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ABSTRACT

Presented are four modules (from Appendix A), developed for a study at Central Michigan University, focusing on competency-based materials in science methods education for elementary school teachers. The Teaching Tactics Module is an attempt to combine process teaching skills and inquiry. Four teaching tactics are emphasized: initiating, focusing, extending, and terminating. The Questioning Techniques Module is based on the seven categories of questions as identified by Sanders in "Classroom Questions: What Kinds?" and is designed to provide experience in formulating and in classifying cognitive questions. The Short-Term Teaching Strategies Module focuses on constructing a daily lesson plan while the Long-Term Module is designed to cause the preservice teachers to plan and develop a resource unit to be used for a minimum of four weeks. (PEB)

APPENDIX A to "A Cooperative Program for Developing a Competency-Based Elementary Teacher Preparation Module in Science Education by University and School Personnel" (Oana/Eiszler)

Science Modules
Science/Social Studies Methods
ELE 340 (431)

TEACHING TACTICS MODULE

INTRODUCTION

You have been introduced to process teaching and to the various inquiry skills. Now we want to help you master some tactics necessary to teach a science lesson. Before teaching a science lesson, three decisions are needed: (1) the objectives to be attained, (2) the methods of attaining those objectives, and (3) the method of evaluating what is attained. This module will help you understand methods of achieving these competencies.

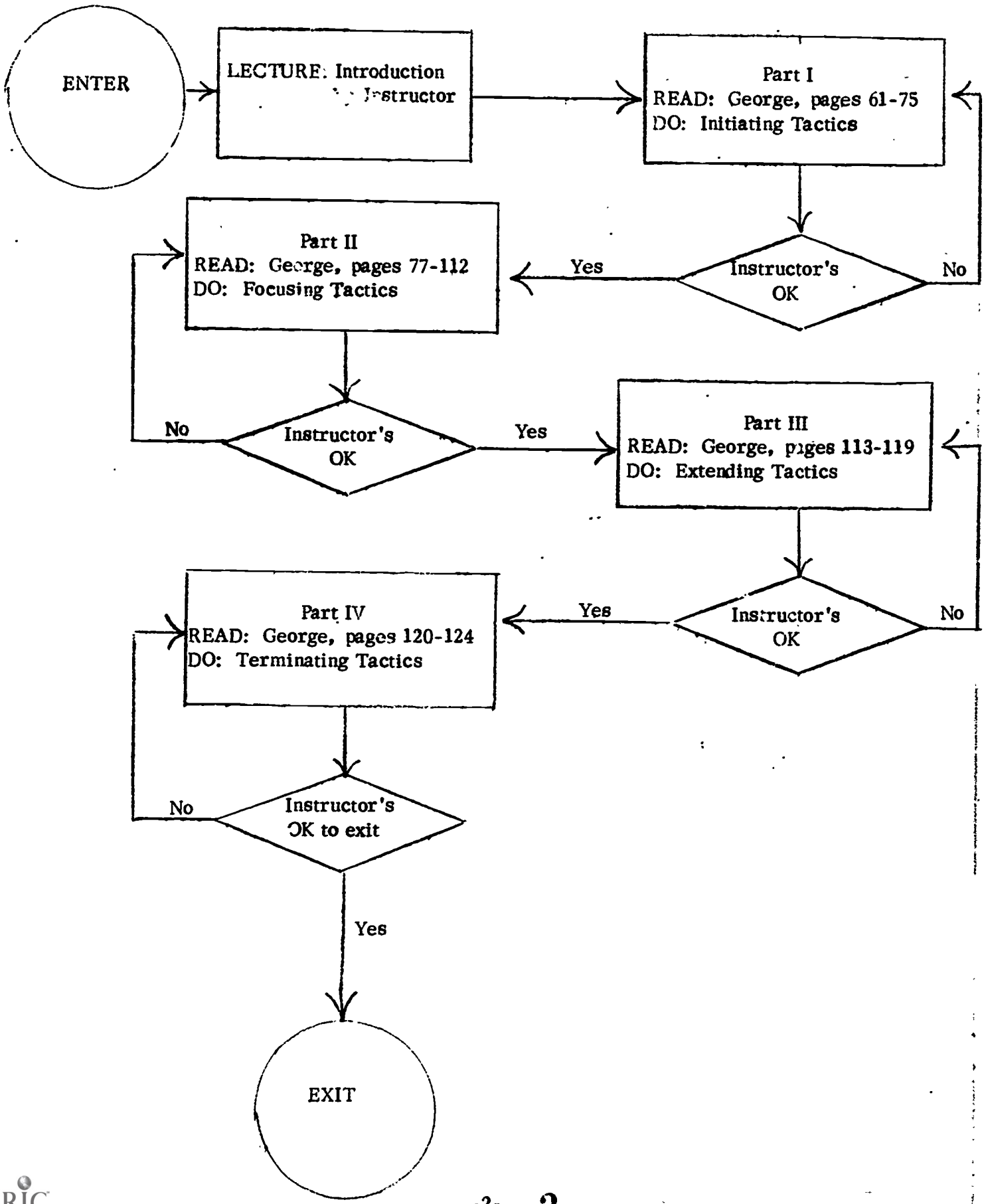
GOAL

You will identify and demonstrate the ability to use selected teaching tactics in conducting learning experiences involving science skills or concepts.

BEHAVIORAL OBJECTIVES

1. You will define and identify the following teaching tactics:
   a. Initiating Tactics
   b. Focusing Tactics
   c. Extending Tactics
   d. Terminating Tactics
2. You will incorporate the selected teaching tactics in lesson plans.

FLOW CHART: TEACHING TACTICS



PART I: INITIATING TACTICS

A. Read the material in George, pages 61-75.

B Do one of the activities on the list on the following pages. Materials for the activities are provided. Record your results on Answer Sheet 1.

C Upon completion of Answer Sheet 1, turn it in for evaluation.

D. Six science concepts are listed below. Choose one, complete Answer Sheet 2 and submit to your instructor for evaluation.

1. An object will remain at rest unless acted upon by some force.

2. Bacteria can be controlled by disinfectant chemicals.

3. Muscles fatigue after constant exercise.

4 Plants grow differently in different types of soil.

5 Two objects of equal weight and the same material may float or sink depending on the shape of the object.

6. Plants do not need soil in order to grow.

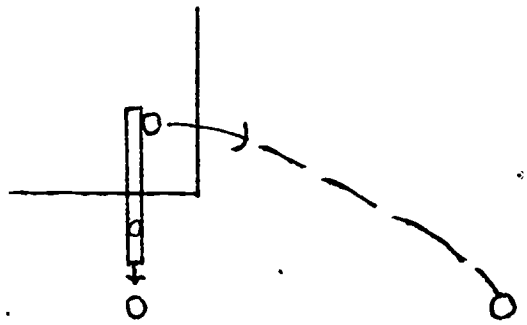
E Get instructor's "ok" or a specific prescription. Proceed to Part II when cleared to do so by instructor.

ACTIVITIES FOR INITIATING TACTICS

Activity One: Coins Dropped and Thrown

A. You will need a ruler and two coins.

B. Place ruler and coins as shown in diagram with one coin on the end of the ruler which extends over the edge of the table and another identical coin on the table against one side of the other end of the ruler.



C. In this activity one coin will drop straight down and the other will be propelled out from the table. Indicate which of the following statements reflects your expectations.

