IQ: WHAT IS IT AND WHAT DOES IT MEAN?

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OVERVIEW

• What is IQ
  History and theory
  Definition
  Connections

• IQ Tests
  What is an IQ test?
  Common measures
  Analysis of the WISC-V

• How we use IQ now
  Profiles
  Applications

• Analyze some IQ data/profiles
HISTORY OF INTELLIGENCE

- Sir Isaac Galton (1822-1922)
- James McKeen Cattell (1860-1944)
- Binet-Simon Scale (1905)
- Stanford-Binet (1916)

(Sattler, 2001)
THEORIES OF INTELLIGENCE

- Cattell-Horn-Carroll Theory
- Sternberg’s Triarchic Theory
- Gardner’s Multiple Intelligence Theory

(Sattler, 2001)
Carroll and Cattell-Horn Model Comparison

(McGrew, 2010)
CHC THEORY

- Most intelligence tests are constructed based on this theory
- Overall intelligence level is g
- Usually 9 to 10 subarea abilities

**Gf: Fluid intelligence**
General reasoning and inductive reasoning

**Gc: Crystallized intelligence**
Knowledge and factual information, affected by acculturation

**Gv: Visual processing**
Ability to manipulate and understand visual information

**Ga: Auditory processing**
Skills needed to listen and respond

**Gsm: Short-term memory**
Retaining and recalling information stored for short intervals

**Glr: Long-term memory**
Retrieving information over longer periods of time

**Gs: Processing speed**
Ability to scan and react to simple tasks quickly

**Gt: Decision speed**
Reacting or answering questions quickly with slight to moderate difficulty

**Gq: Quantitative knowledge**
Understanding and applying mathematical concepts

(Sattler, 2001)
GARDNER’S MULTIPLE INTELLIGENCES

Linguistic Intelligence
Language and communication

Musical Intelligence
Rhythmic and pitch

Logical-Mathematical Intelligence
Logical reasoning

Spatial Intelligence
Perceiving and modifying perceptions

Bodily-Kinesthetic Intelligence
Dancing, acting, athletics

Intrapersonal Intelligence
Knowledge of self and feelings

Interpersonal Intelligence
Understanding and knowing other’s feelings and thoughts

Naturalist Intelligence
Find patterns in nature

(Sattler, 2001)
STERNBERG’S TRIARCHIC THEORY

Metacomponents

Used for planning, monitoring, and evaluating performance of a task

Performance Components

Strategies used to execute a task

Knowledge Acquisition Components

Used to learn new things

- Selecting encoding
- Selective combinations
- Selective comparisons

(Sattler, 2001)
SO WHAT IS IQ?

- David Wechsler stated intelligence is, “the capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment”

- According to Dictionary.com: capacity for learning, reasoning, understanding, and similar forms of mental activity; aptitude in grasping truths, relationships, facts, meanings, etc.

- Intelligence quotient: \[
\frac{\text{Mental Age}}{\text{Chronological Age}} \times 100
\]

- We use IQ assessments to gather information for intervention, diagnoses

- Strong predictive utility

(Wechsler, 2014)
BELL CURVE

BASIC STATISTICS

Scores are generally provided as standard scores

- Mean or average of 100
- Standard deviation of 15

Percentiles are often provided to assist with score interpretation

- 70 = 2^{nd} %
- 90 = 25^{th} %
- 100 = 50^{th} %
- 110 = 75^{th} %
- 130 = 98^{th} %
## HEREDITABILITY

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(Sattler, 2001)
ENVIRONMENTAL FACTORS OF INTELLIGENCE

- Prenatal care
- Nutrition
- Poverty
- Family background
  - Stimulation
  - Punishment
  - Unemployment
STABILITY

For the most part, IQ tends to remain stable.

By 5 or 6, IQ scores tend to become more stable with an increase in predictive utility (.50 correlation with educational attainment by the age of 7 or 8)

Large variations can occur

- Up to 20-point variations
- Adoption studies have shown 10- to 12-point gains
- Various studies indicate positive thinking about improving IQ can result in higher scores

Gender differences

- Mainly equal

Gains over time

(Sattler, 2001)
CORRELATIONS WITH IQ

Mortality

Inverse relationship between early life IQ and mortality
Plays a factor in socioeconomic inequalities in health (Batty et al., 2006)

Functional decline

Those with higher IQs tend to have less functional decline as they age compared to those with lower IQs (Bosma et al., 2007)

General life outcomes

IQ scores at age 13 are good predictors of attained education, occupational status, and material well being (Firkowska-Mankiewicz, 2011)

IQ has a strong connection with schooling and academic skills (Ceci & Williams, 1997)

This in turn leads to better income and job outlook
A college graduate will earn 31% more than a high school graduate of equal verbal abilities
The WISC-V has a .80 correlation with the KTEA-3 and WIAT-III overall achievement

Job performance
SO WHAT IS AN IQ TEST?

