

# Formal Reasoning, Informal Reasoning, and Low Achieving Students

Carl Romstad, Ed.S.  
Milton J. Dehn, Ed.D.

---

---

---

---

---

---

---

## Copyright Notice

This PowerPoint is copyrighted 2018 by Carl Romstad and Milton J. Dehn. All rights reserved. No photocopying, electronic display, or electronic dissemination is allowed without written permission. For permission, contact Carl Romstad <cromstad1981@gmail.com>

---

---

---

---

---

---

---

## Historical Ethnic Differences on IQ Tests

Stanford-Binet introduced in U.S. by Terman in 1916 and an adaptation used to test Army recruits

Recent Polish, Russian, Jewish, and Italian immigrants scored well below earlier immigrants from England and Western Europe

Argued they were genetically inferior and that immigration should be restricted

Hypothesis that they were not as assimilated into the dominant American culture was ignored

---

---

---

---

---

---

---

## Historical Racial/Ethnic Differences in IQ

Until the 1980's African-American reported mean IQ approximately 1 SD lower than White American IQ

Mexican-American also significantly lower than White mean

Argued by Arthur Jensen that 80% of IQ is genetic

Argued that IQ tests predict achievement well

---

---

---

---

---

---

---

## California's Larry P. vs. Riles Case (1979)

Case brought because of disproportionately higher educational placement of African-Americans as intellectually deficient due to their low IQ scores

IQ tests found to discriminate, were biased

Ruling: IQ tests cannot be used with African-Americans

California Department of Education still prohibits use of any tests associated with IQ

---

---

---

---

---

---

---

## Explanations that Account for the Differences

- ▶ The IQ/Cognitive Tests are Biased
- ▶ Genetics
- ▶ Language (limited English proficiency)
- ▶ Education
- ▶ Home Environment
- ▶ Cultural Differences
- ▶ SES

---

---

---

---

---

---

---

### The Black Intelligence Test of Cultural Homogeneity (B.I.T.C.H.) Test (1970's)

Consisted of 100 vocabulary words used in urban African-American culture

Whites performed significantly lower

Evidence that cultural content influences how groups perform on tests

---

---

---

---

---

---

---

### The System of Multicultural Pluralistic Assessment (SOMPA; 1978)

- ▶ Used sociocultural background to adjust IQ scores to reduce bias
  - ▶ Used IQ scores and adaptive behavior
- ▶ Resulting score called Estimated Learning Potential (ELP).
  - ▶ For minorities, this was higher than IQ
  - ▶ But they overestimated learning

---

---

---

---

---

---

---

### Reducing Bias in Intellectual/Cognitive Assessments and Educational Placements

- ▶ Bias review by experts
- ▶ Statistical analysis of test items
- ▶ Less verbal testing
- ▶ Adaptive behavior
- ▶ Multiple sources of information

---

---

---

---

---

---

---

### KABC-II

Original KABC cut racial/ethnic group differences in half

Parent education level (SES) accounts for more variance than ethnicity

---

---

---

---

---

---

---

### KABC-II FCI Means by Parent Education Level for Subjects Ages 7-18

- ▶ 11<sup>th</sup> grade or less - 89
- ▶ High School - 98.1
- ▶ 1-3 years college - 102.2
- ▶ 4 year degree or higher - 106.9

---

---

---

---

---

---

---

### KABC-II FCI Adjusted (for SES level) Means by Ethnicity of Subjects Ages 7-18

- ▶ White - 102.4
- ▶ African-American - 94.5
- ▶ American Indian - 95.6
- ▶ Asian American - 103.9
- ▶ Hispanic - 95.8

---

---

---

---

---

---

---

### WISC-V Ethnic Differences

- ▶ Not reported in technical manual
- ▶ Reports ELL Differences
- ▶ Numerous validity studies

---

---

---

---

---

---

---

### WISC-IV FSIQ Differences by Ethnicity/Race Matched for SES and Other Variables

- ▶ African-American - 91.5
- ▶ White - 100.3
- ▶ Hispanic - 95.2

No or limited data on smaller ethnic groups living in the U.S.

---

---

---

---

---

---

---

### Too Much Emphasis on FSIQ and g

- ▶ Factor analysis always finds a general factor on intelligence, cognitive, etc. tests
- ▶ It fails to describe a variety of cognitive abilities that contribute to the IQ score
- ▶ It predicts achievement well but the majority of achievement variance is due to other variables

---

---

---

---

---

---

---

### Less Emphasis on g: Sternberg's Theory of Intelligence

- ▶ Intelligence is about success in life
- ▶ Analytical abilities, creative abilities, and practical abilities
- ▶ Practical Intelligence: "the mental activity involved in attaining fit to context." Through the three processes of adaptation, shaping, and selection, individuals create an ideal fit between themselves and their environment.

---

---

---

---

---

---

---

### Gardner's Theory

- ▶ Multiple Theories on Intelligence
  - Visual/Spatial
  - Linguistic/Verbal
  - Logical/Mathematical
  - Bodily/Kinesthetic
  - Musical
  - Interpersonal
  - Intrapersonal
  - Naturalistic Intelligence
- ▶ Popular amongst educators
- ▶ Beyond G
- ▶ Hard to make correlation to academics
- ▶ How can we use this to help with academic difficulties?

