An Evidence-based Comparison of Cognitive Ability & Intelligence Tests in Identification of Gifted Learners

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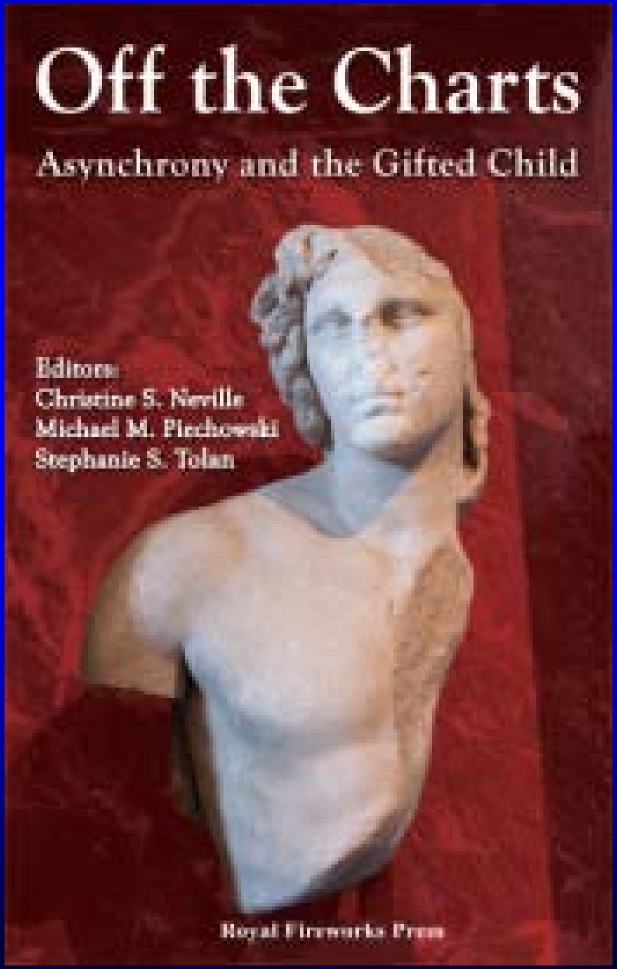
Purpose of this Presentation

- Introduce the concept of application-centered psychometrics
- *Provide you with evidence-based information to enable you to make more informed decisions about ability and intelligence test usage with gifted learners*
- Provide an independent, objective alternative to test authors/publishers test presentations and promotions

Sources of Evidence

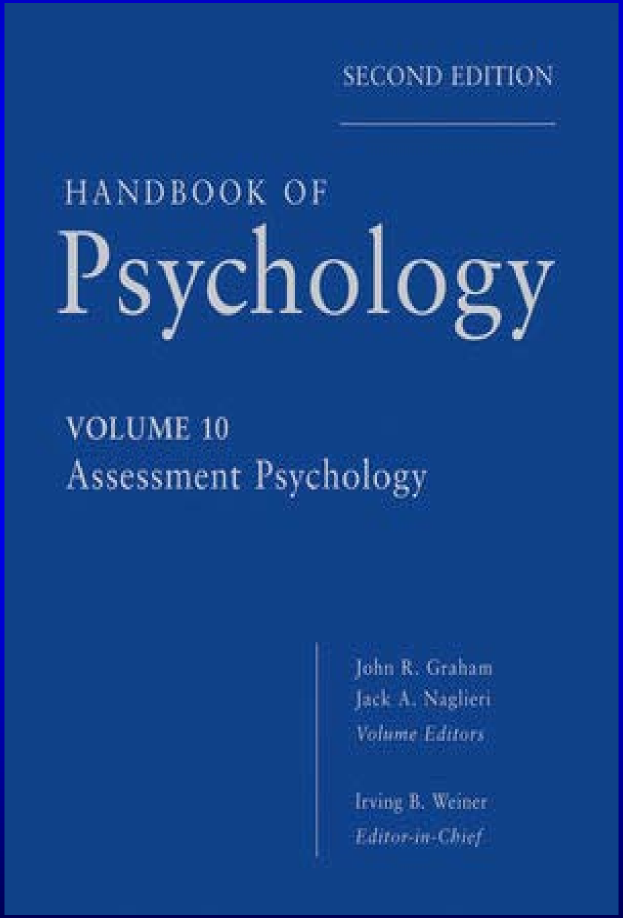
- Test technical manuals and supplemental test materials from test publishers
- *Both published and unpublished studies, as noted*
- There are exceptionally few studies directly comparing tests, as they serve the gifted