1. Both coins will hit the floor at the same time.

2. The coin that drops straight down will hit the floor first.

3. The coin that is propelled out from the table will hit the floor first.

4. Other(s): (State in your own words)

D. Hold the ruler down in the center with one finger. With the other hand, tap the overhanging end of the ruler sharply so that one coin will drop straight down and the other will be propelled out from the table.

E. Were your expectations consistent with what actually happened? If not, can you explain (make inferences about) what happened?

F. What senses were you able to use in making observations about the falling coins?

Activity Two: The Loose Lid

A. You will need a jar, water, paper, and a card.

B. Fill a glass jar to the brim with water. Place a piece of cardboard over the mouth of the jar or a lid. Hold the lid against the jar and turn the jar upside down. What do you think will happen when you remove your hand from the lid?

C. Take your hand off the cardboard lid and hold the jar in the upside down position.

1. How do you explain what happens?

2. Identify a concept which this activity could be used to illustrate.

3. What variables would you suggest changing for activities spinning off this one?

Activity Three: Egg in Water

A. You will need one egg, container A, and container B.

B. Place the egg in container A and observe. Now place the egg in container B.

1. Can you explain what happens?

2. List four inquiry activities (process skills) that can be used in this activity.

a.

b.

c.

d.

Activity Four: Raisins in Sprite

A. You will need 100 ml. Sprite and three raisins.

B. Pour 100 ml. of Sprite into a glass beaker. Place three raisins in the Sprite and observe.

C. Make an inference which explains why the raisins rise to the top of the Sprite.

D. Make another inference explaining why the raisins sink back down to the bottom of the Sprite.

PART II: FOCUSING TACTICS

A. Read George, pages 77-112.

B. Choose an activity from any elementary science text available in the IMC.

C. Complete Answer Sheet 3 and give it to your instructor.

D. Complete Answer Sheet 4 and give it to your instructor.

E. Complete Answer Sheet 5 and give it to your instructor.

F. Complete Answer Sheet 6 and give it to your instructor.

G. Confer with instructor. If your answers are approved, go on to Part III.

PART III: EXTENDING TACTICS

A. Read George, pages 113-119.

B. Complete Answer Sheet 7 and give it to your instructor.

C. When your answers are approved, proceed to Part IV.

PART IV: TERMINATING TACTICS

A. Read George, pages 120-124.

B. Complete Answer Sheet 8 and give it to your instructor.

C. See instructor to arrange seminar.

Name _____

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Answer Sheet 1

Initiating Tactics: Apparent Inconsistency Creating Competition

1. What activity did you select?

2. What was the apparent inconsistency?

3. What would normally be expected in this situation by a person who had not previously seen it?

4. Identify a situation when creating an inconsistency would NOT be a desirable tactic. Why do you think the tactic would not be desirable in the circumstances described?

5. At what grade level could the activity you chose be profitably used? On what basis do you make this judgement?

6. How could you use this activity to create competition?

Name _____

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Module _____

Answer Sheet 2

Initiating Tactics: Defining a Problem, Setting Expectations

1. Which concept area did you choose?

2. State a problem which would be suitable for one lesson in this concept area. Is your answer in line with Piaget's concept of "readiness"?

3. What would determine the grade level for which this lesson is suited?

4. When would you use teacher definition of a problem rather than a discrepant event or a competitive situation?

5. How would you convert the above problem to a situation classified by George as a "setting of expectations?"

Name _____

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Answer Sheet 3

Focusing Tactics

Choose an activity in any elementary science text: _____

State a major objective for it in each of five types of laboratory experiences.

1. Developing psychomotor skills:

2. Verification of concepts previously known to the students:

3. Verification of concepts previously unknown to students:

4. Data collecting and analysis for a problem provided the student:

5. Data collecting and analysis for a problem selected by the student:

Name _____

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Answer Sheet 4

Focusing Tactics

1. Describe a trip to a zoo for fourth graders in the context of;

   a. "Out of class lecture"

   b. "Out of class laboratory"

2. Under what circumstance might a demonstration be more appropriate than a laboratory experience for children?

Name _____

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Module _____

Answer Sheet 5

Focusing Tactics

1. Choose one:

   a. A table or graph in a newspaper, magazine or book.

   b. A newspaper or magazine article that gives an account of a recent scientific discovery.

   c. A data table from your own science experimentation.

2. Identify three inquiry skills that could be developed through the materials you have selected.

   a.

   b.

   c.

3. Construct a "quest" as defined by George, which would develop one of the inquiry skills identified in question two.

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Answer Sheet 6

Focusing Tactics

1. With other members of your group, select one of the following activities.

   a. Revolutions and rotations of moon, earth, and sun

   b. Expansion and contraction

   c. For every action there is a reaction.

2. Which situation did you choose?

3. Verbally explain the concept to your group. (No written answer needed.)

4. With members of your group, act out the concept. Ask your instructor to observe your group.

5. Which method used above do you feel would be most effective in helping children to understand the selected concept? Explain.

Name _____

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Module _____

Answer Sheet 7

Extending Tactics

1. Extending tactics can serve two functions:

   a. Helping students formulate a new concept, principle, or skill

   b. Helping students apply a concept, principle or skill to new situations

2. Select one of the following instructional objectives and develop an extending tactic for it.

   a. Given a woody stem, the students should be able to infer how long it grew over the past year.

   b. When presented with a flower, the student should be able to identify the sepals, petals, stamens, and pistils, if present.

   c. Using a mineral key, the student should be able to identify a mineral.

   d. Given two soil types and two stream speeds, the student should be able to predict which conditions would modify the land at a greater rate.

   e. Given an object, the student should be able to determine its density.

3. Which objective did you choose?

4. Describe your extending tactic.

Name _____

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Module _____

Answer Sheet 8

Terminating Tactics

Describe the circumstances which would dictate the choice of each of these terminating tactics for a daily lesson.

1. Teacher centered review:

2. Question and answer review:

POSTTEST FOR TEACHING TACTICS MODULE

(Note: This test must be completed by the next class day.)

A. Select one of the science generalizations listed below.

1. Most materials expand when heated and contract when cooled.
2. Sounds are produced by vibrations that travel in waves.
3. Light usually travels in straight lines.
4. Magnets commonly attract objects made of iron and steel.
5. Current electricity flows when there is a complete circuit.
6. Force needed to use an inclined plane changes as its tilt is changed.
7. Weathering and erosion constantly wear down the earth's surface.
8. Air has weight.
9. The earth's motion in space causes time and seasonal changes.
10. Some plants grow from seeds.
11. There are many animals without backbones; insects make up the largest group.

B. Develop a 20 minute lesson plan which includes:

1. Initiating tactics
2. Focusing tactics
3. Extending tactics
4. Terminating tactics

C. You may use any outside resource books that you have available to you for content information. Several good textbooks are available in the I.M.C.

D. Use the answer sheet on the back of this page for your answers.

Name _____

Section _____

Date Due _____

ELE 340 (431)

Answer Sheet for Teaching Tactics Posttest

A. Generalization selected: _____

_____

B. Lesson plan

1. Initiating Tactic

2. Focusing Tactic

3. Extending Tactic

4. Terminating Tactic

QUESTIONING TECHNIQUES MODULE

INTRODUCTION

In a rapidly changing society, it is impossible to foresee the problems which will be faced in the next 15 or 20 years. If we could predict them, maybe, just MAYBE, we could teach our students everything they will need to know to handle the specific problems they will face. This is unrealistic, of course. Realizing that we cannot possibly know these things, much emphasis must be placed on the development of generalized ways of attacking problems. We must help children develop the intellectual abilities and skills which will be helpful to them in many new situations. As they mature, they are expected to solve problems on their own and to make decisions wisely on the basis of their own thinking. It is our task, as teachers, to prepare our students to do this.