---

---

---

---

---

---

---

### Questions?

---

---

---

---

---

---

---

## What is reasoning?

One's ability to think about and understand information, discriminate between different types of information and execute a plan or strategy based on that same information.

(Salmon, 1991)

---

---

---

---

---

---

---

## Is reasoning related to I.Q.?

**Reasoning** dictates how we think, interpret, and act on stimuli in front of us.

**General Intelligence(G)/Fluid Intelligence (Gf)** - One's ability to use deductive/mathematical and inductive logic, abstractly thinking, and generalize.

**G and Gf** have been affiliated with types of reasoning, vice versa.

**G/Gf** - Central to cognition and a fundamental element of virtually every assessment of cognition/processing available.

(Ferrer, O'hare, & Bunge, 2009; Perkins, Farady, and Bushy, 1991)

---

---

---

---

---

---

---

## Formal Reasoning

- Conceptual in nature, relying on abstract thinking.
- More deductive, in nature, used in seeking absolute or truth rather than contingent information...Belief mode.
- Mathematical, algorithmic, and reliant on symbolic logic.

(Ferrer, O'hare, & Bunge, 2009; Johnson and Blair, 1991; Miller-Jones, 1991; Perkins, Farady, and Bushy, 1991; Sadler, 2004; Schoenfeld, 1991; Voss, Perkins, & Segal, 1991)

---

---

---

---

---

---

---

## G/Gf = Formal Reasoning

**General Intelligence/Fluid Intelligence** - One's ability to use deductive/mathematical and inductive logic, abstractly thinking, and generalize.

**Formal Reasoning** - Conceptual and abstract in nature, Deductive, Mathematical, and reliant on symbolic logic.

(Ferrer, et al., 2009; Johnson and Blair, 1991; Miller-Jones, 1991; Perkins, et al., 1993; Sadler, 2004; Schoenfeld, 1991; Voss, et al., 1991)

---

---

---

---

---

---

---

## Relational Abstraction

According to James Flynn, *relational abstraction* is a critical component of scientific thinking.

"...for analogical mapping when relations between objects are unrelated to the objects themselves" (Fox & Mitchum, 2013, p.88).

Needed to do well in I.Q assessments like Ravens Progressive Matrices.

(Flynn, 2016; Fox & Mitchum, 2013)

---

---

---

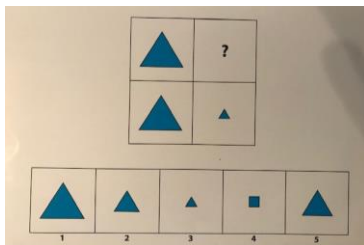
---

---

---

---

## Example 1.




---

---

---

---

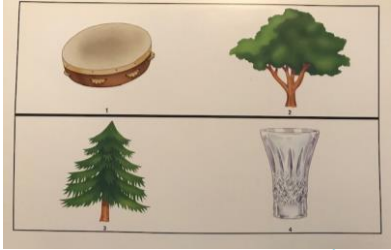
---

---

---



Example 2.



---

---

---

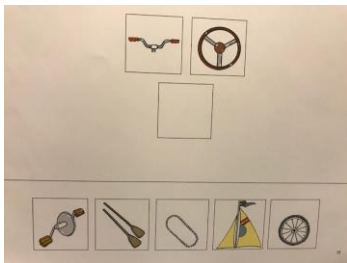
---

---

---

---

Example 3.



---

---

---

---

---

---

---

Example 4.



---

---

---

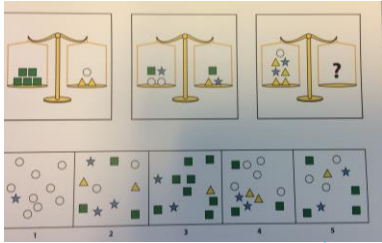
---

---

---

---

## Example 5.




---

---

---

---

---

---

---

### Limitations to I.Q./Assessments based on Formal Reasoning

Nearly every assessment of I.Q./Processing is rooted in Formal Reasoning/Gf.

-NVI, MPI, Luria Model, FSIQ, PASS, etc.

Overemphasis placed on Language/Knowledge

Current IQ assessments measure *deliberative* abilities not our inclination to use them.

(Frederick, 2009; Kolowich, 2016; Serpell, 2017)

---

---

---

---

---

---

---

### Informal Reasoning

- Concrete and contextual problem solving.
- Not reliant on abstract/conceptual thinking to problem solve.
- Done outside of the formal context of symbolic logic and mathematics.
- Design Mode (pragmatism, strengths vs weakness)

(Ferre, O'Hare, & Bunge, 2009; Johnson and Blair, 1991; Miller-Jones, 1991; Perkins, Farady, and Bushy, 1991; Sadler, 2004; Schoenfeld, 1991 Voss, Perkins, & Segal, 1991)

---

---

---

---

---

---

---

### In short...

A form of reasoning reliant on concrete, contextual, and practical thinking and problem solving, not bound by the rules of mathematical logic and/or abstract thinking.

---

---

---

---

---

---

---

### “Point to the one that doesn’t belong.”




---

---

---

---

---

---

---

### Application of Formal and Informal reasoning

Informal reasoning is used when the formal academic structure to guide reasoning is no longer in present.

Outside of the classroom and immediate formal lessons, Informal Reasoning must be used to makes sense of the un-learned.

