Notes

I. Naturalistic Experiences
   a. Those experiences initiated spontaneously by children as they go about their daily activities
   b. Major mode of learning for children during the sensorimotor period
      i. Can also be a valuable mode of learning for older children
   c. Adult’s role is to provide an interesting and rich environment
      i. Should be many things for the child to look at, touch, taste, smell, and hear
      ii. Adult should observe the child’s activity and not how it is progressing and then respond with a glance, a nod, a smile, a verbal description of the child’s actions or elaboration of the child’s comments, or a word of praise to encourage the child

II. Informal Learning Experiences
   a. Experiences initiated by the adult as the child is engaged in a naturalistic experience
   b. Not preplanned for a specific time
      i. Occur when the adult’s experience and/or intuition indicates it is time to scaffold

III. Structured Learning Experiences
   a. Preplanned lessons or activities
   b. Can be done with individuals or small or large groups at a special time or an opportune time
   c. May follow the learning cycle sequence or be more focused direct instruction

IV. Types of Questions
   a. Extremely important to ask many different types of questions
      i. Divergent questions and directions
         1. Do not have one right answer
         2. Provide an opportunity for creativity, guessing, and experimenting
         3. Includes questions that begin with:
            a. Tell me about…
            b. What do you think…?
            c. What have you found out…?
            d. What can we do with…?
            e. Can you find a way to…?
            f. What would happen if…?
            g. Why do you think…?
         4. Also includes directions such as:
            a. You can examine these…
            b. You may play with these…
      ii. Convergent questions and directions
         1. Ask for a specific response or activity
         2. There is a specific piece of information called for
         3. Adults often ask only convergent questions and give convergent
b. Important to remember that children need time to construct their ideas
   i. Divergent questions and directions encourage them to think and act for themselves
   ii. Convergent questions and directions can provide the adult with specific information regarding what the child knows, but too many of these questions tend to make the child think that there might be only one right answer to all problems
       1. Can squelch creativity and the willingness to guess and experiment
   iii. By varying the difficulty of the questions asked, the teacher can reach children of different ability levels

V. Learning Styles
   a. Important to consider individual and culturally determined styles of learning
   b. May relate to:
      i. Modalities such as auditory, visual, kinesthetic, or multisensory preferences
      ii. Temperamental characteristics such as the easygoing, serious student or the easily frustrated student
      iii. Strengths in particular areas such as those identified by Howard Gardner in his theory of multiple intelligences
          1. Originally identified seven intelligences:
             a. Linguistic
             b. Logical-mathematical
             c. Bodily-kinesthetic
             d. Interpersonal
             e. Intrapersonal
             f. Musical
             g. Spatial
          2. Recently added two more intelligences:
             a. Naturalist
             b. Existential
          3. Gardener conceptualizes these nine intelligences as combined biological and psychological potentials to process information that can be used in a culture to solve problems or create products that are valuable to the culture
          4. Important to provide children with opportunities to solve problems using their strongest modalities and areas of intelligence
          5. The variety of learning styles can be reached by integrating the various areas of the curriculum rather than teaching each area as separate topics
   c. Also important to consider diversity in:
      i. Race
      ii. Ethnicity
      iii. Social class
iv. Gender
v. Out-of-school experiences
vi. Special needs
d. Reform classroom is itself a culture different from the traditional classroom
   i. Reform movement is progressing from a linear, formal view of the teacher passing out knowledge to passive students to a setting where mathematics is constructed, discussed, and questioned by active students
   ii. Developing this type of classroom is not easy
       1. Requires the teacher to be tuned into each student’s learning style and abilities
       2. Increasingly, reform mathematics is being criticized as “fuzzy math”
   iii. There is a movement toward again emphasizing basic drills and memorization
       1. There is a need to provide balanced instruction that provides for memorization and understanding

e. Many fundamental concepts in mathematics and science are learned before the child enters school
   i. For example, ethnomathematics refers to mathematics learned outside of school
       1. This type of mathematics is embedded in the out-of-school cultural activities whose primary purpose is not mathematics but to accomplish a culturally relevant task
       2. Each culture has its own way of doing tasks such as:
          a. Counting out equal shares
          b. Setting the table
          c. Calculating a recipe
          d. Exchanging money
          e. Measuring one’s height or weight
       3. Problem teachers face is how to capitalize on what children learn outside of school considering that some of these tasks may apply mathematics differently than it is used in the classroom
          a. Teachers must learn about the everyday lives of their students and how mathematics concepts may be applied on a day-to-day basis
          b. To connect out-of-school to in-school experiences, mathematics and science in school should be introduced by providing students with problems based on everyday experiences
             i. Teachers can then observe as students construct solutions based on their out-of-school life experiences
             ii. Once students have developed their own strategies, the conventional strategies or
algorithms and formulas can be introduced as an alternative means of problem solution

