CHAPTER TWO OUTLINE WITH NOTES
Goals and Objectives for K-8 Science

Chapter Objectives: Upon completion of this chapter, your students should be able to
1. Distinguish among the terms aims, goals, and objectives, describing their relationship to aligned curriculum and authentic assessment.
2. Identify and describe six broad goals for K-8 science.
3. Describe the meaning of scientific literacy.
4. Differentiate between processes of science and the products of science.
5. Distinguish each of the following terms as used in science, giving an example of each: fact, concept, principle, theory, hypothesis, and conclusion, model.
6. Describe the meaning and value of self-reflection.
7. Differentiate between science and technology, and describe their interrelatedness.
8. Distinguish between overt and covert performance outcomes
9. Demonstrate an ability to prepare learning objectives for the three domains of learning.
10. Demonstrate an understanding of the relationship between Bloom's taxonomy of cognitive objectives with levels of thinking and doing.

GOALS FOR K-8 SCIENCE
To Become Scientifically Literate
Terms That Are Basic to Understanding Science and Attaining the Goal of Scientific Literacy
Fact
Concept
Principle (or generalization or law)
Theory and hypothesis

Note **2-1:** See our note on page 19, right hand column, about "wild" versus "educated" guesses and their relationship to hypothesizing.
Conclusion
Model

Note **2-2:** I encourage you to spend a bit of time with your students discussing the concept (page 20, midpage, left column) that says, "natural phenomena do not always fit textbook definitions. Sometimes the distinctions between hypotheses, theories, and models are obscure."

Note **2-3:** See R. Frazier, "Rethinking Models," Science and Children 40(4):29-33 (January 2003).
Self-reflection
Scientifically literate
To Solve Problems by Thinking Critically and Creatively

Note **2-4**: Note the statement (page 20, midpage, right column) "creative problem solving must allow for serendipity and intuitive thought." A useful discussion with your students might revolve around how can a teacher manage a classroom while still encouraging spontaneous discovery.
To Understand Our Environment and the Problems of Preserving It and Making It Better
To Understand How Science, Technology, and Society Are Inextricably Interconnected

To Live Successfully and Productively in a Constantly Changing World
To Grow Intellectually, Emotionally, and Socially According to Individual Abilities, Interests, and Needs

OBJECTIVES FOR K-8 SCIENCE
AIMS, GOALS, AND OBJECTIVES AND THEIR ROLES IN PLANNING FOR SCIENCE INSTRUCTION
Learning Targets and Goal Indicators

Note **2-5:** On page 23**,** midpage of left column, we speak of *mastery learning.* That may also be called *quality learning.*
Overt and Covert Performance Objectives
Balance of Behaviorism and Constructivism
Teaching Toward Multiple Objectives, Understandings, and Appreciations
PREPARING INSTRUCTIONAL OBJECTIVES
Components: The ABCDs of Writing Objectives

Note **2-6:** Some preservice teachers have difficulty learning to write objectives in measurable behavioral terms. One reason for that difficulty is when their focus is on the choice of verb rather than first answering the question, "What is it that I want the student to be able to do as a result of the instruction." An objective is easier to write when that question is answered before dealing with the selection of an appropriate verb.
Classification of Learning Objectives

Note **2-7**: It is important that your students realize they need not try and include all domains and hierarchies in every lesson, lest they spend an inordinate amount of time, and experience an unnecessary amount of frustration trying to do just that.
The Domains of Learning and the Developmental Needs of Children

Note **2-8:** Please note footnote 10, bottom of page 26.
Using the Taxonomies
LEARNING THAT IS NOT IMMEDIATELY OBSERVABLE

Note **2-9:** There are within the affective domain important learning objectives that are *so* difficult and time-consuming to write in behavioral terms that it may not be worth the teacher's time to do so. It may be that some of the most important objectives are those in the affective domain and a teacher may not have the time needed to measure the true long-term learning effects upon the children. Perhaps, For students in a program of teacher preparation, we sometimes tend to belabor the point of learning objectives, when really what our students need to know is the importance of identifying what it is they want their students to be able to do, to teach towards that, and to accurately and continuously assess for it. That knowledge helps them to organize their instruction, to make it clearly and neatly packaged, understandable to them, to their students in turn, and to others, and the resulting learning of their students is easily observed and measured. However, it is not the entire "ball of wax," or shouldn't be.

SUMMARY
QUESTIONS FOR CLASS DISCUSSION
SUGGESTED READINGS

Note **2-10**: The exercise that follows in this manual, as a transparency master, is provided for you to administer to your students so they can self-assess their comprehension of the meaning of a measurable learning objective. The answer key is:
Items 1,3,7, and 10 are inadequate because of their ambiguity.
Item 3 is not even a student-learning objective; it is a teacher goal. "To develop" and "to know" can have too many interpretations.
Items 2,4,5, 6, 8, and 9 are clearly measurable. The teacher would have no difficulty recognizing when a learner had reached those objectives.