Additional Resources



- **Some of the information in this presentation may also be found in two chapters by Wasserman in *Off the Charts: Asynchrony and the Gifted Child* (2013) available from Royal Fireworks Press**
- **Available from http://www.rfwp.com**

Additional Resources



- **Relevant fundamental psychometrics are discussed in a Wasserman & Bracken chapter in *Handbook of Psychology, 2nd ed.* (2013)**
- **Available from http://www.wiley.com/ or http://online library.wiley.com**

In descending order of usage (Robertson et al., 2011)

Seven Intelligence Tests Considered

1. **Wechsler Intelligence Scales for Children (WISC-IV; Wechsler, 2003a, 2003b)**
2. **Woodcock-Johnson Tests of Cognitive Abilities (WJ III NU Cog; Woodcock, McGrew, & Mather, 2001, 2007)**
3. **Stanford-Binet Intelligence Scales (SB5; Roid, 2003a, 2003b, 2003c)**
4. **Differential Ability Scales (DAS-II; Elliott, 2007a, 2007b, 2007c)**
5. **Kaufman Assessment Battery for Children (KABC-II; Kaufman & Kaufman, 2004)**
6. **Cognitive Assessment System (CAS; Naglieri & Das, 1997a, 1997b)**
7. **Reynolds Intellectual Assessment Scales (RIAS; Reynolds & Kamphaus, 2003)**

Two Group Ability Tests Considered

1. **Cognitive Abilities Test (CogAT Form 7; Lohman, 2012)**
2. **Otis-Lennon School Ability Test (OLSAT 8th edition; Otis and Lennon, 2003)**

Mcclain, M.-C., & Pfeiffer, S. (2012). Identification of gifted students in the United States today: A look at state definitions, policies, and practices. *Journal of Applied School Psychology, 28,* 59-88.

Robertson, S. G., Pfeiffer, S. I., & Taylor, N. (2011). Serving the gifted: A national survey of school psychologists. *Psychology in the Schools, 48(8),* 786-799.

Disclosure Statement

- The presenter <u>does not</u> have any financial interests in any of the tests or books discussed
- *The presenter was an employee of Riverside Publishing and The Psychological Corporation (now Pearson) and did research and development work on several associated tests (SB5, WJ III, CAS, NNAT)*

State of education in Gifted Program Eligibility

Intelligence still leading criterion

- **Almost all current state definitions of *gifted and talented* list intellectual giftedness as a constituent element, more than any other examined.**
- ***IQ or ability scores are the most frequently required eligibility criterion for gifted and talented programs, even as a majority of states adopt <u>multiple criteria identification models</u> (National Association for Gifted Children, 2011).***

Mcclain and Pfeiffer (2012)

Survey of 48 State Gifted Policies

In their survey, Mcclain and Pfeiffer (2012) reported

- ***90 percent of state definitions include intelligence as an area or category of giftedness***
- **Only 32 percent of states mandate use of intelligence tests**
- ***"All 50 states have moved beyond the policy of permitting a single IQ score to, alone, determine whether a student is gifted" (p. 76).***

Application-Centered Psychometrics: Definition and Examples

***If a test is intended for use with gifted learners, then its psychometric qualities should be demonstrated with samples of gifted learners*.**

With gifted program identification as the application

Application-Centered Psychometrics

- Most test psychometrics are based on the vast majority of the normative sample (96% of which earns an IQ between 70 and 130)
- *Application-centered psychometrics* simply asserts that evidence of test score reliability, validity, and fairness should be reported for the special population of interest (i.e., gifted and near-gifted students for our purposes)

Application-centered psychometrics

Test Score Reliability as an example

- The idea that reliability is a fixed property of a test or scale has been described as the primary myth about reliability still ubiquitous in test manuals.
- "Reliability is a property of the scores on a test <u>for a particular population of examinees</u>" (Leland Wilkinson and the APA Task Force on Statistical Inference, 1999, p. 596)

Application-centered psychometrics

Test Score Reliability as an example

- **"The traditional reliability coefficient that describes how a test works for an entire group (such as all children of a particular age) may be an inappropriate guide to selecting tests for individual children who are near either the low or the high end of the ability distribution for their age" (Colin D. Elliott, 2007, p. 123)**

Elliott, C. D. (2007). *Differential Ability Scales, Second Edition. Introductory and technical handbook.* Minneapolis, MN: Pearson.