f. Teachers need to be responsive to the diverse cultural values and experiences of their students in order to identify each individual’s ZPD and build from where the children are operating independently to where their capabilities can take them with appropriate scaffolding
   i. Multicultural education should permeate the whole curriculum
   ii. Practice should be both developmentally and culturally appropriate
   iii. Across cultures children develop in the same sequence physically, socially, and intellectually but experience varied cultural experiences within their environments
      1. Child-rearing practices and environmental variation provide the content of children’s knowledge and views of the world
      2. Behavior that is considered normal within a particular culture may be viewed as unacceptable by a teacher from another culture
      3. Teachers need to study the cultures of their students before making any behavioral decisions

g. Equity also needs to be considered in relation to socioeconomic status
   i. Children from lower socioeconomic status (SES) homes lack important mathematics concepts according to research

h. Children with special needs
   i. Includes children who are gifted and those with learning disabilities
      1. Gifted students can be provided with enrichment experiences that go beyond numeracy and into probability, problem solving, geometry, and measurement
      2. Children with disabilities may have any one or a combination of problems in:
         a. Memory, visual or auditory perception
         b. Discrimination deficits
         c. Abstract reasoning difficulties
         d. Other difficulties that intrude on learning
   ii. Different approaches must be taken with each type of learner
      1. Cooperative learning groups can be effective
      2. Clements and Sarama cite studies that indicate that computer activities can be very helpful in increasing all young children’s mathematics skills and understanding
   iii. Geary states that math anxiety results from a fear of mathematics
      1. A positive math experience in early childhood may help prevent the development of math anxiety
      2. About 6% of school age children may have a mathematics learning disorder (MD)
         a. Some cannot remember basic facts
         b. Others cannot carry out basic procedures like solving a simple addition problem
      3. Math disabilities may also result from brain injury
a. Geary found that about half of the students identified with MD had no perceptual or neurological problem, but more likely:
   i. Lacked experience
   ii. Had poor motivation
   iii. Suffered from anxiety

4. Procedural problems are usually related to slow cognitive development and usually clear up by the middle elementary grades
   a. The fact retrieval problem tends to continue
   b. Some children have problems in reading and writing numbers and may also have problems in reading and writing words and letters
      i. These problems usually are developmental and eventually disappear
   c. Some children may have spatial relations problems, which show up when they misalign numbers in columns or reverse numbers
   d. Geary concludes that early experiences that make necessary neural connections in the brain can lessen the chances of MD

5. Geary suggests several ways to help children who have MD:
   a. Memory problems
      i. Don’t expect the child to memorize the basic facts
      ii. Provide alternative methods
   b. Procedural problems
      i. Make sure the child understands the fundamental concepts
      ii. Then have the child practice the procedures.
   c. Visuospatial problems
      i. Provide prompts or cues that will help the child organize numbers so they are lined up correctly
   d. Problem-solving difficulties
      i. First help the child with any basic skill difficulties
      ii. Have the child identify different types of word problems and help identify the steps needed to solve the problem

iv. Young children need to be carefully assessed and provided with extra practice and direct instruction if they don’t seem to be developing and acquiring the fundamental and advanced concepts
   1. Wright, Martland, Stafford, and Stanger provide a sequenced assessment and instruction method for teaching young children numbers
   2. Karp and Howell emphasize the importance of individualizing for children with learning disabilities
      a. Describe four components of individualization:
i. Remove specific barriers  
ii. Structure the environment  
iii. Incorporate more time and practice  
iv. Provide clarity

3. Ritz provides suggestions for supporting children with special needs in doing science  
   a. Teachers need to be responsive to each student’s special needs and make appropriate accommodations

VI. Technology  
   a. Internet provides many opportunities for learning  
      i. More and more preschools and elementary schools are including computers in the classrooms  
      ii. Computer activities can help children bridge the gap from concrete to abstract  
         1. Children can learn math and science concepts from software that presents a task, asks for a response, and provides feedback  
         2. Software should go beyond drill and practice and provide for the children’s creativity  
      iii. Computers also provide social opportunities because children enjoy working together  
         1. One or more computers can serve as centers in the classroom  
      iv. As children explore, the adult can provide suggestions or ask questions  
         1. Adult can observe and learn something about how children think and solve problems  
   b. Assistive technology  
      i. Supports the learning of children with disabilities  
      ii. High-tech tools include:  
         1. Voice synthesizers  
         2. Braille readers  
         3. Switch-activated toys  
         4. Computers  
      iii. Low-tech tools can also expand the experiences of children with special needs  
         1. Special handles can be put on pans and paintbrushes  
         2. Pillows and bolsters can help a child have a place in circle time activities  
         3. Board with photos can be used as a means for a child to make choices  
      iv. Selection must consider the children served and their abilities, the environment, and the cost