Note 2-10

RECOGNIZING MEASURABLE LEARNING OBJECTIVES

Instructions: Although "audience," "conditions," or "performance levels" may be absent, ask yourself, "As stated, is this a student-centered and measurable objective?" If it is, place an X in the blank provided.

1 . To develop an appreciation for science.

2. To identify those celestial bodies that are known planets.

3. To provide meaningful exploratory experiences for the children.

4 . To predict whether the flower is self-pollinating.

5. To recognize an environment that is damaged from acid rain.

6. To analyze and compare patters of data on specific quartile maps.

7. To develop skills in inquiry.

8. To identify the mountain as being either a folded mountain or a fault-block mountain.

9. To use maps and charts to identify and calculate in square kilometers areas of remaining world rain forests.

10. To know causes for the variations in atmospheric ozone concentration.

Victor, Kellough, and Tai
Science K-8: ***An Integrated Approach***

CHAPTER TWO EXAMINATION QUESTIONS

I. Multiple choice

1. Which one of the following behaviors is covert?
(a) will read
(b) will write
(b) will know
(d) will measure

2. "The teacher will contrast problem solving from true inquiry" is an example of
(a) a simple attitudinal objective
(b) an objective at the highest level of the cognitive domain
(c)a criterion-referenced objective within the cognitive domain
(d) a simple objective at the application level of the cognitive domain

3. Which one of the following terms is the same as the others?
(a) performance-based education
(b) competency-based education
(c) outcome-based education
(d) results-driven education
(e) mastery learning

4. Which one of the following contains an overt behavior that could be included in a measurable learning outcome?
(a) think critically about the similarities and differences between respiration and photosynthesis
(b) appreciate the similarities and differences between t respiration and photosynthesis
(c) understand the similarities and differences between respiration and photosynthesis
(d) explain the similarities and differences between respiration and photosynthesis
(e) none of the answers provided

5. Statements that describe what the student will be able to do upon completion of an instructional experience are called -.
(a) course goals
(b) instructor goals
(c) covert objectives
(d) instructional objectives
(e) none of the above

6. When writing instructional objectives, the anticipate, measurable student performance is the part of the objective referred to as the -.
(a) audience
(b) target behavior
(c) performance level
(d)observable conditions

7. When writing overt objectives, from the following, which is the only acceptable verb?
(a) know

(b) apply
(c) appreciate
(d) understand
(e) none is acceptable

8. Of the following, which is at the highest level of the cognitive domain?
(a) analysis
(b) evaluation
(c) application
(d) knowledge

9. According to the classification system presented in the text, which of the following is at the highest level of the psychomotor domain?
(a) recall
(b) create
(c) movement
(d) manipulate
(e) communicate

10. According to the classification system presented in the text, which of the following is at the highest level of the affective domain?
(a) recalling information
(b) responding to an issue
(c) demonstrating awareness
(d) showing behaviors that demonstrate the internalization of values

11. From the following, which one is the most acceptable performance term for use in writing an overt objective?
(a) know
(b) translate
(c) appreciate
(d) fully understand

12. In science, a *fact* is
(a) an abstraction that organizes the world of objects and events into a smaller number of categories
(b) directly observable and can be readily demonstrated
(c) any event involving two or more concepts
(d) the same as a conclusion

13. In the ABCDs of writing behavioral objectives, the D represents .
(a) delivery
(b) students
(c) authentic
(d) performance level

14. Which of the following sets of behaviors are at the highest level within the cognitive domain?
(a) match, list, define
(b) show, predict, use
(c) rank, assess, argue
(d) describe, infer, explain
(e) none of the provided answers is completely correct

15. Development of acceptable values and ethics is at the highest level of the domain
(a) affective
(b) cognitive
(c) psychomotor
(d) none of these
(e) any of these

16. In science education, which one of the following is least like the others?
(a) law
(b) concept
(c) principle
(d) generalization

17. The national curriculum standards
(a) have been in existence in the United States since 1960
(b) have been developed only for mathematics, science, and technology education
(c) represent a mandated national curriculum defining what students should know and be able to do
(d) represent the best thinking of panels of experts about the essential elements of a basic core of subject knowledge that all students should acquire

18. In meaning, which one of the following is least like the others?
(a) law
(b) concept
(c) principle
(d) generalization

19. A curriculum that is aligned is one that is centered on the following three components:
(a) objectives, students, and instructional strategies
(b) objectives, instruction, and assessment
(c) students, teachers, and administrators
(d) goals, aims, and objectives

20. Which one of the following statements is an accurate statement?
(a) The terms goals and objectives are synonymous.
(b) An observable change in the behavior of a learner is indicative that learning has occurred.
(c) If a teacher attends to the students' cognitive learning, then their affective learning will naturally occur .