Application-centered psychometrics

Test Score Validity as an example

- Spearman's (1927) "law of diminishing returns" states that the "*g*" saturation of cognitive ability tests decreases as a function of ability or age.
- ***SLODR implies that "g" loadings of test scores will be lower for high ability groups, such as the intellectually gifted.***
- More than 150 independent scientific investigations have investigated SLODR in the last eight decades, with the majority (but not all) yielding supportive results.

Does more "*g*" determine intellectual giftedness?

Test Score Validity as an example

David Wechsler (1958, p. 110) accepted SLODR and believed that very high intelligence was not due to "*g*" but to some unspecified special ability:

> **"The lower ceiling of the [Wechsler intelligence scales] is no accident but represents the author's deliberate attempt to eschew measuring abilities beyond points at which he feels they no longer serve as a valid measure of a subject's general intelligence. IQ's of 150 or more may have some discriminative value in certain fields, such as professional aptitude, but only as measures of unusual intellectual capacity. Intellectual ability, however, is only partially related to general intelligence. Exceptional intellectual ability is itself a kind of special ability."**

Does more "g" determine intellectual giftedness?

Test Score Validity as an example

- **The point is that we cannot assume that the characteristics of test scores in the middle ranges of performance are identical to those in the more extreme gifted ranges.**
- ***Application-centered psychometrics simply implies that the only way to know what is happening in the upper extremes is to do the analyses and report the results.***

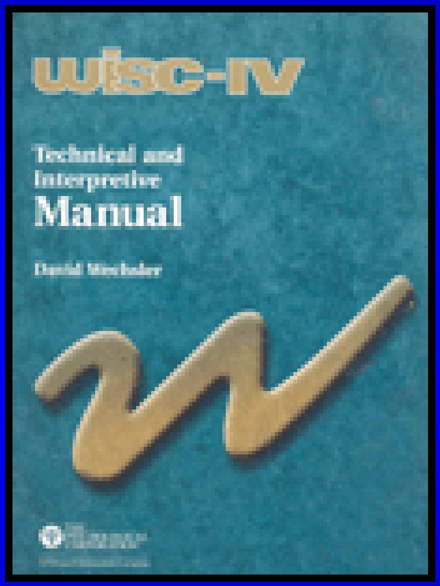
Wasserman (2010) NAGC Aspirations Paper

Application-Centered Psychometrics

1. Develop high ability (extended) norms
2. Raise test and subtest ceilings
3. Calibrate items on high ability samples
4. Ensure adequate difficulty gradients
5. Discriminate levels of giftedness
6. Discriminate types of giftedness
7. Validity of discontinue rules with gifted
8. Academic consequential validity (GT curriculum)
9. Reliability with gifted samples
10. Reliability near GT decision-making ranges
11. Fairness demonstrated in high ability samples
12. Prop. identification of minorities reported

WISC-IV Supplemental Materials for Gifted

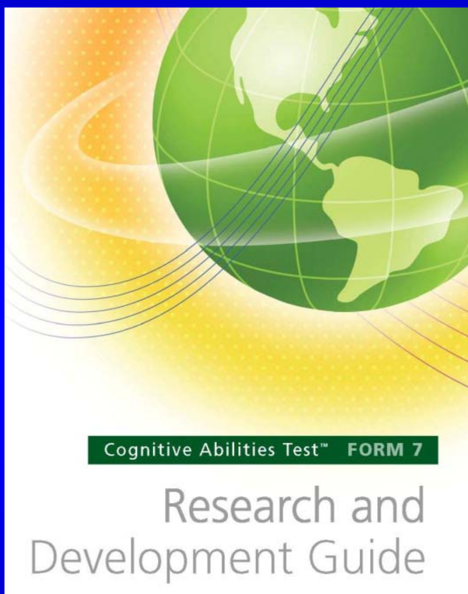
Application-Centered Psychometrics



- Alternative composite index to improve identification of gifted learners: General Ability Index (GAI)
- *Test score reliability is reported with gifted samples (Wechsler, 2003, p. 36).*
- Subtest ceilings have been raised from 19 to 28 in separate extended norms.
- Composite score norms have been extended upward from 160 to 210 (Zhu, Cayton, Weiss, & Gabel, 2008).
- These advances for gifted learners deserve applause.