• **Online Measures**
  
  Often inaccurate or only measure one aspect of IQ
  
  IQ-test.com: 133 to 149 (matrix problems)
  
  Free-iqtest.net: 140 (various types of problems)

• **Standardized Measures**
  
  Have been normed on many individuals
  
  Have excellent technical characteristics
    
    Reliability
    
    Validity
  
  Have strong predictive utility
COMMON IQ TESTS

Wechsler assessments

- Wechsler Intelligence Scale for Children-Fifth Edition (WISC-V) (6-16)
- Wechsler Adult Intelligence Scale-Fourth Edition (WAIS-IV) (16-90)
- Wechsler Preschool and Primary Scale of Intelligence-Fourth Edition (WPPSI-IV) (2:6-7:7)

Kaufman Assessment Battery for Children-Second Edition (KABC-II) (3-18)

Stanford-Binet Intelligence Scales-Fifth Edition (SB5) (2-85+)

WISC-V OVERVIEW

FIVE MAIN COMPOSITES

Verbal Comprehension Index (VCI)
   Ability to access and apply acquired word knowledge
   Gc

Visual Spatial Index (VSI)
   Evaluate visual details and understand visual spatial relationships
   Gv

Fluid Reasoning Index (FRI)
   Detecting underlying conceptual relationships among visual objects
   Gf

Working Memory Index (WMI)
   Register, maintain, and manipulate visual and auditory information
   Gsm

Processing Speed Index (PSI)
   Speed and accuracy of visual identification and decision making
   Gs

FSIQ: Similarities, Vocabulary, Block Design, Matrix Reasoning, Figure Weights, Digit Span, and Coding

SUBTEST SCORES

VCI
   Similarities* (describe how two words are similar)
   Vocabulary* (define vocabulary terms)
   Information (answer questions about general-knowledge topics)

VSI
   Block Design* (copy block designs)
   Visual Puzzles* (mentally construct puzzles)

FRI
   Matrix Reasoning* (select missing piece to complete matrix or sequence)
   Figure Weights* (select responses to balance a scale)
   Picture Concepts (view two or three rows of pictures and pick similar pictures among the rows)
   Arithmetic (mentally solve math problems)

WMI
   Digit Span* (recall sequence of digits in various orders)
   Picture Span* (presented with pictures then asked to recall them among many more pictures)
   Letter-Number Sequencing (given sequence of letters and numbers and repeat them with numbers first then letters)

PSI
   Coding* (use key to copy symbols corresponding with numbers)
   Symbol Search* (scan groups to identify target symbol)
   Cancellation (mark objects in random and sequenced presentations)

(Wechsler, 2014)
SIMILARITIES
EXAMPLE

EASY
How are red and blue alike?

ABSTRACT
How are the ocean and the sky alike?
VOCABULARY EXAMPLE

EASY
What is broccoli?

ABSTRACT
What does parsimonious mean?
MATRIX REASONING
EXAMPLE

EASY

(Wechsler, 2014)
## VISUAL PUZZLE EXAMPLE

### EASY

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*(Wechsler, 2014)*
FIGURE WEIGHTS
EXAMPLE

EASY

ABSTRACT

(Wechsler, 2014)
DIGIT SPAN EXAMPLE

EASY

Forward
Backward
Sequencing

ABSTRACT

Forward
Backward
Sequencing
PICTURE SPAN EXAMPLE
**Coding Example**

Digit symbol substitution test

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SYMBOL SEARCH EXAMPLE
COMPLIMENTARY SUBTESTS

• Naming Speed
  Literacy
  Quantity
• Storage and Retrieval
  Immediate
  Delayed
  Recognition
COMMON PROFILES

• ADHD
  Lower scores on WMI and PSI
  Common lower scores on Digit Span (WMI) and Coding (PSI)

• English Learners

• High functioning autism
  Lower scores on the WMI and PSI

• Learning Disabilities
  Tend to have statistically lower scores across each index for populations with reading/writing/math disorders

• Math and Reading
  Math tends to be correlated with nonverbal reasoning
  Reading/writing is more connected with verbal reasoning
COMMON APPLICATIONS OF IQ TESTS

- **Giftedness**
  
  FSIQ ≥ 130

- **Intellectual Disability**
  
  FSIQ ≤ 70 ± 5
  
  Also need to display deficits in adaptive behavior

- **Learning Disabilities**
  
  Only in schools within certain states
  
  Newer definitions of learning disabilities only require information from academic deficits
LEARNING DISABILITIES IN SCHOOLS IN MINNESOTA

• Three components
  Underachievement
    Oral expression, listening comprehension, written expression, basic reading skills, reading comprehension, reading fluency, mathematics calculation, mathematical problem solving
  AND
  Processing deficits
    Storage, organization, acquisition, retrieval, expression, manipulation
  AND
  Severe discrepancy
    Mathematical calculation of difference between cognitive functioning and academic skills
  OR
  Inadequate rate of progress
    Response to Intervention (RTI)
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REFERENCES


