Notes

I. Concept Formation in Young Children
   a. Children try very hard to explain the world about them
      i. Use their sense or intuition to make judgments
      ii. Logic is unpredictable, and they frequently prefer to use “magical explanations” to explain what is happening in their world
      iii. Comments often have a self-centered view
      iv. Have a difficult time remembering more than one thing at a time
      v. The child brings meaning to the world, not vice versa
      vi. Misconceptions of a child are normal
   b. Temptation to try to move children out of their magical stage of development
      i. This is a mistake
      ii. Although some misconceptions can be corrected, others have to wait for more advanced thinking to develop
      iii. Students cannot be pushed, pulled, or dragged through developmental stages
         1. Goal instead is to support the development of young children at their present level of operation
   c. Enhancing awareness
      i. When teaching concepts that are too abstract for children to fully understand, try to focus on aspects of the concept that can be understood
      ii. Can be enhanced by the use of:
         1. Visual descriptions
            a. Understanding about weather can be developed by recording the types of weather that occur in a month
               i. Construct a large calendar on which children can draw a picture representing the weather for that day
               ii. At the end of the month, cut it into individual days and use them to create a bar graph based on the type of weather
               iii. Ask the children to form conclusions about the month’s weather from the graph
            b. Children will be better prepared for later studies of nutrition if they have some understanding of their own food intake
               i. Graphing favorite foods is a way for children to visually compare and organize what they eat
               ii. Mount pictures from the five basic food groups in columns and discuss which group children’s favorite foods belong in
                  1. Discuss healthy foods and make a new chart at the end of the week and see if there is a difference in choices
2. Observing
   a. Observations should be:
      i. Done in ten minutes or less
      ii. Conducted with a purpose
      iii. Brought together by discussions
   b. Unconnected observations do not aid in concept formation
   c. Discussions that follow observations heighten a child's awareness of that observation
   d. Differences of opinion about observations stimulate interest and promote discussion
3. Drawing
   a. Can provide excellent opportunities for observation and discussion
   b. Effective use of drawing to enhance concept development would be to have children draw a tiger from memory before going to the zoo
      i. After visiting the zoo, have the children draw a tiger and compare it with the one drawn before the field trip
4. Discussion
   a. Should focus on the similarities and differences between the two drawings
   d. Teacher magic and misconceptions
      i. Children need time to reflect and absorb ideas to fully understand a concept
         1. Give children plenty of time to manipulate and explore
         2. Children cannot carry out most operations mentally, so they need to manipulate materials to develop concepts
         3. Teachers can enhance a child's understanding by making comments or asking questions that draw attention to a particular area
      ii. Misconceptions can occur at any stage of development
         1. Some children in the primary grades may be in a transitional stage or have moved into the concrete operation stage of development
            a. Although these students will be able to do much logical thinking, the concepts they work with must still be tied to concrete objects that they can manipulate
            b. Firsthand experiences with materials continue to be essential for learning
         iii. Child in this developmental stage no longer looks at the world through "magical eyes"
            1. Explanations for natural events are influenced by other natural objects and events
            2. Do not be misled in apparent new awareness
a. Major factor in concept development is still contingent upon children’s need to manipulate, observe, discuss, and visually depict things to understand what is new and different about them

II. Self-Regulation and Concept Attainment
   a. Self-regulation occurs when your brain responds to interactions between you and your environment
      i. Described by Gallagher and Reid as the active mental process of forming concepts
      ii. As children move through the world and encounter new objects and phenomena, they assimilate and accommodate new information and store it in the correctly labeled mental category in their minds
      iii. Lind describes the brain as functioning like a postal worker, naturally classifying and storing information in the appropriate pigeonholes
         1. New information is always stored close to all of the related information that has been previously stored
         2. Grouping of closely related facts and phenomena related to a concept is called a cognitive structure or schema
   b. Our understanding of the world is imperfect because, sooner or later, there is some point at which true understanding ends and misconceptions exist but go unquestioned
      i. This is because incorrect interpretations of the world are stored alongside correct ones
   c. Point can be reached where new information conflicts with older information stored in a given cognitive structure
      i. When children realize that they do not understand something they previously thought they understood, they are said to be in what Piaget calls a state of disequilibrium
      ii. This is a teachable moment
         1. When children are perplexed, their minds will not rest until they can find some way to make the new information fit
         2. Because existing structures are inadequate to accommodate all of the existing information, they must continually modify or replace it with new cognitive structures
         3. When in this state, children actively seek out additional information to create the new structure
            a. They:
               i. Ask probing questions
               ii. Observe closely
               iii. Inquire independently into the materials at hand
            b. In this state, they are highly motivated and very receptive to learning
         4. When children have had enough information to satisfy their curiosity and to create a new cognitive structure that explains most or all of the facts, they return to a state of equilibrium, where everything appears to fit together
a. As children move from disequilibrium to equilibrium, two mental activities take place:
   i. Assimilation
      1. When confronted with something they don’t understand, children fit it into a scheme (something they already know)
   ii. Accommodation
      1. Children modify the scheme or create a new scheme because the existing scheme does not fit with the new information

d. To make use of the process of self-regulation in your classroom, find out at what point your students misunderstand or are unfamiliar with the topic you are teaching
   i. Can be done in a number of ways
      1. Refer to the assessment units in the textbook
      2. Listen to children’s responses to a lesson or question
      3. Ask the children to describe their understanding of a concept