**Formal Reasoning** is a specific ability that is effective when used how it was intended (abstract pattern identification, conceptual thinking, mathematical logic, etc.).

**Informal Reasoning** is a more innate ability that helps figure out when and how to use Reasoning abilities inside and outside of academic and formal environments.

(Teig & Scherer, 2016)

---

---

---

---

---

---

---

## Reasoning types in academics

Formal Reasoning may favor:

- Individualized instruction
- Decontextualized material
- Literacy is key

Informal Reasoning may favor:

- Collective instruction
- Pragmatic/contextualized material
- Oral in nature, less reliant on literacy

(Marshall & DeCapua, 2013; Miller Jones, 1989; Miller-Jones, 1991)

---

---

---

---

---

---

---

---

## Informal Reasoning in Professional Life

Science (Tweney, 1991)

Medicine (Christensen & Elstein, 1991)

Foreign Relations (Voss, 1991)

Law (Lawrence, 1991)

Nearly Every Profession (Voss, Perkins, & Segal, 1991)

---

---

---

---

---

---

---

---

## What determines our reasoning style?

Luria emphasized the role of culture in neurological development and cognitive processing.

Cultural experiences can impact and accelerate planning and self-regulation. Abstraction and generalization ability levels are products of culture and environment.

Children learn relevance of objects and information through play and adult interaction.

Cultural experiences such as poems, rules of games, and songs.

(Naglieri, Das, & Goldstein, 2012)

---

---

---

---

---

---

---

---

## Informal Reasoning found in the below groups:

Populations in Eastern Europe - 1970's  
 Students in Zambia - 1970's-present day  
 Inner-city AA Populations -1989  
 Indigenous Populations of Papua New Guinea - 1997  
 Indigenous Mayan Populations - 2005  
 Students in Germany - 2014  
 Specific S.E. Asian populations - 2017  
 Many more....

(Cheng, Wild, Hollmann, & Otterpohl, 2014; Cole, 2005; Diamond, 1997; Hvitfeldt, 1986; Kathuria, & Serpell, 1998; Marshall, 1998; Miller-Jones, 1991; Naglieri et al., 2012; Romstad & Xiong, 2017; Serpell, 2017)

---

---

---

---

---

---

---

---

## Previous research cont.

Previous research observed some problem solving related to informal reasoning.

Did not measure or quantifying it for psychometric purposes.

Majority of research done on verbal reasoning styles and decision making in social situations.

---

---

---

---

---

---

---

---

## Questions?

---

---

---

---

---

---

---

---

## Recent study in 2017

200 Hmong Students were administered I.Q. tests across three school settings.  
 154 Kaufman Assessment Battery for Children - Second Edition  
 46 Wechsler Intelligence Scale for Children - Fifth Edition  
 Data gathered over five year span across grades K-12  
 Compared to a sample of 51 Caucasian students.

(Romstad & Xiong, 2017)

---

---

---

---

---

---

---

---

## Findings

Overall performance across all full scale indices on both KABC-II and WISC-V one S.D. below the mean or more.  
 The younger students obtained lower scores, Kindergarten obtaining the lowest.  
 Caucasian sample were average across full scale indices. +/- 2 points below the mean of 100.  
 Formally nutured tasks (Gv and Gf) = lower scores.  
 Informally nutured tasks (Gv and Gf) = higher scores

(Romstad & Xiong, 2017)

---

---

---

---

---

---

---

---

## Hmong KABC-II scores - 154 Assessments - grades k-12

|        | FCI | NVI | MPI | Seq. | Simul. | Plan | LTS.Ret | Cryst. |
|--------|-----|-----|-----|------|--------|------|---------|--------|
| Mean   | 83  | 86  | 85  | 84   | 93     | 91   | 86      | 75     |
| Median | 82  | 86  | 85  | 85   | 93     | 90   | 85      | 75     |
| Mode   | 80  | 90  | 84  | 94   | 97     | 88   | 84      | 69     |
| St.Dev | 10  | 15  | 12  | 12   | 15     | 13   | 12      | 10     |
| N      | 99  | 65  | 137 | 138  | 138    | 120  | 138     | 100    |

(Romstad & Xiong, 2017)

---

---

---

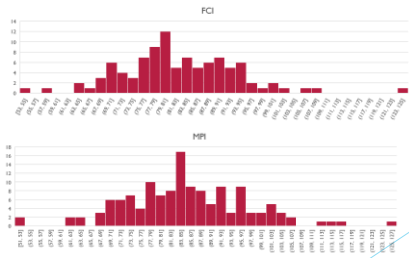
---

---

---

---

---



---

---

---

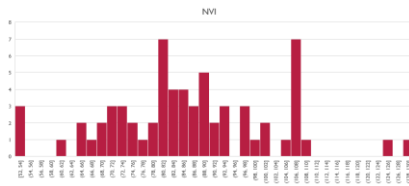
---

---

---

---

---



---

---

---

---

---

---

---

---

Kindergarten - 3<sup>rd</sup> Grade - 71 data points

|        | FCI | NVI | MPI | Seq. | Simul. | Plan | LTS_Ret | Cryst. |
|--------|-----|-----|-----|------|--------|------|---------|--------|
| Mean   | 82  | 84  | 83  | 84   | 92     | 92   | 83      | 74     |
| Median | 81  | 83  | 83  | 93   | 93     | 93   | 84      | 72     |
| Mode   | 93  | 82  | 79  | 94   | 97     | 88   | 84      | 72     |
| St.Dev | 12  | 14  | 11  | 13   | 14     | 12   | 12      | 13     |
| N      | 42  | 37  | 60  | 61   | 61     | 44   | 61      | 40     |

