HOW DO CHILDREN LEARN MATHEMATICS?

Two Theories of Learning:

Behaviorism and Constructivism

Behaviorism

- Behavior can be shaped by reinforcement of drill and practice.
- Specific skills need to be learned in a fixed order.

Behaviorism (cont.)

- Clear objectives help
- students and teachers.

- Edward L. Thorndike
- B.F. Skinner
- Robert Gagne

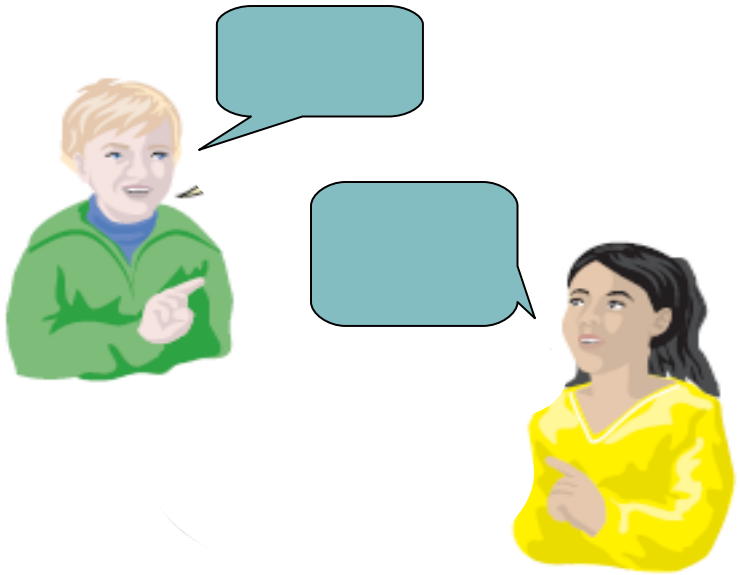
Constructivism

- Learners actively create or invent (construct) their own knowledge.
- Students create (construct) new mathematical knowledge by reflecting on their physical and mental actions.

Constructivism (cont.)

- Learning reflects a social process in which children engage in dialogue and discussion with themselves as well as others as they develop intellectually.

William Brownell,
Jean Piaget,
Jerome Bruner,
Zoltan Dienes



HOW CAN WE HELP CHILDREN MAKE SENSE OF MATHEMATICS?

- Several characteristics and stages of thinking exist; children progress through stages as they mature.
- Recommendation #1: Teachers should teach to the developmental characteristics of students.

TABLE 2-2 • Characteristics of Learners in the Primary Grades (Ages 4–7)

Cognitive Characteristics (thinking and ways of learning)	Suggestions for Teachers
• Piaget's preoperational stage • Concentration—able to focus on only one idea or stimulus at a time • Irreversibility—unable to recognize the reversibility of changes to actions or objects • Begins to understand ideas beyond firsthand concrete experiences	• Use everyday experiences to connect mathematics concepts to children's life experiences • Break tasks into manageable parts • Encourage informal exploration, choice, and experimentation with concrete materials • Use questions to stimulate thinking and challenge misconceptions • Begin using pictures and symbols to represent concrete actions
Physical Characteristics (muscle and motor skills)	**Suggestions for Teachers**
• Developing control of large and small muscles, fine-motor skills • Short attention span	• Provide short, hands-on activities with choice and opportunity for movement • Focus more on process than product • Provide materials that can be easily handled or manipulated
Social Characteristics (self-concept and interpersonal skills)	**Suggestions for Teachers**
• Egocentric—focuses more on self than others, talks at rather than with others • Developing sense of self and abilities • May have a best friend and exclude others • Learning to express oneself and make decisions	• Encourage friendship skills, sharing, taking turns, and working with another person • Provide positive support, challenge, and feedback • Allow children to make their own plans for manipulating things in the environment and solving problems

TABLE 2-3 • Characteristics of Learners in the Intermediate Grades (Ages 8–11)

Cognitive Characteristics (thinking and ways of learning)	Suggestions for Teachers
• Piaget's concrete operational stage • Able to decenter, can focus on part/whole • Understands reversibility of actions or objects • Able to classify and sequence by attribute • Can use logic and concrete objects to solve problems	• Use concrete materials and link to symbols • Provide opportunities to manipulate, classify, and sequence both objects and numbers • Explore multiple representations and strategies • Have students regularly explain thinking
Physical Characteristics (muscle and motor skills)	**Suggestions for Teachers**
• Able to complete more complex physical skills	• Provide experiences that promote active, physical involvement • Provide opportunities for children to use real tools and materials, make models and diagrams, and conduct experiments
Social Characteristics (self-concept and interpersonal skills)	**Suggestions for Teachers**
• Growing more independent • Small groups of friends have major influence • Hard to accept failure or criticism	• Provide opportunities for problem solving and projects • Provide opportunities for group work • Provide positive support, challenge, and feedback

HOW CAN WE HELP CHILDREN MAKE SENSE OF MATHEMATICS?

- Learners are actively involved in the learning process.
- Recommendation #2: Teachers should actively involve students.

Reys/ Lindquist/ Lamdin/ Smith, *Helping Children Learn Math, 10th Edition, © 20012*

HOW CAN WE HELP CHILDREN MAKE SENSE OF MATHEMATICS?

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- Learning proceeds from the concrete to abstract.
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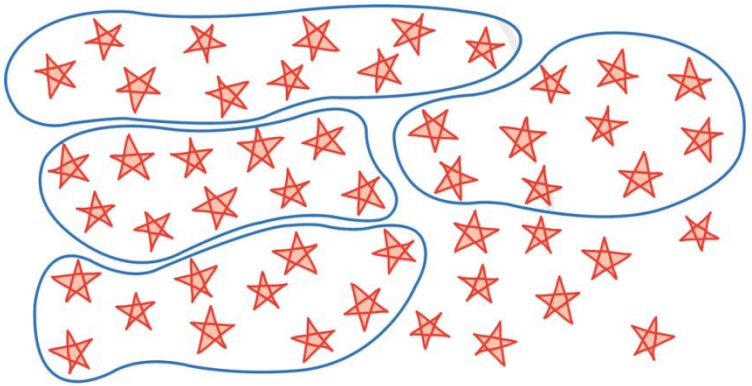
Recommendation #3: Teachers should move learning from concrete to abstract.



HOW CAN WE HELP CHILDREN MAKE SENSE OF MATHEMATICS?

- Learners need opportunities for talking and communicating their ideas with others.

  Recommendation #4: Teachers should use communication to encourage understanding.