5. Cognitive Development Throughout the Lifespan
5.1 Thinking

5.2 Piaget’s Cognitive Development Theory

5.3 Vygotsky’s Sociocultural Theory
5.4 Play

5.5 Information Processing

5.6 Executive Function
5.7 Attention

5.8 Memory

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5.12 Wisdom
5.1 Thinking
Thinking and its development

• Thinking differences infant to child to teen to adult
• How/when do changes occur?
• What can/can’t be thought at different ages?
5.2 Piaget’s Cognitive Development Theory
Piaget: observing child thinking/acting

• Before cognitive science, but mostly accurate

• Stages/ages with distinct thinking traits

• Should show up across cultures
Piaget: First model

- Schema = concept or category of information
- Disequilibrium = new facts don’t match schema
- Adaptation (reorganize)
  - Accommodate (modify)
  - Assimilate (incorporate)

→ New equilibrium
Piaget: Example

- **Schema**: DOG = small, furry
- **Disequilibrium**: Say “DOG” parent says, “No, CAT”
Piaget: Example

- **Adaptation**
  - **Accommodation**: Some small, furry are not dogs
  - **Assimilation**: Create new CAT schema

→ New equilibrium achieved
Sensorimotor stage (0-2)

Characteristics & challenges

• Senses and manipulation
• Focus and intention
• Object permanence
• Imitation
• “Random” explorations and experimentation
Preoperational (2-7)

• Centration (can filter only 1 attribute out of many), so not able to understand
• Conservation of quantity
• Reversibility of operations

• Egocentric viewpoint
  • From “my” perspective
  • Animism (“Ball is sad”)
Preoperational (2-7)

• “Play” as primary learning mode

• Language acquisition

• Also time of mastering gender identity/stability
Concrete operations (7-11)

• Mastery of previous challenges
• Less egocentric
• Logical reasoning
  • Classification (by attribute)
  • Seriation (sequencing)
Formal operations (11-)

- Abstract reasoning
  - Literary symbols
  - Ideological implications

- Quantitative concepts
  (higher math, geometry)

- Hypothetical reasoning
  - Generate hypotheses
  - Idealization
5.3 Vygotsky’s Sociocultural Theory
Vygotsky: Social learning

• Internalization = soaking up environment (learning) through interaction with others

• Observation and imitation central to learning
Scaffolded learning

• Parent/sibling/teacher assesses zone of proximal development (gap in skills or knowledge)

• “Teacher” sets up mediated learning experiences

• Sets environment to fill in gap sequentially
5.4 Play
Play: child’s work

• Fits Piaget and Vygotsky

• Stages of play:
  • Solitary
  • Parallel
  • Cooperative

• Types of play:
  • Constructive
  • Symbolic/pretend
5.5 Executive Function
Executive function

• All brain processes that affect learning/behavior
• Examples: control of attention, memory
• Early childhood (2-5):
  • Inhibitory control (block impulses)
  • Working (temporary) memory
Executive function

• Middle childhood (6-12):
  • Verbal working memory
  • Plan/organize
  • Cognitive flexibility

• Adolescence:
  • Strong improvement of all previous
Executive function

• Adulthood:

• Myelination in prefrontal cortex for maximum cognitive ability (peak 20-29)

• Decline in memory in later adulthood

• Cognitive flexibility starts declining age 70
5.6 Information Processing
Cognitive science brain models

• Explain how executive function works
• How stimuli “out there” ➔ usable knowledge
• Memory processes:
  • Attend (focus)
  • Encode (retain)
  • Retrieve (recall)
5.7 Attention
ATTENTION PLEASE!
Attention

Act of focusing/filtering sensory input

• Sensory input is constant, changing, and vast

• From earliest age, brain learns to filter and attend to small portion of input
5.8 Memory
Working memory (aka “short-term memory”)

• Like computer RAM (temporary storage before processing)

• Capable of storing few bits of information

• Size of bits can be enlarged by chunking
Rehearsal

Prevent loss of working memory contents

• Maintenance rehearsal = rote/repetition

• Elaborative rehearsal = encoding by activity or by relating to previous knowledge
Long-term memory

Like computer storage

- Semantic = facts and information
- Episodic = experiences and events
- Procedural = “how-to”
Schemata (plural)

Organizational metaphor

- Like folders on computer screen to show contents

- Schema = concept or category (e.g. “dog”) [like document folder]

- Subschema = sub-category [folder in folder]
5.9 Problem Solving and Planning
Problem-solving ability

• Related to developing prefrontal cortex and myelin sheathing

• Ability in childhood, big increase in adolescence, more in early adulthood
Synthesizing memory for new situations

• Brainstorming (idealizing and rearranging memory)
• Creating/using heuristics (general rule, mental map)
• Ability to work backward from goal
5.10 Environmental Influences
Cognitive influencers

- Long-term stress (family, SES, events)
- Affects brain structure development
- Affects hormone balance brain/body
- Culture & gender
- Expectations mold cognitive functions
5.11 Expertise
10,000 Hours = 10 years

- Expertise: know, apply, analyze, and synthesize

- Associated with middle adulthood ➔ peak of knowledge/ability

- Good for promotion, mentoring, or entrepreneurship
5.12 Wisdom
Wisdom of age?

- Associated with late adulthood (but not all)
- Self-awareness, emotional stability, appropriate word/action
- Understanding and empathy
- From helping and leading others