(Romstad & Xiong, 2017)

---

---

---

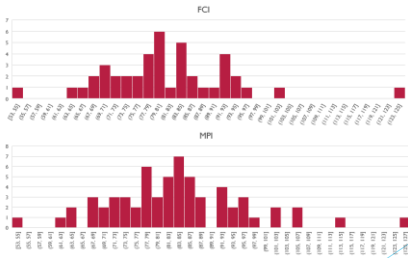
---

---

---

---

---



---

---

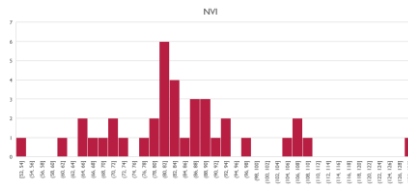
---

---

---

---

---



---

---

---

---

---

---

---

WISC-V grades 3<sup>rd</sup> - 9<sup>th</sup>  
Sample size - 46

|        | FSIQ | NVI | GAI | Verb. Comp | Fluid R. | Visual Sp. | Mem. | Processing |
|--------|------|-----|-----|------------|----------|------------|------|------------|
| Mean   | 78   | 84  | 78  | 71         | 88       | 90         | 76   | 87         |
| Median | 79   | 84  | 77  | 70         | 88       | 89         | 75   | 87         |
| Mode   | 83   | 76  | 73  | 78         | 82       | 86         | 74   | 92         |
| St.Dev | 8    | 9   | 8   | 10         | 10       | 11         | 9    | 14         |
| N      | 40   | 45  | 38  | 40         | 46       | 46         | 44   | 44         |

(Romstad & Xiong, 2017)

---

---

---

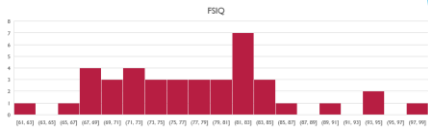
---

---

---

---






---

---

---

---

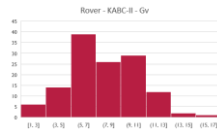
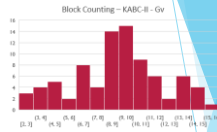
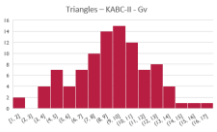
---

---

---

---

#### Informal General Thinking (Gf & Gv)




---

---

---

---

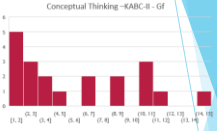
---

---

---

---

#### Formal General Thinking abilities (Gf & Gv)




---

---

---

---

---

---

---

---

## Further Investigation

- ▶ Flanagan, Ortiz, & Alfonso (2013) - Culture-Language Interpretative Matrix (C-LIM)
- ▶ Serves to identify if culture or language impacted scores
- ▶ Subtests assigned ranking for both Cultural and Linguistic Loading
- ▶ Low/Low to High/High
- ▶ C-LIM spread sheet allows input of scores to be further categorized.
- ▶ If scores follow a specific trend they are suggested to be a misrepresentation of student's true abilities.

---

---

---

---

---

---

---

---

|                            |          | DEGREE OF LINGUISTIC DEMAND   |   |  |  |
|----------------------------|----------|---|---|--|--|
|                            |          | LOW   | MODERATE  | HIGH   |  |
| DEGREE OF CULTURAL LOADING | LOW      | KABC-II Attentions<br>KABC-II Attentions Delayed<br>KABC-II Face Recognition<br>KABC-II Hand Wiggles<br>KABC-II Phonics Reasoning<br>KABC-II Trigrams<br>Cell Average: 93 | KABC-II Block Counting<br>KABC-II Number Recall<br>KABC-II Rebus<br>KABC-II Rebus Delayed<br>Cell Average: 95 |  |  |
|                            | MODERATE |   | KABC-II Conceptual Thinking<br>KABC-II Boxes<br>KABC-II Word Order<br>Cell Average: 85                        |  |  |
|                            | HIGH     |   |   | KABC-II Expressive Vocabulary<br>KABC-II Riddles<br>KABC-II Verbal Knowledge<br>Cell Average: 95 |  |
|                            |          |   |   |  |  |
|                            |          |   |   |  |  |

T-Score to Standard Score Converter: T-Score here = Standard Score here → Use/enter this score in the matrix.

