does each of the questions in the sequence match up with the criteria below?

Open - allow everyone to participate. Get a lot of data.

Focus - focus attention on specific data as a central point for discussion.

Interpretive - seeks relationships. Compare, contrast, relate specific points in the data.

Capstone - call for a statement which summarizes the discussion.