III. Discrepant Events
a. A discrepant event puts students in disequilibrium and prepares them for learning
   i. Recommended that you take advantage of the natural learning process to teach children what you want them to understand

IV. Using the Learning Cycle to Build Concepts
a. You can assist your students in creating new cognitive structures by designing learning experiences in a manner congruent with how children learn naturally
b. Learning cycle is based upon the cycle of equilibration originally described by Piaget
   i. Combines aspects of naturalistic, informal, and structured activity methods into a method of presenting a lesson

c. Learning begins with a period of free exploration
   i. During the exploration phase, the children’s prior knowledge can be assessed
      1. Teacher can assess inquiry skills and gain clues to what the children know about a science concept as they explore the materials
      2. Any misconceptions the children may have are often revealed during this phase
      3. Exploration can be as simple as giving students the materials to be used in a day’s activity at the beginning of a lesson so they can play with them for a few minutes
         a. Minimal or no instructions should be given other than those related to safety, breaking the materials, or logistics in getting the materials
      4. By letting students manipulate the materials, they will explore and very likely discover something they did not know before or
something other than what they expected to happen

ii. Concept development phase
   1. Provides for accommodation

iii. Concept application phase
   1. Expands the concept
   2. Strategies for retaining the new concept are provided

V. Using Part of the Learning Cycle to Build Concepts
   a. Not desirable to teach all lessons with the entire learning cycle
   b. At times, exploration and observation might be the full lesson
      i. Giving students an opportunity to practice their skills of observation is
         often sufficient for them to learn a great deal about unfamiliar objects
         or phenomena
   c. Some lessons can be improved by having children do more than just
      observing and exploring
      i. These exploration lessons include data collection as an instructional
         focus
      ii. Data collection and interpretation are important to real science and real
         problem solving
         1. Although firsthand observation will always be important, most
            breakthroughs in science are made in the analysis of carefully
            collected data
         2. Scientists usually spend much more time searching through
            stacks of data than peering down the barrel of a microscope or
            through a telescope
      iii. Data collection for young children is somewhat more abstract than
           firsthand observation.
           1. Important that students have sufficient practice in making
              predictions, speculations, and guesses with firsthand
              observations before they begin to collect and interpret data
           2. Young students can benefit from early experience in data
              collection and interpretation
           3. Initial data collections are usually pictorial in form
           4. Long-term patterns and changes that children cannot easily
              observe in one setting are excellent beginnings for data
              collection
   d. Another technique for designing science lessons is to allow students to have
      input into the process of problem solving and designing investigations
      i. Might be called a concept introduction lesson because it utilizes the
         concept introduction phase of the learning cycle as the basis for a
         lesson
      ii. Although initial investigation and problem-solving experiences may be
          teacher designed, students eventually will be able to contribute to
          planning their own investigations
      iii. Most students probably will not be able to choose a topic and plan the
          entire investigation independently until they reach the intermediate
          grades, but their input into the process of planning gives them some
ownership of the lesson and increases their confidence to explore ideas more fully
iv. When solving real problems, identifying the problem is often more critical than the skills of attacking it
v. Students need practice in both aspects of problem solving

VI. Strategies that Encourage Inquiry
a. National Science Education Standards suggest the following strategies to engage students in the active search for knowledge:
   i. Ask a question about objects, organisms, and events in the environment
   ii. Plan and conduct a simple investigation
   iii. Employ simple equipment and tools to gather data and extend the senses
   iv. Use data to construct a reasonable explanation
   v. Communicate investigations and explanations
b. Natural inquiry of young children can be seen as they observe, group, sort, and order objects
   i. By incorporating familiar teaching strategies such as providing a variety of objects for children to manipulate and talking to children as they go about what they are doing with objects, teachers can help children to learn more about their world
   ii. Children can also learn about their world through observations and discussions about those observations
   iii. When opportunities are provided for children to work individually to construct their own knowledge, they will gain experiences in organizing data and understanding processes
   iv. Variety of activities that let children use all of their senses should be offered
      1. Allows children to explore at their own pace and to self-regulate their experiences

c. Assessing inquiry learning
   i. Observation is vital for the teacher as she assesses children’s progress
      1. Essential that the teacher watch carefully as the children group and order materials
          a. Clues to children’s thinking can be gained by watching what children do and having them explain what they are doing to each other or to you