---

---

---

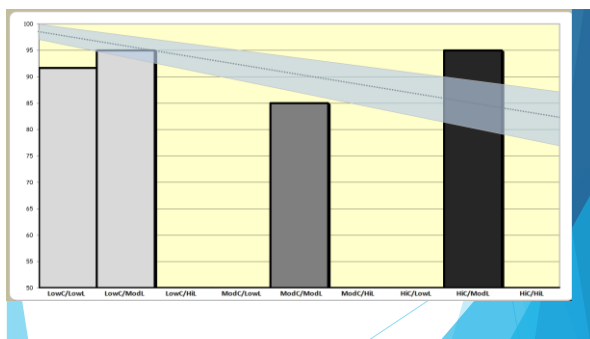
---

---

---

---

---




---

---

---

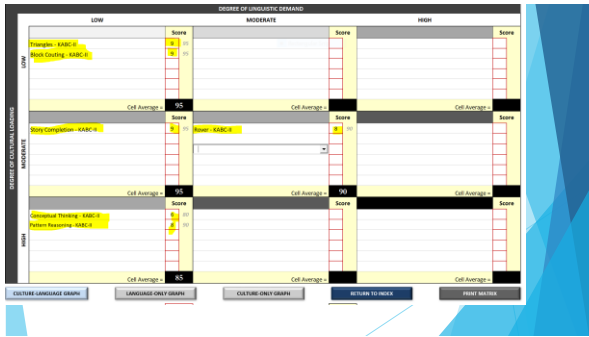
---

---

---

---

---




---

---

---

---

---

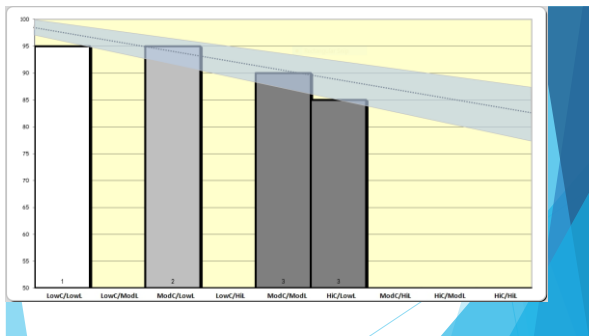
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---

## Limitations

- SES data was not collected or observed along with scores
- All ages and data points from all subtests were not analyzed
- Sample take from charter schools only, not all schools
- EL status was not analyzed and compared to scores

---

---

---

---

---

---

---

---

---

---

## Why the emphasis on Formal Reasoning in assessment?

Formal reasoning is easier to measure, less disputable

Regression to the belief that Formal Reasoning/Fluid Reasoning is the best predictor of life success and academics

Measurement of psychological concepts as they relate to education have not been fully researched.

Too much emphasis on language and not enough understanding of how culture truly impacts reasoning and academics.

(Johnson & Blair, 1991; Serpell, 2017)

---

---

---

---

---

---

---

---

## Questions?

---

---

---

---

---

---

---

---

## Romstad Assessment of Informal Nonverbal Reasoning - RAINR

RAINR was created and piloted in 2018/19.

Currently being field tested and normed.

Measurement of Informal Reasoning abilities.

Three main attributes of the RAINR:

- **Test items are more concrete and contextual** - Very Low demand for abstraction of general ideas and concepts to solve problems.
- **Test items require more inductive, hypothesis-driven problem solving** - A less deductive approach to problem solving is employed to solve problems. This promotes the *learn-by-doing* concept to be successful
- **Test items are common for many, are relevant, and would be done in the real-world** - Impractical and novel reasoning to solve a novel problem is not needed for test items.

RAINR piloting version is comprised of 5 subtests.

---

---

---

---

---

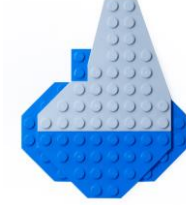
---

---

---

## Object Assembly

Examinee is given a set of building pieces and told to make the design they are shown by selecting only the correct pieces they need and assembling them, precisely.




---

---

---

---

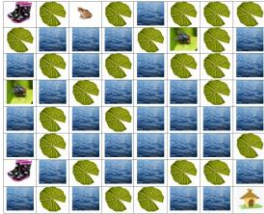
---

---

---

## Toad's Adventure

Examinee finds the quickest way home for Toad on a game board while taking into account four different variables that impact its trip.




---

---

---

---

---

---

---

## Block Towers

Examinee must analyze and identify blocks described by Examiner (Items 1-7)

Examinee must analyze and understand the physical dynamics of a tower of blocks and determine which blocks can be removed without the tower falling over.




---

---

---

---

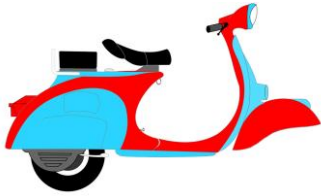
---

---

---

### Missing Pieces

Examinee must observe a common situation and identify the "missing piece," or, the part that is needed for the picture to make sense.




---

---

---

---

---

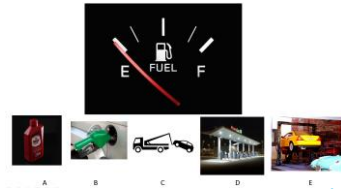
---

---

---

### Analytical Thinking - Problem Solving

Problem Solving - Examinee must observe a problem or situation and identify the needed item(s) to solve the problem, from choices provided.




---

---

---

---

---

---

---

---

### Analytical Thinking - Object Creation

Object Creation - Examinee must observe an object and select the needed item(s) to create that object, from choices provided.




---

---

---

---

---

---

---

---

## Current Field Testing

- Caucasian - 35
- Ages 5 - 16 years of age
  - 19 males
  - 16 females
- Non-Caucasian - 60
- Ages 5 - 16 years of age
  - 38 males
  - 22 females
- Ethnic categories
  - 26 African American
  - 13 Latino
  - 21 Asian/ Other

---

---

---

---

---

---

---

---

## Research Questions

1. Which subtests showed a significant difference in performance between the white and non-white groups?
2. How do the different racial/ethnic groups perform on the subtests?
3. In the non-white group, what are the correlations between the Reasoning subtests and performance on the WISC V GI?
4. How does parent education level/SES relate to performance on the test?