Even though knowing facts and recalling information are not the ultimate goals we have for our students, more than half of the questions we teachers ask require only these behaviors--memorizing facts and recalling information. Memory is a very lowest level of intellectual behavior. For students to develop critical thinking and problem solving abilities, they must have an opportunity to develop and use intellectual skills at all levels. If we are to fulfill our obligations to students, we must ask more thought-provoking questions than simple recall of knowledge.

What other kinds of questions are there? Sanders has indicated that cognitive questions can be classified into seven categories based on the kind of mental behavior the question is intended to elicit.

These seven categories are (1) memory, (2) translation, (3) interpretation, (4) application, (5) analysis, (6) synthesis, and (7) evaluation. The "questions" he classifies with this system include not only interrogatory statements, but also all problems and projects posed to stimulate thinking; any intellectual experience calling for a response.

In the classroom three factors enter into determining the kind of thinking that is brought about in the minds of the students by any given question: (1) the structure of the question, (2) the knowledge the student has of the subject, and (3) the preceding instruction given. Usually a teacher can anticipate the amount of knowledge students have on a subject and the mental process they will use to arrive at an answer. There are exceptions, however, and it is wrong to assume that a question inevitably leads to a single category of thinking or that all students are necessarily using the same mental processes to arrive at an answer. The classification of questions within the framework of this module should be done on the basis of the structure of the question, when there are no students actually involved.

For each of the seven categories the intended student behavior and some examples of questions which could elicit the intellectual behavior are given on the following pages. Study these carefully, then do the activities for this module.

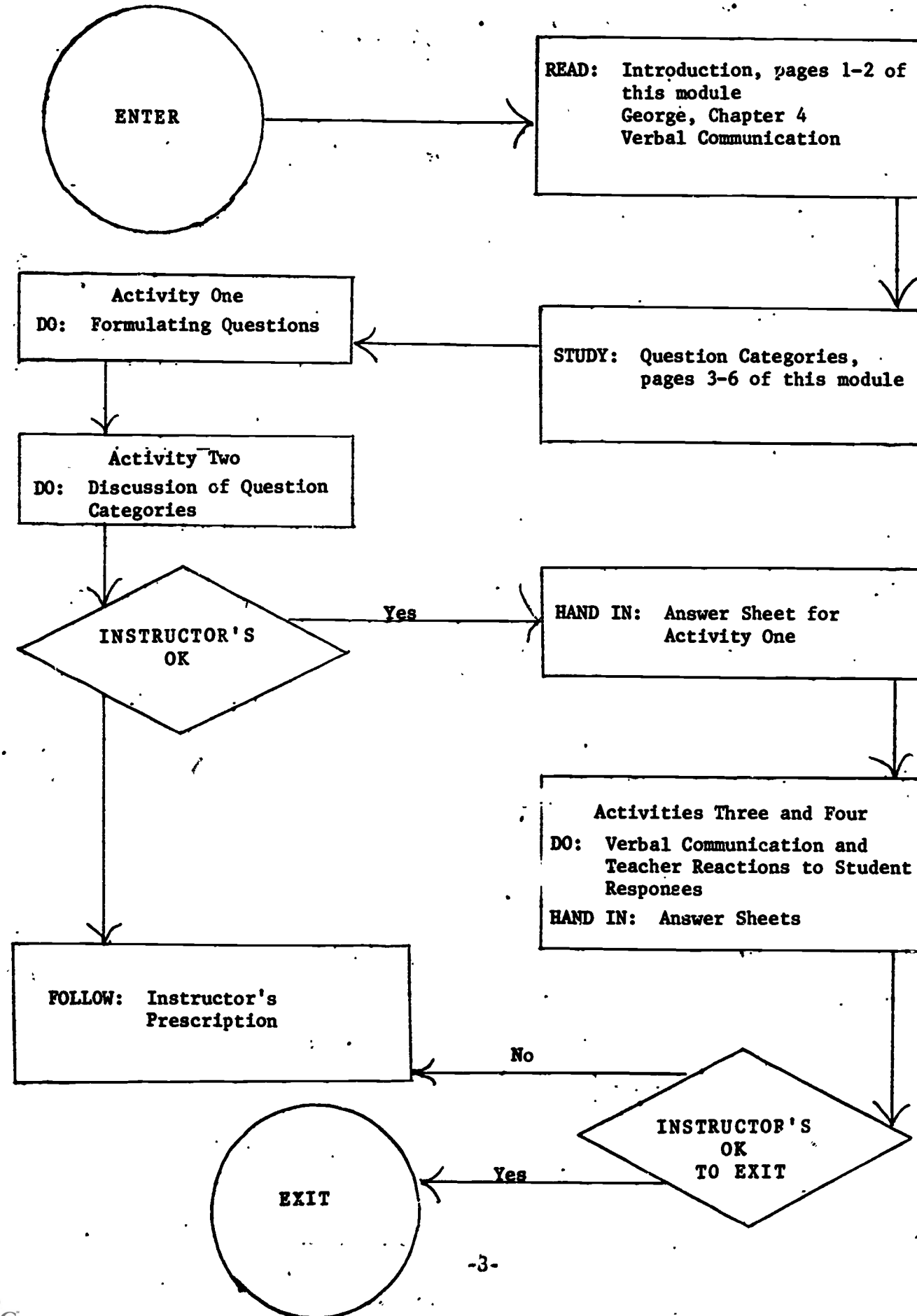
GOAL

You will utilize specific questioning techniques.

BEHAVIORAL OBJECTIVES

1. You will identify cognitive levels of questioning.
2. You will select a topic in science and formulate questions at each of the cognitive levels indicated by Sanders.
3. You will identify the two broad categories of verbal communication according to George.
4. You will identify the five different types of reactions to responses involved in inquiry discussions according to George.

FLOW CHART: QUESTIONING TECHNIQUES MODULE



QUESTION CATEGORIES

Level One: Memory

A. The student is asked to recall or to recognize information.

B. Sample questions:

1. What is a thermometer used to measure?

2. True or false? Paper is made from wood.

3. Snails are: a. cars

b. bipeds

c. animals

d. plants

4. Lemons are _____ (blue, yellow).

Level Two: Translation

A. The student is to change information from one symbolic form or language into another symbolic form or language.

B. Sample questions:

1. Put your finger on the object in the picture which is red. (If the picture has not been used in this way before!)

2. Draw a picture to represent something round.

3. Make a graph to represent your data.

4. In your own words explain what is meant by "inference."

Level Three: Intepretation

A. The student is to relate or compare facts, generalizations, definitions, values, and skills.

B. Sample questions

1. Is (color) different or the same as (texture)?

2. Given: All round things roll. Are the following statements true or false?

   a. Oranges do not roll.

   b. A soup can rolls.

   c. A book rolls.

   d. A ball rolls.

3. Everybody was gone for two weeks during the Christmas vacation. All of our mealworms died. What caused this to happen? How many reasonable causes can you suggest?

4. Following are 3 types of conclusions:

   a. Conclusions based on observations

   b. Conclusions based on inferences

   c. Conclusions based on assumptions (no data)

   Listed below are some conclusions concerning an object in a cardboard box. Classify each as an example of one of the above types of conclusions.

   _____ The object is smaller than the box.

   _____ The object is old.

   _____ The object is a book.

   _____ The object slides from side to side but not from end to end.

   _____ The object is green.

Level Four: Application

A. The student is given the opportunity to transfer training to new situations with a minimum of directions or instructions.