CogAT 7 Technical Advances for ELL/Gifted

Application-Centered Psychometrics



- **The CogAT 7 offers several important innovations at its lowest levels (5/6 to 8) that may potentially solve the challenge of identifying gifted ELL students**
  - **All but one of nine picture-based subtests can be solved without specific item prompts, based on generic instructions in English or Spanish**
  - **Recognizes that even verbal items do not require extended instructions**
- **Local reliabilities in gifted ranges through Conditional Standard Errors of Measurement**

Consumers need to ask for it

Application-Centered Psychometrics

- The presenter believes it is very reasonable for test consumers (e.g., school systems and advocacy groups) to ask test authors and test publishers to provide application-centered psychometric data (e.g., reliability, validity, fairness) to support the use of tests with gifted learners.
- *Some additional research will need to be conducted by test publishers.*

Consumers need to ask for it

Application-Centered Psychometrics

When test authors or publishers compile and report research on test performance with special populations (e.g., intellectual giftedness), our field is advanced.

Ability and intelligence tests with gifted learners

Application-Centered Psychometrics: Reviewing evidence

Gifted Studies in Test Manuals

- **Six of the nine ability/intelligence tests report special population studies with gifted children (RIAS, CogAT, and OLSAT do not so report)**
- ***These studies generally involve samples of students previously found eligible for GT programs and placed in gifted and talented programs, or sometimes simply IQ ≥ 130***
- **Most of these studies reflect conventional approaches, but tests taking different approaches may identify different types of gifted students.**

Basics of cognitive ability tests

Gifted Application vs Evidence

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Intended for gifted applications	Yes	Yes	Yes	Yes
Gifted evidential support presented	*n*=63	*n*=39 to 124	*n*=96	*n*=68

KABC-II	CAS	RIAS	CogAT7	OLSAT8
Yes	Yes	Yes	Yes	Yes
n=95	*n*=173	none	none in test technical materials	none in test technical materials

The case of RIAS (2006): No evidence

Advocacy without evidence

Gifted Education International 2006 Vol 21, pp 127-136

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the reynolds intellectual assessment scales (RIAS) and assessment of intellectual giftedness

Abstract

The Reynolds Intellectual Assessment Scales (RIAS) (Reynolds & Kamphaus, 2003) is a psychometrically sound, individually administered test of intelligence developed and standardized for ages 3 through 94 years. This article describes the goals for development of the RIAS and its underlying theory, emphasizing its applicability to the identification of intellectually gifted individuals. In addition, an overview of the test's administration and psychometric properties is provided.

The Reynolds Intellectual Assessment Scales (RIAS; Reynolds & Kamphaus, 2003) is a recently published, rapidly administered (25-35 minutes for most school-aged individuals), individually administered test of intelligence. Developed and standardized for ages 3 years to 94 years, the RIAS yields three intelligence scores, a Verbal Intelligence Index (VIX), a Nonverbal Intelligence Index (NIX), and a global Composite Intelligence Index (CIX), derived from the VIX and NIX. Co-normed verbal and nonverbal memory subtests are included as well but are considered to represent a related but separate construct that is not as strongly associated with general intelligence (defined more strongly as representing problem solving skill on the RIAS). The memory scores do not contribute to the calculation of the various intelligence indexes on the RIAS.1

Theory and Goals

The RIAS is based on the consensus findings of Cattell and Horn's (Horn & Cattell, 1966) theory of fluid and crystallized abilities and Carroll's (1993) three-stratum theory of intelligence (Reynolds & Kamphaus, 2005).

Email: crrh@earthlink.net.

- **A 2006 publication by the RIAS authors, both eminent scholars, argues for the use of RIAS in identifying gifted learners with no evidence at all**
- ***It seems hard to imagine how a contemporary case for applied test use can (or should) be justified in the absence of any evidential support***

The case of WJ III Cog: Independent criterion?

