Intelligence and Cognition

Psychology of Adulthood and Aging

Performance vs. Ability

Are apparent deficits due to decline in cognitive function or are they due to non-cognitive factors?

Impaired Health
- Our mental state is inextricably tied to our physical function
- Cardiovascular functioning
- Nervous system functioning

Normal biological changes with age
- Slowing of behavior
- CNS speed of responding
- Lower energy levels
- Sensory functioning

Changed teaching methods
- Omission vs. Commission
- Metacognition & Mnemonics
- Functional vs. Conceptual

Lack of Confidence
- Time factors
- Meaningfulness of the task
- Interference factors
- Social factors - ageism
- Lack of test taking experience
The Lack of Mental Stimulation
If you don’t use it, you lose it!

Memory Stimulating Strategies
- Stay in good physical and mental health
- Keep mentally stimulated
- Use mnemonic techniques
- Enhance memory self-efficacy

 defining intelligence

 Measuring Intelligence: The Psychometric Approach
- Defining intelligence.
- The invention of IQ tests.
- Can IQ tests be culture-free.

Defining Intelligence
- Intelligence
  - An inferred characteristic of an individual, usually defined as the ability to profit from experience, acquire knowledge, think abstractly, act purposefully, or adapt to changes in the environment.
- g factor
  - A general intellectual ability assumed by many theorists to underlie specific mental abilities and talents.
- Psychometrics
  - The measurement of mental abilities, traits and processes.

The Invention of IQ tests
- Binet believed we should measure a child’s mental age.
- Binet and Simon developed a test which measured memory, vocabulary, and perceptual discrimination.
- Mental age was divided by chronological age and multiplied by 100 to get an IQ or intelligent quotient score.
- Now IQ scores are derived from norms provided for standardized intelligence tests.
IQ Testing

What’s on a test?
Problems
- cultural bias, content & construct validity,
  self-fulfilling prophecy, age biased
Ability vs. performance

The Psychometric Approach

- IQ scores are distributed “normally”
  • Bell-shaped curve
- Very high and low scores are rare
- 68% of people have IQ between 85-115
  • 99.7% between 55-145

Can IQ Tests be Culture Free?

- Attempts to make IQ tests culture fair have backfired
  because different cultures have different problem-solving strategies.
- Cultural values and experiences affect a person’s:
  • Attitude toward exams,
  • Comfort in the settings required for testing,
  • Motivation
  • Rapport with test provider,
  • Competitiveness, and
  • Ease of independent problem solving.

Expectations, Stereotypes and IQ Scores

- Scores are affected by expectations for performance.
- These expectations are shaped by cultural stereotypes.
- Stereotype threat
  • A burden of doubt one feels about his or her performance due to
    negative stereotypes about his or her group’s abilities.
  • Research has shown effects of stereotype threat on African-
    Americans, Latinos, low-income people, women, and elderly people.

An Illustration of Stereotype Threat

Wechsler Scales
Verbal Subscales - test our store of knowledge
  Information
  Digit Span
  Vocabulary
  Arithmetic
  Comprehension
  Similarities
Performance Subscales - timed, principally unfamiliar tasks
  Picture Completion
  Picture Arrangement
  Block Design
  Object Assembly
  Digit Symbol.
Dissecting Intelligence: The Cognitive Approach

- The triarchic theory.
- Domains of intelligence.
- Motivation and intelligence.

Sternberg's Triarchic Theory

- Componential - a.k.a. “Analytic”
  - Comparing, analyzing, and evaluating.
  - This type of processes correlates best with IQ.
- Experiential - a.k.a. “Creative”
  - Inventing or designing solutions to new problems.
  - Transfer skills to new situations.
- Contextual - a.k.a. “Practical”
  - Using (i.e., applying) the things you know in everyday contexts.

Gardner’s Multiple Intelligence Theory

Verbal-linguistic

Verbal-linguistic learners have highly developed auditory skills, enjoy reading and writing, like to play word games, and have a good memory for names, dates, and places. They like to tell stories, and get their point across. You learn best by saying and hearing words. Poets, writers, and people who speak a great deal in their jobs (like teachers) probably have a high degree of verbal-linguistic intelligence.

Musical-Rhythmic

Musical-rhythmic learners are sensitive to the sounds in their environment, including the inflections in the human voice. They enjoy music, and may listen to music when they study or read. They are skilled at pitch and rhythm. Learning through melody and music works well for people with high musical-rhythmic intelligence. Singers, conductors, and composers obviously have a high musical-rhythmic intelligence. Anyone who enjoys, understands, and uses various elements of music probably has a high degree of musical-rhythmic intelligence.

Logical-Mathematical

Logical-mathematical intelligence is often linked with the term "scientific thinking." Logical-mathematical people like to explore patterns and relationships, like to experiment with things you don't understand, ask questions, and enjoy well-ordered tasks. They like to work with numbers and relish opportunities to solve problems via logical reasoning. They learn best by classifying information, using abstract thought, and looking for common basic principles and patterns. Many scientists have a high degree of logical-mathematical intelligence.
**Visual-Spatial**

Visual-spatial people work well with maps, charts, diagrams, and visual arts in general. They are able to visualize clear mental images. They like to design and create things. They learn best by looking at pictures and watching videos. Sculptors, painters, architects, surgeons, and engineers are a few professions that require people with well-developed visual-spatial abilities.