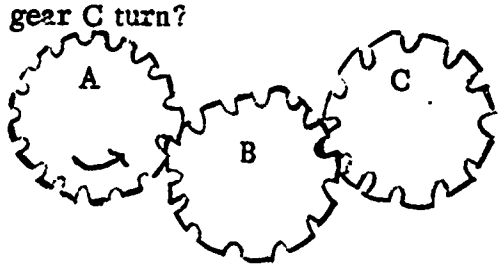
B. Sample questions

   1. Make at least 10 observations about this object. (Given an object not previously considered in class.)

   2. List everything a person would need to live in an empty, windowless room for six days. Do not indicate how much of an item, just list the item.

(Continued on next page)

3. Which way will gear C turn?



4. Find something in this room which is rough.

Level Five: Analysis

A. The student is asked to solve problems with conscious knowledge of the parts and processes of reasoning. The student is concerned with subject matter, but in addition the student must be conscious of the intellectual process he is performing.

B. Sample questions

1. Tell why the reasoning in the following paragraphs is sound or unsound:

a. Jane wants a pet cat. John's cat scratches him. Jane shouldn't get a pet that will scratch her.

b. Dr. J wants to determine if all rabbits are the same color. He examines 84 rabbits. Three are blind. All three blind rabbits are brown. Dr. J says all brown rabbits are blind.

2. William has presented his case in support of sending astronauts to the moon. Analyze his reasoning.

3. That was a fine answer you just gave. Now, can you tell us how you figured it out?

Level Six: Synthesis

A. The student is encouraged to engage in imaginative, original thinking; to discover knowledge that is new to him; to deal with simple problems that require creative answers. The teacher should seek out and reward originality.)

B. Sample questions

1. How would you test your hypothesis?

2. How would you go about finding out which bait is best for fishing in your favorite lake?

3. What problems would you work on in order to make a better selling alarm clock?

Level Seven: Evaluation

A. The student is to set up his own standards or values and then determine how closely an idea or object meets his standards or valuee.

B. Sample questions

1. Is that the best answer?

2. Would you favor a law which says no mother or father can make a child eat something he doesn't like?

3. Is it important for a child to learn how to walk?

ACTIVITIES FOR QUESTIONING TECHNIQUES

Be sure to study the seven question categories before beginning these activities. Record your answers on the answer sheets on pages 8-11 and submit them to your instructor.

Activity One: Formulating Questions

A. Select a topic or lesson in science at your grade level.

B. Formulate at least two questions (each) at Levels One, Two, Three and Four (at least eight questions).

C. Formulate one question each at Levels Five, Six and Seven.

Activity Two: Discussion of Question Categories

A. Meet in a small group (three to five people) and discuss any differences of opinions on the question categories that you have chosen.

B. See instructor for final approval.

C. Turn in Answer Sheets for Activity One and Activity Two.

Activity Three: Verbal Communication

A. According to George there are two broad categories of verbal communication.

B. List each, giving examples and the rationale for using it.

Activity Four: Teacher Reactions to Student Responses

A. According to George inquiry discussions involve at least five different types of reactions to responses.

B. List these and give an example of each.

Name _____

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Answer Sheet for Activity One

A. Topic or lesson selected _____

1. Memory level

   a.

   b.

2. Translation level

   a.

   b.

3. Interpretation level

   a.

   b.

4. Application level

   a.

   b.

5. Analysis level

   a.

6. Synthesis level

   a.

7. Evaluation level

Name _____

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Answer Sheet for Activity Two

A. Members of your group:

B. Summary of discussion:

C. Additional comments:

D. Instructor's approval:

Name _____

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Module _____

Answer Sheet for Activity Three

A. One broad category of verbal communication is _____.
Examples and rationale:

B. Another broad category of verbal communication is _____.
Examples and rationale:

Name _____

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Module _____

Answer Sheet for Activity Four

Five different types of teacher reactions to student responses in inquiry discussions are:

1. _____

   Example:

2. _____

   Example:

3. _____

   Example:

4. _____

   Example

5. _____

   Example:

Name _____

Section _____

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POSTTEST FOR QUESTIONING MODULE (Form A)

(Do not write on the test. Mark your answers on the answer sheet provided.)

A. Classify the following questions according to the Sander's categories.

1. Given: Magnets commonly attract objects made of iron and steel. Which of the following are true?

   A magnet can attract any metal.
   A magnet can attract a copper penny.
   A magnet can attract a nail.
   A magnet can attract a rubber band.

   a. Interpretation
   b. Evaluation
   c. Memory
   d. Application

2. Find as many conductors as you can in this room using your battery and bulb materials.

   a. Memory
   b. Translation
   c. Interpretation
   d. Application

3. Does the instructor always have the right answer?

   a. Analysis
   b. Evaluation
   c. Application
   d. Memory

4. Describe this plant by making at least ten observations.

   a. Memory
   b. Application
   c. Evaluation
   d. Interpretation

5. Pick out the picture which shows something you might do in the winter.

   a. Memory
   b. Translation
   c. Synthesis
   d. Application

6. You put hot water into a glass and the glass broke. Why?

   a. Application
   b. Interpretation
   c. Memory
   d. Translation

7. If your best friend were smoking pot, would you turn him in?

   a. Evaluation
   b. Analysis
   c. Application
   d. Translation

8. How can you find out if mealworms have eyes?

   a. Analysis
   b. Synthesis
   c. Translation
   d. Application

9. How could you determine the ideal temperature for a mealworm?

   a. Analysis
   b. Evaluation
   c. Application
   d. Synthesis

10. Do you think that is the best way to test that hypothesis?

    a. Synthesis
    b. Analysis
    c. Evaluation
    d. Translation

11. Carole wants to find out if all babies have blue eyes. She looks at every baby she can find. They all have blue eyes. Carole says that all babies have blue eyes. Explain why Carole's reasoning is sound or unsound.

    a. Evaluation
    b. Translation
    c. Application
    d. Analysis

12. You told us that the stove is hot. How did you arrive at that conclusion?

    a. Evaluation
    b. Analysis
    c. Interpretation
    d. Memory

13. Is a dog a mammal, reptile, bird or insect?

    a. Evaluation
    b. Application
    c. Interpretation
    d. Memory

14. Draw a picture of the say you hooked up the bulb to make it burn.

    a. Translation
    b. Memory
    c. Application
    d. Synthesis

15. How far is it from Earth to the Moon?

    a. Application
    b. Memory
    c. Translation
    d. Interpretation

B. Classify the reactions listed below according to the following categories discussed in George. Mark the letter of the appropriate category before each response.

    a. Accepting
    b. Rejecting
    c. Asking for Clarification
    d. Asking for Evidence
    e. Asking Another Person

16. I'm not sure what you mean. Can you explain it again?

17. Give me three good reasons for your answer.

18. Good answer.

19. Can you explain that further?

20. No, that is not right, Sally,

21. What do you think about Jack's explanation, Sue?

22. Bill, does that make sense to you?

23. Water and oil don't mix, so you can't say that.

24. Yes, magnets attract only those objects which contain iron or steel.

25. How do you know that?

Name _____

Section _____

ELE 340 (431)

POSTTEST FOR QUESTIONING MODULE (Form B)

(Do not write on the test. Mark your answers on the answer sheet provided.)