---

---

---

---

---

---

---

---

## Research Questions 1 & 2

- ▶ Demographic matches were analyzed
- ▶ Demographic matches determined by:
  - Parental Education Level/SES
  - Age
  - Gender\* (in some cases)

---

---

---

---

---

---

---

---

1. Which subtests showed a significant difference in performance between the white and non-white groups?

No significant differences found between groups.

| Caucasian | Block Towers | Missing Pieces | Object Assembly | Toad's Adc. | A. Thinking Prob. Solve | A. Thinking Object. Cr. | Mean Raw Total |
|-----------|--------------|----------------|-----------------|-------------|-------------------------|-------------------------|----------------|
| Mean      | 17.78        | 18.30          | 23.52           | 23.27       | 18.76                   | 18.82                   | 117.21         |
| St. Dev.  | 4.50         | 5.81           | 5.21            | 8.67        | 8.54                    | 8.10                    | 35.53          |
| N         | 27           | 33             | 33              | 33          | 33                      | 33                      | 33             |

| Non-Caucasian | Block Towers | Missing Pieces | Object Assembly | Toad's Adventure | A. Thinking Prob. Solve | A. Thinking Object. Cr. | Mean Raw Total |
|---------------|--------------|----------------|-----------------|------------------|-------------------------|-------------------------|----------------|
| Mean          | 17.92        | 18.74          | 23.65           | 21.74            | 19.77                   | 19                      | 117.28         |
| St. Dev.      | 5.87         | 4.49           | 4.85            | 8.76             | 7.40                    | 7.94                    | 33             |
| N             | 37           | 46             | 46              | 46               | 45                      | 45                      | 46             |

---

---

---

---

---

---

---

---

2. How do the different racial/ethnic groups perform on the subtests?

Asian Compared to Caucasian

| Asian    | Block Towers | Missing Pieces | Object Assembly | Toad's Adventure | A. Thinking Prob. Solve | A. Thinking Object. Cr. | Mean Raw Total |
|----------|--------------|----------------|-----------------|------------------|-------------------------|-------------------------|----------------|
| Mean     | 15.29        | 18.87          | 23.93           | 19.93            | 18.57                   | 19.64                   | 107            |
| St. Dev. | 5.38         | 4.47           | 4.76            | 9.35             | 7.98                    | 7.32                    | 31             |
| N        | 7            | 15             | 15              | 15               | 14                      | 14                      | 14             |

| Caucasian | Block Towers | Missing Pieces | Object Assembly | Toad's Adventure | A. Thinking Prob. Solve | A. Thinking Object. Cr. | Mean Raw Total |
|-----------|--------------|----------------|-----------------|------------------|-------------------------|-------------------------|----------------|
| Mean      | 17.36        | 16.6           | 23.2            | 21.93            | 18.87                   | 20.73                   | 114.1          |
| St. Dev.  | 5.43         | 5.87           | 5.51            | 10.28            | 9.21                    | 8.43                    | 40.30          |
| N         | 11           | 15             | 15              | 15               | 15                      | 15                      | 15             |

---

---

---

---

---

---

---

---

African American compared to Caucasian

| African American | Block Towers | Missing Pieces | Object Assembly | Toad's Adventure | A. Thinking Prob. Solve | A. Thinking Object. Cr. | Mean Raw Total |
|------------------|--------------|----------------|-----------------|------------------|-------------------------|-------------------------|----------------|
| Mean             | 17.11        | 18.16          | 22.84           | 21.95            | 18.79                   | 19.58                   | 119.53         |
| St. Dev.         | 6.54         | 4.39           | 4.54            | 9.52             | 6.48                    | 8.92                    | 31.14          |
| N                | 19           | 19             | 19              | 19               | 19                      | 19                      | 19             |

| Caucasian | Block Towers | Missing Pieces | Object Assembly | Toad's Adventure | A. Thinking Prob. Solve | A. Thinking Object. Cr. | Mean Raw Total |
|-----------|--------------|----------------|-----------------|------------------|-------------------------|-------------------------|----------------|
| Mean      | 17.38        | 19.05          | 23.89           | 24.47            | 17.16                   | 20.11                   | 119.32         |
| St. Dev.  | 4.77         | 5.31           | 4.95            | 7.53             | 7.75                    | 8.45                    | 32.34          |
| N         | 16           | 19             | 19              | 19               | 19                      | 19                      | 19             |

---

---

---

---

---

---

---

---



### Latino compared to Caucasian

| Latino  | Block Towers | Missing Pieces | Object Assembly | Toad's Adventure | A. Thinking Prob. Solving | A. Thinking Object Cr. | Mean Raw Total |
|---------|--------------|----------------|-----------------|------------------|---------------------------|------------------------|----------------|
| Mean    | 20.5         | 19.33          | 24.58           | 23.67            | 22.75                     | 17.33                  | 128.17         |
| St. Dev | 4.19         | 4.89           | 5.60            | 6.77             | 7.89                      | 7.39                   | 27.76          |
| N       | 12           | 12             | 12              | 12               | 12                        | 12                     | 12             |

| Caucasian | Block Counting | Missing Pieces | Object Assembly | Toad's Adventure | A. Thinking Prob. Solving | A. Thinking Object Cr. | Mean Raw Total |
|-----------|----------------|----------------|-----------------|------------------|---------------------------|------------------------|----------------|
| Mean      | 17.91          | 20.42          | 24.42           | 24.42            | 21.33                     | 20                     | 127            |
| St. Dev   | 3.99           | 6.16           | 4.08            | 5.92             | 8.18                      | 8.81                   | 29.87          |
| N         | 11             | 12             | 12              | 12               | 12                        | 12                     | 12             |

### 3. In the non-white group, what are the correlations between the Reasoning subtests and performance on the WISC V Gf?