**Bodily-Kinesthetic**

Bodily-kinesthetic learners use bodily sensations to gather information. They have good balance and coordination and are good with their hands. Learning activities that provide physical activities and hands-on learning experiences work well for them. People with highly developed bodily-kinesthetic abilities include carpenters, mechanics, dancers, gymnasts, swimmers, and jugglers.

**Intrapersonal**

Intrapersonal learners are aware of their own strengths, weaknesses, and feelings. They are aware of self, being a creative and independent, and reflective thinker. They usually possess independence, self-confidence, determination, and high motivation. They may respond with strong opinions when controversial topics are discussed. They learn best by engaging in independent study projects rather than working on group projects. Pacing their own instruction is important to them. Entrepreneurs, philosophers, and psychologists are a few professions where strong intrapersonal skills are a benefit.

**Interpersonal**

Interpersonal learners are "people-persons." They enjoy being around people, like talking to people, have many friends, and engage in social activities. They can develop genuine empathy for the feelings of others. They learn best by relating, sharing, and participating in cooperative group environments. The best salespeople, consultants, community organizers, counselors, and teachers have a high interpersonal intelligence.

**Horn**

**Crystallized Intelligence** - "the extent to which a person has absorbed the content of culture." (Belsky, 1990, p. 125)

**Fluid Intelligence** - "on-the-spot reasoning ability, a skill not basically dependant on our experience." (Belsky, 1990, p. 125)

**Baltes**

**Mechanics of Intelligence** - biologically based, hardware or mechanisms underlying cognition

**Pragmatics of Intelligence** - Experience, metacognition, knowledge
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Schaie’s Conclusions
1. Reliable decrements can not be found for all abilities for all persons. Decline is not likely at all until very late in life.
2. Decline is most evident where speed of response and peripheral nervous system are involved.
3. Declines will be evident for most abilities for individuals of any age who have severe central nervous system disease and for those in their 50s and 60s who live in deprived environments.
4. Data on independent samples will over estimate loss for abilities (no benefit of practice). Dependent samples will better measure age changes for those in good health and stimulating environments and underestimate loss for those in poor health and impoverished environments.
5. Cohort effects account for more variance in intelligence than do ontogenetic (age-related, maturational) biologically based factors.
6. Individual differences in what skills decline as well as the extent of the declines are substantial.

Piaget &
Beyond

Jean Piaget
3 August 1896 — 15 September 1980
A short biography of Piaget
Stages

Sensorimotor
Preoperational
Concrete Operations
Formal Operations

Sensorimotor
* Six Stages
* Coordinate Schemas
* Object Permanence
* Symbolic Thought

Infants discover aspects of the world through their sensory impressions, motor activities, and coordination of the two.

Preoperational

Egocentric
Pre-Logical

Children cannot yet manipulate and transform information in logical ways, but they can now think in images and symbols.

Conservation of Liquids

They learn to differentiate themselves from the external world. They learn that objects exist even when they are not visible (object permanence) and that they are independent of the infant’s own actions. They gain some appreciation of cause and effect.

They become able to represent something with something else, acquire language and play games of pretend. Intelligence at this stage is said to be intuitive because children cannot make general, logical statements.

Conservation of Liquids
Conservation of Mass

Conservation of Numbers

A. 
B.

A. 
B.

Contrasts

Centration vs. Decentration  
Irreversible vs. Reversible  
States vs. Transformations  
Perceived Appearance vs. Inferred Reality

Concrete Operations

Children can understand logical principles that apply to concrete external objects. They can appreciate that certain properties of an object remain the same, despite changes in appearance (conservation), and sort objects into categories. They can appreciate the perspective of another viewer. They can think about two concepts, such as longer and wider, at the same time.

Formal Operations

Only adolescents and adults can think logically about abstractions, can speculate, and can consider what might or what ought to be. They can work in probabilities and possibilities. They can imagine other worlds, especially ideal ones. They can reason about purely verbal or logical statements. They reflect on their own activity of thinking.

Characteristics of Formal Operations

- Hypothetical Deductive Reasoning
- Proportional Thinking
- Isolation & Control of Variables

\[ T = \sqrt{\frac{2Lg}{\pi}} \quad (\theta \text{ small}) \]

\[ T = \text{period time for one round trip oscillation} \]
\[ L = \text{length of pendulum} \]
\[ g = \text{acceleration due to gravity} \]
Characteristics of Formal Operations

• Hypothetical Deductive Reasoning
• Proportional Thinking
• Isolation & Control of Variables

\[ T = \frac{2\pi \sqrt{L}}{g} \text{ (T small)} \]

T = period (time for one swing of the pendulum)
L = length of pendulum
\( g \) = acceleration due to gravity

Critique of Formal Operations

Formal operations overemphasizes the power of pure logic in problem solving

Formal operations underemphasizes the pragmatic quality of real life cognitive activity

Formal thinking is only suited for the problems that call for scientific thinking and logical mathematical analyses

Formal operations is geared for the solution of closed system, well-defined problems
Formal operations does not recognize the relative nature of knowledge and the need to adopt multiple frames of reference.

Formal thinking places a greater emphasis on problem solving that on problem finding.

Post-Formal Thought

Post-formal thinkers possess an understanding of the relative, nonabsolute nature of knowledge.

Accept contradiction as a basic aspect of reality.

Post-formal thinkers capable of dialectic reasoning.
A contextual approach to problem solving

Directed towards problem finding

“Often in great discovery, the most important thing is that a certain question is found”
- Wertheimer

Post-formal thinking tends to be domain-specific

Based on social cognition - reasoning about the social and interpersonal world