A. Classify the following questions according to Sander's categories.

1. I have given you three reasons for man to help his fellow man. Are my reasons valid? Why or why not?

   a. Synthesis
   b. Analysis
   c. Evaluation
   d. Application

2. True or false: Air has weight.

   a. Evaluation
   b. Application
   c. Interpretation
   d. Memory

3. What kinds of changes can you suggest to make the pencil better?

   a. Interpretation
   b. Application
   c. Analysis
   d. Synthesis

4. Should everyone wear seat belts?

   a. Application
   b. Translation
   c. Evaluation
   d. Interpretation

5. Devise an experiment to answer your question.

   a. Analysis
   b. Application
   c. Synthesis
   d. Interpretation

6. Tell me how you decided that the mystery powder was sulphur.

   a. Analysis
   b. Translation
   c. Evaluation
   d. Application

7. What is a microscope?

   a. Application
   b. Memory
   c. Translation
   d. Analysis

8. What do we call a substance that turns litmus paper blue?

   a. Memory
   b. Application
   c. Interpretation
   d. Synthesis

9. Can you explain to the class how you arrived at this conclusion?

   a. Analysis
   b. Synthesis
   c. Translation
   d. Application

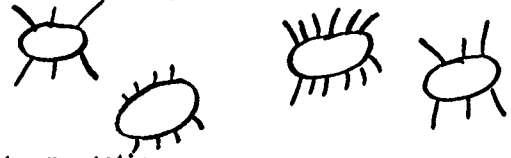
10. You are stranded on a desert isle. List the six most important items you would need for survival.

   a. Analysis
   b. Application
   c. Evaluation
   d. Memory

11. How are the cricket and grasshopper alike?

   a. Memory
   b. Evaluation
   c. Interpretation
   d. Application

12. If it is true that all insects have six (6) legs, then which of the following are insects? (Circle your answers)



   a. Interpretation
   b. Analysis
   c. Translation
   d. Application

13. Put the blue object in the blue bowl.

    a. Interpretation
    b. Analysis
    c. Transiation
    d. Application

14. Draw a picture to show something square.

    a. Analysis
    b. Synthesis
    c. Translation
    d. Memory

15. Which of these objects will be attracted to the magnet?

    a. Memory
    b. Evaluation
    c. Application
    d. Interpretation

B. Classify the reactions listed below according to the following categories discussed in George. Write the letter of the appropriate category before each reaction.

    a. Accepting
    b. Rejecting
    c. Asking for Clarification
    d. Asking for Evidence
    e. Asking Another Person

16. No, but close.

17. I don't understand what you mean.

18. John, do you agree with Bill's answer?

19. That's right, birds do fly.

20. Why do you say that the mystery powder must be baking soda?

21. Who else wants to comment?

22. Why do you say that?

23. Very good, Linda.

24. Can you support that statement?

25. Could you state that more clearly?

Name _____

Section _____

ELE 340 (431)

POSTTEST FOR QUESTIONING MODULE (Form C)

(Do not write on the test. Mark your answers on the answer sheet provided.)

A. Classify the following questions according to Sander's categories.

1. Does the instructor always have the right answer?

   a. Analysis
   b. Evaluation
   c. Application
   d. Memory

2. Pick out the picture which shows something you might do in the winter.

   a. Memory
   b. Translation
   c. Synthesis
   d. Application

3. If your best friend were smoking pot, would you turn him in?

   a. Evaluation
   b. Analysis
   c. Application
   d. Translation

4. Find as many conductors as you can in this room using your battery and bulb materials.

   a. Memory
   b. Translation
   c. Interpretation
   d. Application

5. You put hot water into a glass and the glass broke. Why?

   a. Application
   b. Interpretation
   c. Memory
   d. Translation

6. Carole wants to find out if all babies have blue eyes. She looks at every baby she can find. They all have blue eyes. Carole says that all babies have blue eyes. Explain why Carole's reasoning is sound or unsound.

   a. Evaluation
   b. Translation
   c. Application
   d. Analysis

7. How far is it from Earth to the Moon?

   a. Application
   b. Memory
   c. Translation
   d. Interpretation

8. Given: Magnets commonly attract objects made of iron and steel. Which of the following are true?

   A magnet can attract any metal.
   A magnet can attract a copper penny.
   A magnet can attract a nail.
   A magnet can attract a rubber band.

   a. Interpretation
   b. Evaluation
   c. Memory
   d. Application

9. Describe this plant by making at least ten observations.

   a. Memory
   b. Application
   c. Evaluation
   d. Interpretation

10. Draw a picture of the way you hooked up the bulb to make it burn.

    a. Translation
    b. Memory
    c. Application
    d. Synthesis

11. Do you think that is the best way to test that hypothesis?

    a. Synthesis
    b. Analysis
    c. Evaluation
    d. Translation

12. How can you find out if mealworms have eyes?

    a. Analysis
    b. Synthesis
    c. Translation
    d. Application

13. Is a dog a mammal, reptile, bird or insect?

    a. Evaluation
    b. Application
    c. Interpretation
    d. Memory

14. How could you determine the ideal temperature for a mealworm?

    a. Analysis
    b. Evaluation
    c. Application
    d. Synthesis

15. You told us that the stove is hot. How did you arrive at that conclusion?

    a. Evaluation
    b. Analysis
    c. Interpretation
    d. Memory

B. Classify the reactions listed below according to the following categories discussed in George. Write the letter of the appropriate category before each reaction.

    a. Accepting
    b. Rejecting
    c. Asking for Clarification
    d. Asking for Evidence
    e. Asking Another Person

16. Yes, magnets attract only those objects which contain iron or steel.

17. Give me three good reasons for your answer.

18. Bill, does that make sense to you.

19. Good answer.

(Continued on next page)

20. I'm not sure what you mean. Can you explain it again?

21. Can you explain that further?

22. How do you know that?

23. No, that is not right, Sally.

24. Water and oil don't mix, so you can't say that.

25. What do you think about Jack's explanation, Sue?

Name _____

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POSTTEST FOR QUESTIONING MODULE (Form D)

(Do not write on the test. Mark your answers on the answer sheet provided.)

A. Classify the following questions according to Sander's categories.

1. What kinds of changes can you suggest to make the pencil better?

   a. Interpretation
   b. Application
   c. Analysis
   d. Synthesis

2. Devise an experiment to answer your questions.

   a. Analysis
   b. Application
   c. Synthesis
   d. Interpretation

3. What is a microscope?

   a. Application
   b. Memory
   c. Translation
   d. Analysis

4. True or false: Air has weight?

   a. Evaluation
   b. Application
   c. Interpretation
   d. Memory

5. Tell me how you decided that the mystery powder was sulphur.

   a. Analysis
   b. Translation
   c. Evaluation
   d. Application

6. How are the cricket and grasshopper alike?

   a. Memory
   b. Evaluation
   c. Interpretation
   d. Application

7. Which of these objects will be attracted to the magnet?

   a. Memory
   b. Evaluation
   c. Application
   d. Interpretation

8. I have given you three reasons for man to help his fellow man. Are my reasons valid? Why or why not?

   a. Synthesis
   b. Analysis
   c. Evaluation
   d. Application

9. Should everyone wear seat belts?

   a. Application
   b. Translation
   c. Evaluation
   d. Interpretation

10. Draw a picture to show something square.

   a. Analysis
   b. Synthesis
   c. Translation
   d. Memory

11. You are stranded on a desert isle. List the six most important items you would need for survival.

   a. Analysis
   b. Application
   c. Evaluation
   d. Memory

12. What do we call a substance that turns litmus paper blue?

   a. Memory
   b. Application
   c. Interpretation
   d. Synthesis

13. Put the blue object in the blue bowl.

   a. Interpretation
   b. Analysis
   c. Translation
   d. Application

14. Can you explain to the class how you arrived at that conclusion?

    a. Analysis
    b. Synthesis
    c. Translation
    d. Application

15. If it is true that all insects have six (6) legs, then which of the following are insects? (Circle your answers)

    a. Interpretation
    b. Analysis
    c. Translation
    d. Application

B. Classify the reactions listed below according to the following categories discussed in George. Write the letter of the appropriate category before each reaction.