Advocacy with sloppy evidence

Mean WJ III scores

	RMM (2001) (*n*=102)	MF (2009) (*n*=34)
Gsm	122.5	113.0
Gf	122.1	117.4
Glr	120.9	104.9
Gc	120.3	115.3
Gv	117.1	114.4
Ga	116.1	111.4
Gs	115.4	111.2

- Rizza, McIntosh, & McCunn (2001) drew children from the WJ III stdz sample if GIA-Extended ≥125
- Margulies and Floyd (2009) recruited a sample <u>independently</u> identified as gifted, also requiring a WISC-IV FSIQ ≥125

The case of David Lohman and CogAT

Advocacy by Test Developers

- The lead author of CogAT7 presents a significant body of <u>scholarly</u> evidence regarding giftedness on his university website
- This evidential support is substantial, but it is ***<u>not</u>*** independent or objective; there is an obvious conflict of interests

http://faculty.education.uiowa.edu/dlohman/

Even more: Jack Naglieri and NNAT

Advocacy by Test Developers

From the article:

THE WALL STREET JOURNAL

NY SCHOOLS October 7, 2012, 9:39 p.m. ET

Big Change in Gifted and Talented Testing

By SOPHIA HOLLANDER

A new test for admission into New York City's gifted and talented program will account for the bulk of a student's score, upending a testing regime that a growing number of children had appeared to master.

In a broader overhaul than previously announced, the Naglieri Nonverbal Ability Test, also known as the NNAT, will count for two-thirds of a student's score, said city officials, who signed a three-year, $5.5 million contract with the testing company Pearson earlier this year. The Otis-Lennon School Ability Test, or OLSAT, which increasing numbers of children had prepared for intensely, will drop to a third of the total from 75%.

Lauren DeCicca for the Wall Street Journal

Janet Roberts, the director of education at Aristotle Circle, tutors a 3-year-old in pattern-completion questions for the gifted-and-talented exam.

City officials hailed the new test as a vast improvement. It relies on abstract spatial thinking and largely eliminates language, even from the instructions, an approach that officials said better captures intelligence, is more appropriate for the city's multilingual population and is less vulnerable to test preparation.

As a result, they expressed the hope that it would "improve the diversity of

Some experts have raised doubts about the NNAT's ability to create a racially balanced class. Several studies show the test produces significant scoring gaps between wealthier white and Asian children and their poor, minority counterparts.

"The NNAT is advertised as the gold standard ticket that will solve all your problems," said Carol Carman, associate professor in the School of Education at the University of Houston-Clear Lake who has studied the test. "I'm not sure that any test should advertise itself that way."

Pearson officials didn't respond to a request for comment.

Jack Naglieri, author of the test, said Ms. Carman's study was "fraught with problems."

"There have been people who have taken pot shots and used bad research to say I'm wrong," Mr. Naglieri said. "The goal of my test is to give everyone an equal opportunity to do well."