(d) The terms learning target, behavioral objective, instructional objective, and performance objective are synonymous.

II. True/False with optional explanation

1. State department of education curriculum frameworks influence the development of textbooks and other curriculum materials used in the public schools.

2. Understanding and appreciation are examples of overt behaviors.

3. By definition, curriculum is content, while instruction is methods.

4. A student teacher should avoid the discussion of controversial issues in the classroom

5. What is a hypothesis could stem from either a "wild guess" or from an "educated guess."

6. Assessment of student learning is easier when the desired performance is overt rather than when it is covert.

7. The domain that principally involves feelings and attitudes is the *cognitive* domain

8. A complete instructional objective includes a description of learning activities.

9. The terms *goals* and *objectives* can correctly be used interchangeably.

10. The following objective is an example within the psychomotor domain: "The student will name the classes that make up the phylum Arthropoda."

11. The following objective is an example within the highest level of the cognitive domain: "The student will write a critical appraisal of the statement that cellular respiration is the opposite of photosynthesis. "

12. Instructional objectives that are written in behavioral terms are inappropriate for today's constructivist classroom.

13. Behavioral objectives are well suited for use in results-drive educational settings.

14. A criterion in an instructional objective defines what will be considered "correct" performance by the students.

15. A teacher should prepare instructional objectives, teach toward those objectives, and then assess student learning against those same objectives.

16. To be most competent, a teacher need not plan for the individual differences among the students, but simply teach the subject matter.

17. Teacher goals are different from target objectives.

18. State curriculum frameworks influence the development of textbooks and other curriculum materials used by schools to determine the science curriculum.

19. What is known as "cell theory" is not really a theory but a hypothesis.

20. One way of distinguishing science from technology is the consideration that while science is concerned with "what is," technology is concerned more with "how to."

III. Essay
1. Identify two academic reasons for using overt objectives in your teaching. Describe when, if ever, is it okay for a teacher to use student learning objectives that are not written in overt terms?

2. For a specific science topic and for a specific grade level, write a *complete* behavioral objective for the cognitive domain.

3. For a specific science topic and for a specific grade level, write a *complete* behavioral objective for the affective domain.

4. Describe the meaning of "mastery learning." Describe the status of the use of mastery learning today. Why is it used, or why is it not use more than it is?

5. Clearly support an argument for or against the following statement: It is not important that the teacher write an overt objective for every intended learning outcome.

6. Identify the skills demonstrated by a student when he or she is doing higher order thinking.

7. Explain whether it is possible for a student to do hands-on learning without it being minds-on learning as well.

8. Explain how it can be that what for one student represents low-order thinking for another might be high-order thinking.

9. Are all instructional outcomes immediately observable? Explain why or why not.

10. The objectives of K-8 science programs fall into three broad areas. Two of these are (1) and understanding of science concepts and (2) development of skills in the processes of science. Describe the third area.

Chapter 2 Key

I. Multiple choice
1. c
2. d
3. e
4. d
5. d
6. b
7. b
8. b
9. b
10. d
11. b
12. b
13. d
14. c
15. a
16. b
17. d
18. b
19. b
20. d

II. True/False
1. True
2. False
3. True
4. False
5. True
6. False
7. False
8. False
9. False
10. False
71. True
12. False
13. True
14. True
15. True
16. False
17. True
18. True
19. False
20. True

III. Essay

1. They provide direction for one's teaching; they provide clear statements to the students as what it is they will be expected to do as a result of the learning experience; they provide clear statements from which evaluative items may be written. The second part of the question allows for divergence but the response should be clear and persuasive.

2. Answers should include the four ingredients-audience, behavior in measurable terms, conditions, and performance level.

3. Answers should include the four ingredients-audience, behavior in measurable terms, conditions, and performance level.

4. Answer should include that the lesson is taught until the student(s) achieves an 85-100 percent performance level.

5. Answers will vary but should represent knowledge, critical thinking, and skillful written expression.

6. The student is analyzing, synthesizing, and evaluating data

7. Answers will vary but should represent knowledge, critical thinking, and skillful written expression.

8. Whereas one student may "know it" (be able to recall), the other may need to figure it out by deduction.

9. No. Reasons will vary but should indicate that real learning, learning that is most meaningful, can extend beyond that which is immediately measurable or observed.

10. The area of attitudes, appreciations, and values.