    a. Accepting
    b. Rejecting
    c. Asking for Clarification
    d. Asking for Evidence
    e. Asking Another Person

16. Can you support that statement?

17. I don't understand what you mean.

18. Why do you say that?

19. John, do you agree with Bill's answer?

20. No, but close.

21. Thats right, birds do fly.

22. Can you state that more clearly.

23. Why do you say that the mystery powder must be baking soda?

24. Very good, Linda.

25. Who else wants to comment?

Science Modules
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ELE 340 (431)

PLANNING MODULE: SHORT-TERM TEACHING STRATEGIES

INTRODUCTION

George (1974) defines a teaching strategy as a planned arrangement of teaching tactics designed to reach an instructional objective. There is no one combination of tactics that works best, but rather the choice and arrangement of tactics depend upon the specific instructional objectives selected.

The ideas of both Piaget and Brunner provide insight or the elementary teacher involved in constructing teaching strategies. Piaget suggests that the learner be kept actively involved and that there must be peer interaction. Brunner makes us aware of three modes of presentation: action, imagery and language.

As a teacher you must first decide on your instructional objectives and on what student behaviors will be taken as evidence for successful attainment of these objectives. Then select an initiating tactic that gets the attention of the students and relates to their past experience. Next, choose focusing tactics which are designed to provide the students with common experience involving data collecting. The third step in constructing an effective teaching strategy employs extending tactics. Have the students process the data and evaluate the concepts generated from the data. To complete the strategy, pull the main ideas together with terminating tactics.

This module is designed to help you construct a short-term teaching strategy utilizing the ideas presented above and the information presented in your text.

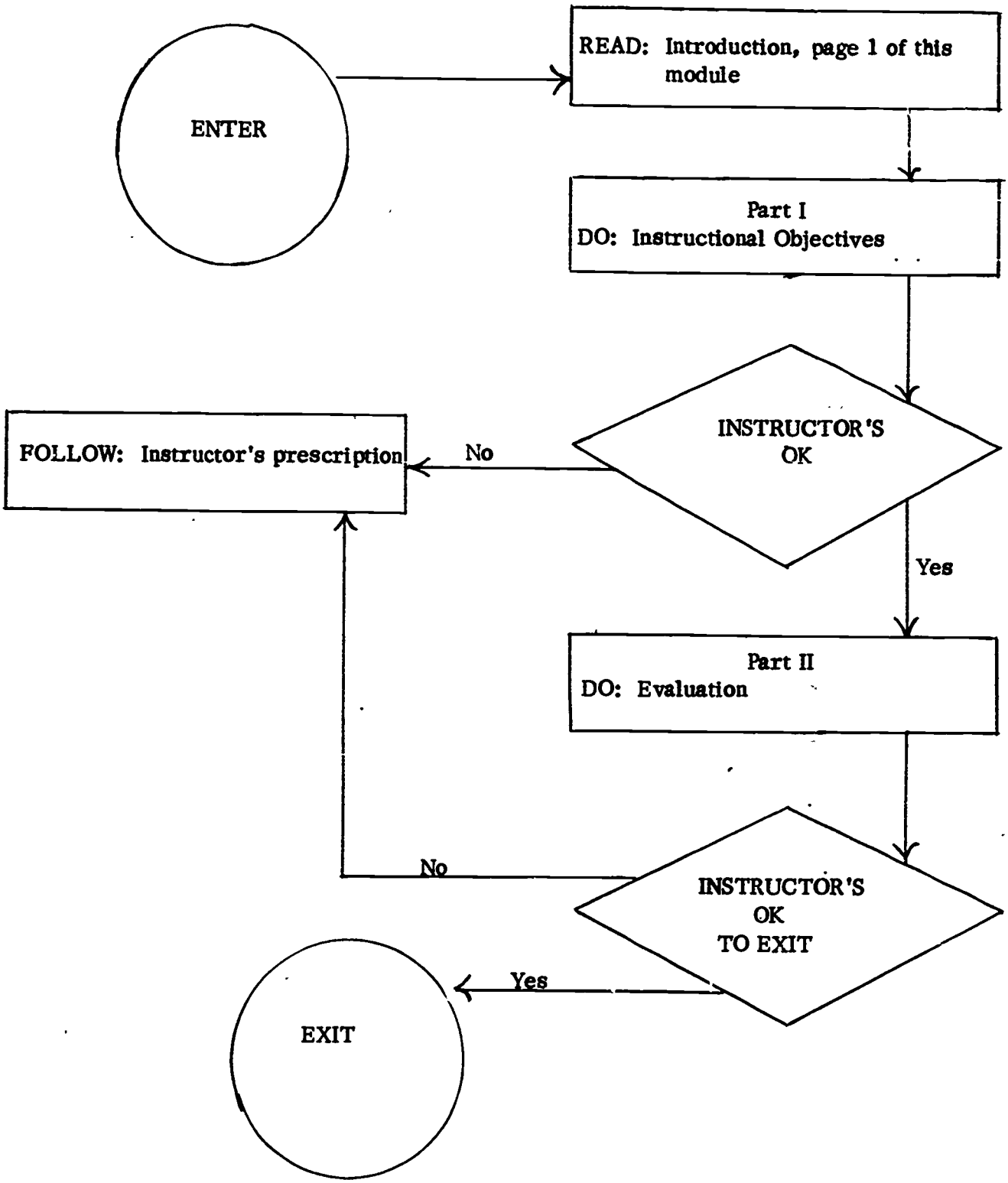
GOAL

You will demonstrate your ability to develop effective short-term strategies for science teaching.

BEHAVIORAL OBJECTIVE

You will select a science topic and make a daily lesson plan which includes instructional objectives, behavioral indicators, and the evaluation to be used.

FLOW CHART: PLANNING MODULE (SHORT TERM TEACHING STRATEGIES)



PART I: INSTRUCTIONAL OBJECTIVES

Activity One: Content Objectives

A. Read George, pages 125-136.

B. Identify an appropriate topic in science for children in one of the following categories:

1. Kindergarten - Grade 1
2. Grades 2-4
3. Grades 5-6
4. Grades 7-8
5. Special Education

C. Formulate at least one lecture-recitation instructional objective and one discovery-oriented objective for the selected topic.

D. List student behaviors for each objective that would indicate these objectives have been met.

Activity Two: Inquiry Skill Objectives

A. Read George, pages 137-150.

B. Formulate at least two inquiry skill instructional objectives for the topic selected in Activity One.

C. List student behaviors for each objective that would indicate these objectives have been met.

Activity Three: Psychomotor Objectives

A. Read George, pages 151-158.

B. Formulate at least two psychomotor instructional objectives for the topic selected in Activity One.

C. List student behavior(s) for each objective that would indicate these objectives have been met.

Activity Four: Affective Objectives

A. Read George, pages 158-161.

B. Formulate at least one affective instructional objective for the topic selected in Activity One.

C. List student behavior that would indicate the objective has been met for each objective you formulate.

PART II: EVALUATION

A. Be sure to get your answers for Activities One through Four checked by your instructor before beginning Part II.

B. Read George, pages 178-196.

C. Design an evaluation task (test) for each of the objectives formulated in Activities One through Four (content, inquiry, psychomotor, and affective). These tasks (tests) should give students the opportunity to demonstrate the specified observable behaviors listed in Activities One through Four.