- Existent but do not indicate that they measure the exact same thing.
- RAINR and the WISC-V share a common relation to G.
- Each measuring this in it's own way, however.

|                |                     | WISCV_MR_RS | WISCV_FW_RS |
|----------------|---------------------|-------------|-------------|
| PBJ_Assy_RS    | Pearson Correlation | .650**      | .532**      |
|                | Sig. (2-tailed)     | .000        | .001        |
|                | N                   | 35          | 34          |
| Toad_Frog_RS   | Pearson Correlation | .572**      | .638**      |
|                | Sig. (2-tailed)     | .000        | .000        |
|                | N                   | 35          | 34          |
| Blk_Tow        | Pearson Correlation | .547**      | .747**      |
|                | Sig. (2-tailed)     | .003        | .000        |
|                | N                   | 27          | 26          |
| Miss_P_RA      | Pearson Correlation | .426*       | .099        |
|                | Sig. (2-tailed)     | .011        | .579        |
|                | N                   | 35          | 34          |
| AT_ProbSolv_RS | Pearson Correlation | .556**      | .504**      |
|                | Sig. (2-tailed)     | .001        | .002        |
|                | N                   | 35          | 34          |
| AT_ObjCre_3RS  | Pearson Correlation | .501**      | .494**      |
|                | Sig. (2-tailed)     | .002        | .003        |
|                | N                   | 35          | 34          |

### Further information

- Asian Sample size, so far, is predominantly 2<sup>nd</sup> generation S.E. Asian immigrant/refugees (Hmong, Laotian, Thai).
- African American Population is comprised of half Somali-American examinees.
- Performance between African-American and Somali-American indicates, overall, equivalent performance when appropriately matched.
- Latino sample includes Mexican-American and Colombian-American children.

## SES and Formal Reasoning performance

SES can impact what a person is being exposed to, which will shape cognition

- High-Quality day care and experiences between birth and pre-school/Kindergarten are predictors of cognitive performance (Downer & Pianta, 2006)
- Study found that high-quality daycare alone can impact a students cognitive performance and academic success from K - 2<sup>nd</sup> grade (Feinberg-Peiser, Burchinal, Clifford, Culkin, Howes, Kagen, & Yazejian, 2001).
- Peasant farmers of Luria's work were much more utilitarian in thinking, which is why they did poorly in his studies of object association, based on abstraction and conceptualization (Flynn, 2016).
- Cole's (2005) work with Mayan children suggested that their under privileged lifestyle was a factor in abstract word association/problem solving.

---

---

---

---

---

---

---

---

## Academic ways of thinking - Reasoning and Processing abilities

- ▶ When we limit our classroom interventions to academics we limit the support we are giving.
- ▶ Even if we find success after altering an assignment to a less formal style, we need to teach formal thinking, reasoning, and processing.
- ▶ Propagation of academic ideas and ways of thinking is key.
- ▶ Making formal reasoning as important as formal academics.
- ▶ MTSS pyramid for cognition?




---

---

---

---

---

---

---

---

## Ending Thoughts

"It is perhaps possible now, with the coming of postmodern thought that the cleansing science of values, insisted on by those who see science as beyond the influence of historical rhetoric, can be over. To see the rhetorical nature of psychology is to put psychology into a different historical narrative than the modern one of self-correcting, universal, and objective science. It is time to revise our theory. I wonder if good clinicians have not always known this" (Keen, 2001, p. 239).

In short: Times have changed, people have changed, our students have changed...our methods must evolve.

---

---

---

---

---

---

---

---

## References

- ▶ Chng, G., Wild, E., Hollmann, J., & Otterpohl, N. (2014). Children's evaluative skills in informal reasoning: The role of parenting practices and communication patterns. *Learning, Culture, and Social Interaction*, 3 (2), 88-97.
- ▶ Christensen, C., & Eistner, A. S. (1991). *Informal Reasoning in The Medical Profession*. (pp. 17-25). In J. Voss, D. Perkins, & J. Segal, *Informal Reasoning and Education*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- ▶ Cole, M. (2009). Cross-cultural and historical perspectives on the development consequences of education. *Human Development*, 48, 195-214.
- ▶ Diamond, J. (1997). *Guns, germs, and steel: The fates of human societies*. New York, NY: Norton & Company.
- ▶ Downer, J., & Puente, R. (2004) Academic and Cognitive Functioning in First Grade: Associations with Earlier Home and Child Care Predictors and with Concurrent Home and Classroom Experiences. *School Psychology Review*, 33, 11-30.
- ▶ Ferrer, E., O'Hare, E., & Bunge, S. (2009). Fluid Reasoning and The Developing Brain. *Frontiers in Neuroscience*, 3(1), 46-51 Retrieved on July 27, 2017, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC283616/>
- ▶ Flynn, J. R. (2014). *Does Your Family Make You Smarter? Nature, Nurture, and Human Autonomy*. Cambridge, UK: Cambridge University Press.
- ▶ Fox, M.C., & Witthum, A. L. (2013). A knowledge-based theory of rising scores on "culture-free" tests. *Journal of Experimental Psychology: General*, 142, 979-1000.
- ▶ Frederick, S. (2009). Why a high IQ doesn't mean you're smart. *Nale School of Management*. Retrieved on January 17, 2017, from <https://www.nyu.edu/content?cid=111006-high-ig-doesnt-mean-youre-smart>
- ▶ Hvitfeldt, C. (1984). Traditional culture, perceptual style, and learning: The classroom behavior of living adults. *Adult Education Quarterly*, 31, 45-77.