D. Establish criteria (standards) by which you will judge whether the students have achieved the instructional objectives.

E. Record your answers for this activity in the space provided at the bottom of each answer sheet for Activities One through Four.

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Answer Sheet for Activity One: Content Objectives

Topic:

Grade level:

1. Lecture-recitation instructional objective:

   Student behavior (behavioral objective):

2. Discovery-oriented instructional objective:

   Student behavior (behavioral objective):

Answer Sheet for Part II: Evaluation

(Do not begin Part II until all activities in Part I have been approved)

1. Evaluation task or test for lecture-recitation objective:

   Criteria or standards:

2. Evaluation task or test for discovery-oriented objective:

   Criteria or standards:

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Answer Sheet for Activity Two: Inquiry Skill Objectives

Topic:

Grade level:

1. Inquiry skill instructional objective:

   Student behavior (behavioral objective):

2. Inquiry skill instructive objective:

   Student behavior (behavioral objective)

Answer Sheet for Part II: Evaluation

(Do not begin Part II until all activities in Part I have been approved)

1. Evaluation task or test:

   Criteria or standards:

2. Evaluation task or test:

   Criteria or standards:

Name _____

Section _____

Module _____

Answer Sheet for Activity Three: Psychomotor Objectives

Topic:

Grade level:

1. Psychomotor instructional objective:

   Student behavior (behavioral objective):

2. Psychomotor instructional objective:

   Student behavior (behavioral objective)

Answer Sheet for Part II: Evaluation

(Do not begin Part II until all activities for Part I have been approved.)

1. Evaluation task or test:

   Criteria or standards:

2. Evaluation task or test:

   Criteria or standards:

Name _____

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Answer Sheet for Activity Four: Affective Objectives

Topic:

Grade level:

1. Affective instructional objective:

   Student behavior (behavioral objective):

Answer Sheet for Part II: Evaluation

(Do not begin Part II until all activities for Part I have been approved.)

1. Evaluation task or test:

   Criteria or standards:

POSTTEST FOR PLANNING MODULE: SHORT-TERM STRATEGIES

A. Construct a teaching strategy (a planned arrangement of teaching tactics) relative to the instructional objectives you formulated in Part I of the planning module. Plan lessons approximately 30-45 minutes in length.

B. Construct an evaluation instrument to be used in determining if children have accomplished the objectives selected for your lesson. You may use any of the tasks or tests developed in Part II of the module, and you may add others if you need them.

1. If the instrument is a paper-pencil test:

   a. Include an actual complete copy of test.
   b. Provide the correct answers.
   c. Include criteria (standards) to be used in determing whether objectives have been met. (What percent correct is acceptable to you as evidence that the student has met objectives?)

2. If the instrument is a performance task:

   a. Include a complete description of the procedure to be followed.
   b. Include any written directions necessary.
   c. Include any verbal directions necessary and indicate that they are to be given orally.
   d. Include a check-list or similar instrument which lists criteria to be used in judging the student's performance.

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Answer Sheet for Planning Posttest (Short-term Strategies)

Topic:

Grade level:

Instructional objectives:	Student behavior:
A. Content:	A. Content
1.	1.
2.	2.
B. Inquiry	B. Inquiry
1.	1.
2.	2.
C. Psychomotor	C. Psychomotor
1.	1.
2.	2.
D. Affective	D. Affective
1.	1.

Teaching Strategy:

A. Initiating tactic:

B. Focusing tactic:

C. Extending tactic:

D. Terminating tactic:

Evaluation task or test:

A. Type of evaluation chosen:

B. Brief description:

C. Criteria or standards:

(Note: attach all other information required for your choice of evaluation instrument.)

Science Modules
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PLANNING MODULE: LONG-TERM TEACHING STRATEGIES

INTRODUCTION

One of the most useful long-term teaching strategies available to you as a teacher is the resource unit. A resource unit is a collection of instructional materials and activities organized to develop major understandings on a sizeable topic, such as "Trees in Our Environment," "Weather," "Mexico," "The American Indian," "Using the Senses," etc. In this module you will develop a resource unit for a topic of your choice. Several examples of completed resource units are available for examination from your instructor.

See your instructor for reading material which will provide the background you need to begin planning for your resource unit. Be sure to read this material before you start work on your unit. Also be sure you complete the Suggested Procedures for Organizing a Resource Unit before you begin Part I.

The completed resource unit should contain activities that would be used for a minimum of four (4) weeks. It should be organized according to the outline provided on page 5 of this module. Any deviations from this outline must be cleared with your instructor. Your work should be completely legible, and preferably typed. Proofread your work!

The completed unit must be submitted to your instructor before _____.

The activities in this module consist of formulating first drafts of the components of the resource unit according to the following schedule.

Part I:	Analysis of Content (first draft)	_____
Part II:	Objectives (first draft)	_____
Part III:	Evaluation (first draft)	_____
Part IV:	Complete Resource Unit (final draft)	_____

These activities are to be handed in only once. Your instructor will read the first drafts and make suggestions or comments that can be used in the final draft. Class time will be used for verbal feedback to questions, problems, concerns, etc. that occur while working on the unit. You may also schedule other individual conferences (appointments) with your instructor during regularly scheduled office hours.

Be sure to schedule an individual conference with your instructor when you hand in your completed unit. Conferences will be scheduled on a first come, first serve basis. There will be a sign-up sheet available in your instructor's office for this purpose.