- ▶ Johnson, R., & Blair, J. (1991). *Contexts of Informal Reasoning: Commentary*. (pp. 131-150). In J. Voss, D. Perkins, & J. Segal, *Informal Reasoning and Education*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- ▶ Keen, E. (2001). *History of Ideas in American psychology*. Westport, CT: Praeger Publishers.
- ▶ Kathura, R., & Serpell, R. (1998). Standardization of the Panga Munthu Test: A nonverbal cognitive test developed in Zambia. *The Journal of Negro Education*, 47, 228-241.
- ▶ Kolowich, L. (2014). Why some of the most successful people aren't that "smart." Retrieved January 17, 2017, from <http://www.foxnews.com/story/2014/01/17/why-some-of-the-most-successful-people-arent-that-smart>
- ▶ Lawrence, J. A. (1991). Informal Reasoning in the Judicial System (pp. 59-81). In J. Voss, D. Perkins, & J. Segal, *Informal Reasoning and Education*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- ▶ Luria, A. R. (1973). *The working brain*. New York, NY: Basic Books.
- ▶ Marshak, H., & DeCapua, A. (2013). *Making the transition to classroom success: Culturally responsive teaching for struggling language learners*. Ann Arbor, MI: University of Michigan Press.
- ▶ Miller-Jones, D. (1989). Culture and Testing. *American Psychological Association*, 44, 360-364.
- ▶ Miller-Jones, D. (1991). *Informal Reasoning in Inner-city Children*. (pp. 107-130). In J. Voss, D. Perkins, & J. Segal, *Informal Reasoning and Education*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- ▶ Minnesota Department of Education (2017). Minnesota Data Center. Retrieved on August 8<sup>th</sup>, 2017, from <http://rc.education.state.mn.us/dmfc/data/p-1>
- ▶ Naglieri, J., Das, J.P., & Goldstein, S. (2012). Planning, attention, simultaneous, successive: A cognitive processing based theory of intelligence. (pp. 179-194). In D. Flanagan & P. Harrison, *Contemporary intellectual assessment: Theories, tests, and issues*. Spring Street, NJ: Guilford Press.
- ▶ Peisner-Feinberg, E., Burchinal, M., Clifford, R., Culkin, M., Howes, C., Kagan, S., & Vazirji, N. (2001). The Relation of Preschool Child-Care Quality to Children's Cognitive and Social Developmental Trajectories through Second Grade. *Child Development*, 72, 1534-1553.

- ▶ Perkins, D. N., Farady, M., and Bushey, B. (1991). *Everyday Reasoning and The Roots of Intelligence* (pp. 83-105). In J. Voss, D. Perkins, & J. Segal, *Informal Reasoning and Education*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- ▶ Roenstad, C., & Xiong, Z. B. (2017). Measuring Formal Intelligence in the Informal Learner: A Case Study of Hmong American Students and Cognitive Assessment. *Among Studies Journal*, 16, 1-31.
- ▶ Sadler, T. D. (2004). Informal reasoning regarding socio-scientific issues: A critical review of research. *Journal of Research in Science Teaching*, 41(5), 513-534.
- ▶ Salmon, M. (1991). *Informal Reasoning and Informal Logic* (pp. 83-105). In J. Voss, D. Perkins, & J. Segal, *Informal Reasoning and Education*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- ▶ Serpell, R. (2017). How the study of cognitive growth can benefit from a cultural lens. *Perspectives on Psychological Science*, 12(5), 889-899.
- ▶ Schoenfeld, A. H. (1991). On Mathematics as Sense-Making: An Informal Attack On the Unfortunate Dichotomy of Formal and Informal Mathematics (pp. 311-343). In J. Voss, D. Perkins, & J. Segal, *Informal Reasoning and Education*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- ▶ Teig, N., & Scherer, R. (2016). Bringing Formal and Informal Reasoning Together: A New Era of Assessment? *Frontiers in Psychology*. Retrieved September 15, 2017, from <http://journal.frontiersin.org/article/10.3389/fpsyg.2016.01097/full>
- ▶ Tweney, R. (1991). *Informal Reasoning in Science* (pp. 3-15). In J. Voss, D. Perkins, & J. Segal, *Informal Reasoning and Education*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- ▶ Voss, F. (1991). *Informal Reasoning and International Relations* (pp. 37-57). In J. Voss, D. Perkins, & J. Segal, *Informal Reasoning and Education*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- ▶ Voss, F., Perkins, D., & Segal, J. (1991). *Informal Reasoning and Education*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.