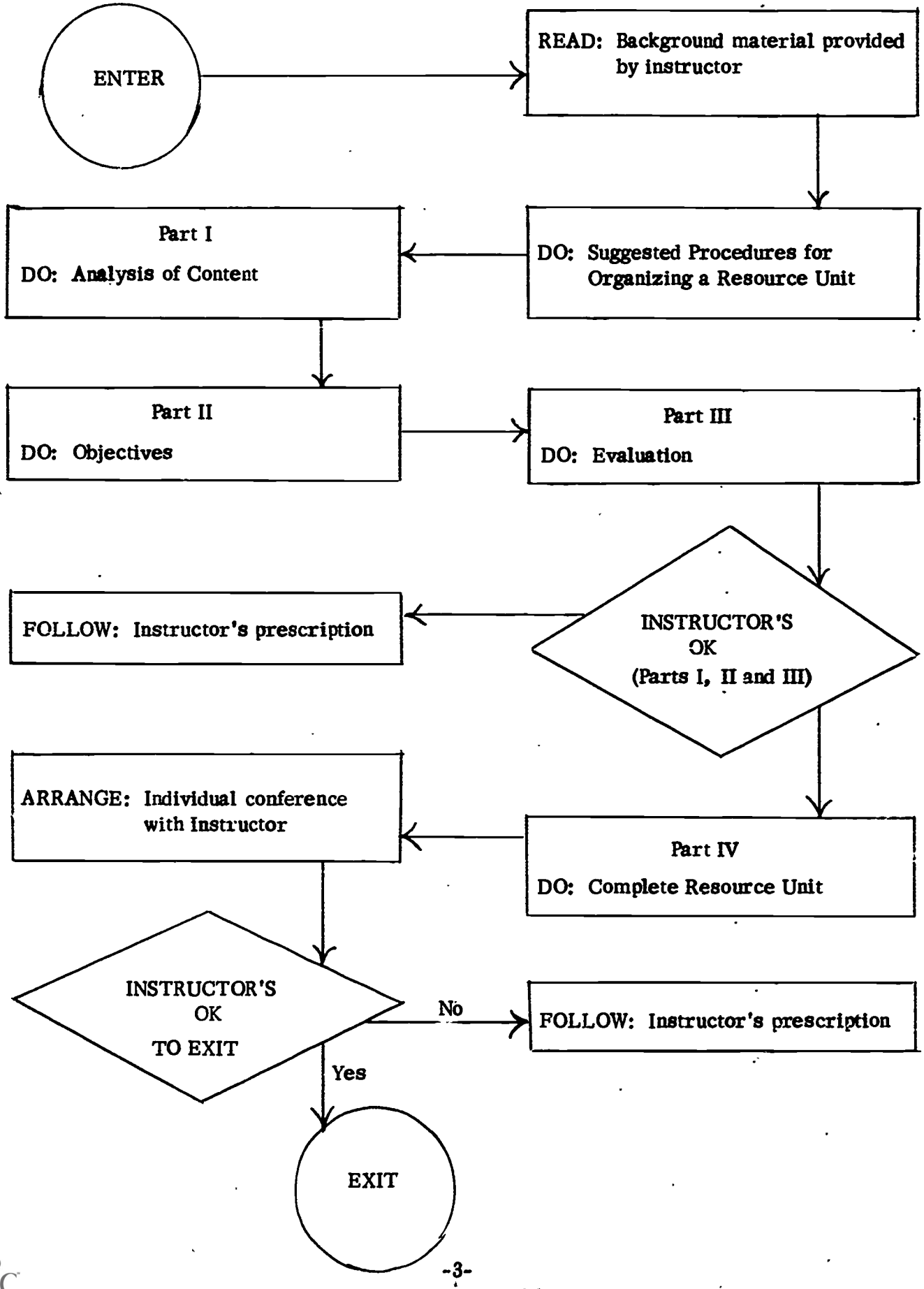
GOAL

You will demonstrate the ability to develop effective long-range strategies for teaching.

BEHAVIORAL OBJECTIVE

You will select a topic and develop a resource unit that could be used with elementary children.

FLOW CHART: LONG-TERM TEACHING STRATEGIES



SUGGESTED PROCEDURES FOR ORGANIZING A RESOURCE UNIT

A. Select an age level and familarize yourself with its characteristics and needs. (Review ideas of Piaget, Brunner, Bloom and others.)

B. Explore content ideas and materials. (Science textbooks are available in IMC.)

C. Select an area or topic suitable for the age level chosen. (Be sure content of topic corresponds to the developmental level of children.)

D. Begin to collect ideas for experiences related to the topic chosen. (Include a variety of possible activities and resources, such as field trips, resource people, films, visual aids, problem-solving activities, experiments, simulation games, role-playing, etc.)

E. Try out the experiences (as far as possible). Take field trips, do experiments, interview resource people, examine or construct visual aids, play simulation games, etc.

F. Consider integrating other subject areas into the unit. (Music, art, dramatics, social studies, math, physical education, etc.)

G. Think of organizing the experiences in terms of initiating, focusing, extending, and terminating activities.

H. Think of ways to evaluate the unit. (Paper-pencil tests/performance tasks)

OUTLINE FOR PREPARING A RESOURCE UNIT

I. Cover Sheet (See example on next page.)

II. Analysis of Content

A. Overview

1. Introduction
2. Rationale

B. Content Outline

III. Objectives

A. Content
B. Inquiry
C. Psychomotor
D. Affective

IV. Learning Experiences (Activities)

A. Initiating
B. Focusing
C. Extending
D. Terminating

V. Evaluation

VI. Instructional Materials (films, visual aids, games, songs, etc.)

VII. Bibliography

A. Children's Books
B. Teacher References

SAMPLE COVER SHEET

MEXICO

A Resource Unit
Designed for Grades Four through Six.
Approximate Duration: 6 weeks

Your Name
ELE 340 Your section
Your Instructor's Name
Date

PART I: ANALYSIS OF CONTENT

Prepare a draft of the items listed below. Use standard 8½ x 11 - inch paper. Odd sizes are not acceptable.

A. Title of unit

B. Grade level

C. Overview (Look at the background reading materials again if you need to.)

1. Introduction to the unit

2. Rationale for teaching the unit

D. Content outline

1. Outline subject matter, scope and sequence. (Be specific.)

2. Example:

Content Outline: Communication

I. Interpersonal Communication
   A. Group dynamics
   B. One-to-one
      1. Listening and speaking

II. Communication and the Mass Media
   A. Television
      1. News around the world

E. Submit Part I to your instructor and proceed to Part II.

PART II: OBJECTIVES

Prepare a draft of your objectives for the unit. They must be specific. Generalities will not be accepted. They must all be written in behavioral terms. Remember: Use standard 8½ x 11 - inch paper.

A. Content objectives

1. The factual material that you want the student to learn (See samples.)

2. The child will:

   a. State that Mexican clothing is different from ours
   b. Distinguish between Mexican "everyday" clothing and "festive" clothing
   c. Explain how the climate in Mexico is different from ours
   d. Define a fiesta.

B. Inquiry objectives

1. Objectives involving the process skills (See samples)

2. The child will:

   a. Compare the weights of two white rats
   b. Infer how diet influences growth in white rats
   c. List observations of changes in appearance of two white rats on different diets for seven diets.

C. Psychomotor objectives

1. The manipulative skills that you expect the child to develop (See samples)

2. The child will:

   a. Increase his manual dexterity by constructing an "Ojo de Dios".
   b. Draw an outline map of Mexico and locate Mexico City, Cuernavaca, Acapulco, Tampico and Veracruz.

D. Affective objectives

1. Objectives which deal with attitudes, interests, values, and feelings of the child (See samples)

2. The child will demonstrate his appreciation of the importance of preserving the natural environment by

   a. Participating in a river bank clean-up day
   b. Writing a composition on "What I Can Do to Fight Pollution"
   c. Creating an original anti-litter poster.

E. Submit Part II to your instructor and proceed to Part III.

PART III: EVALUATION

Describe the evaluation techniques which could be used with your unit. Include a brief example of each technique. (See samples below.) Remember to use standard size paper.

A. Paper-Pencil test (true-false type): This test would include information from the content objectives. Twenty true-false questions will be given. The child must answer at least 15 correctly. Sample questions follow.

T F 1. Mexico is a long way from Michigan.

T F 2. All Mexicans are rich.

T F 3. Spanish is the national language of Mexico.

T F 4. Mexico is in South America.

B. Performance task (informal observation): The teacher will observe the student to see if the following is performed:

a. The student can construct a simple balance scale from materials provided.
b. The student can locate the paint on a graph which indicate the heaviest weights recorded for each white rat for seven days.
c. The student can verbally describe the difference in the appearance of two rats who have been fed different diets for seven days.

C. Submit Part III to your instructor. Be sure you have approval of Parts I, II and III before you go on to Part IV (the completed unit).

PART IV: COMPLETE RESOURCE UNIT

Complete the final draft of your resource unit by combining Parts I, II and III of this module with the other elements of the unit listed in the outline (learning experiences, instructional materials and bibliography).

A. Be sure your unit is organized according to the outline on page 5 of this module.

B. Be sure to arrange an individual conference with your instructor to discuss your unit at the time you hand it in.

C. Hand in the completed unit by _____.