On the value of

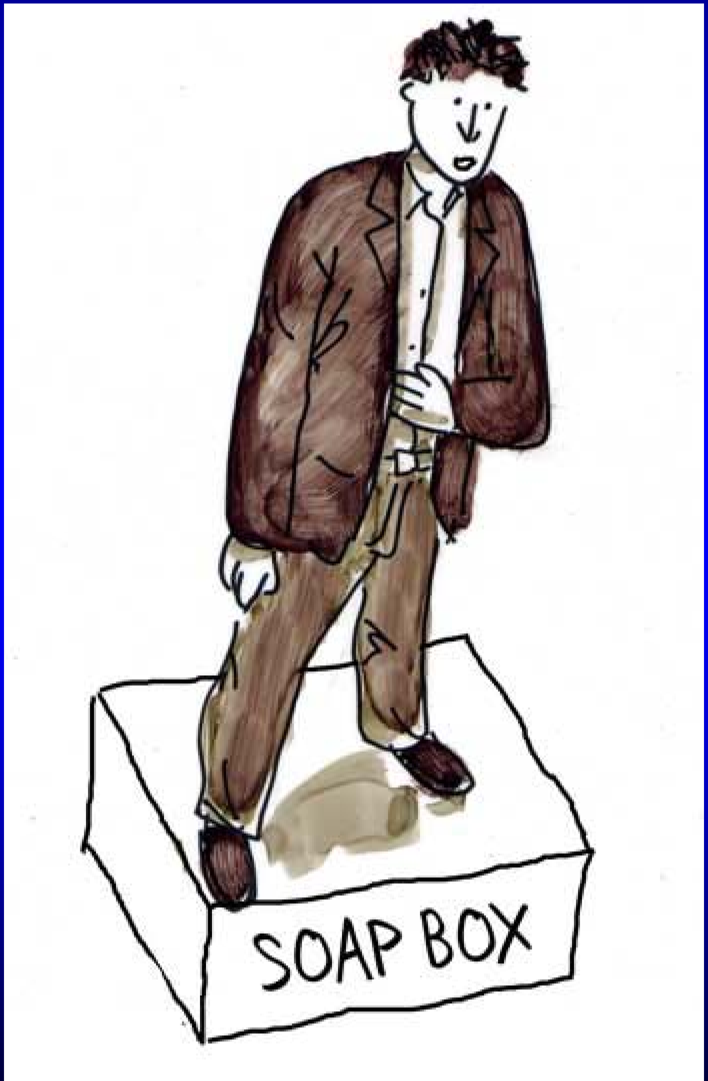
Independent, Objective Research

- The sale of tests to identify gifted learners is big $$$$ business
- *Advocacy for tests without evidence should be considered unacceptable*
- Advocacy for tests with scholarly evidence is much more desirable, but test authors have a conflict of interest
- *When was the last time you saw a critical article about a test from its author?*

On the value of
Independent, Objective Research

- Test authors and publishers appear intent on protecting their investments.
- *School districts across the country have an abundance of data on the identification of gifted learners that, if pooled, could answer many questions.*
- Educational psychometricians and indep. researchers can provide unique insights that go far beyond test manuals (see e.g., Carol E. George's 2002 dissertation on the NNAT).

Step down from soapbox



What are ability tests trying to measure?

Theoretical Emphases of the Tests

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Theoretical emphasis	Taps general ability "*g*" and verbal-nonverbal abilities	Seven-factor Cattell-Horn-Carroll model	Taps general ability "*g*"; five CHC abilities X verbal-nonverbal	Taps general ability "*g*"; seven CHC abilities; diagnostic abilities

KABC-II	CAS	RIAS	CogAT7	OLSAT8
Dual theory CHC / Lurian cognitive processing (CHC preferred with gifted)	Lurian cognitive processing; deemphasis on acquired knowledge	Brief measure of "*g*" and verbal-nonverbal abilities	General ability "*g*" especially 3 forms of fluid reasoning	General ability "*g*" and verbal-nonverbal abilities

What summary scores are derived?

Overall Test Composite Scores

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Overall composite	Full Scale IQ (FSIQ); General Ability Index (GAI)	General Intellectual Ability (GIA)	Full Scale IQ (FSIQ)	General Conceptual Ability (GCA)

KABC-II	CAS	RIAS	CogAT7	OLSAT8
Fluid Crystallized Index (FCI) or Mental Processing Index (MPI)	Full Scale standard score	Composite Intelligence Index (CIX)	Composite Standard Age Score (SAS); Mean (*SD*) of 100 (*16*)	Total School Ability Index (SAI); Mean (*SD*) of 100 (*16*)

All tests have a normative mean (*SD*) of 100 (*15*) unless otherwise noted.

With students independently identified as gifted

Mean Overall Composite Scores

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Mean (*SD*) score in gifted sample	FSIQ=123.5 (*8.5*)	GIA Std=116 (*10*); GIA Ext=118 (9)	FSIQ=123.7 (*9.0*)	GCA=125.4 (*10.3*); SNC=121.8 (*10.9*)

KABC-II	CAS	RIAS	CogAT7	OLSAT8
FCI=120.1 (*11.8*); MPI=118.7 (*11.9*)	FS=118.2 (*10.0*)	--	--	--

***Note*. Some regression toward the normative mean should always be expected. The reduced *SD*s probably result from test ceiling effects.**

With students independently identified as gifted

Mean Overall Composite Scores

- ❑ *Mean gifted group performance is highest on high "g" tests including DAS-II, SB5, and WISC-IV*
- ❑ **Mean gifted group performance is lower on cognitive processing tests like the KABC-II and CAS; note even for the KABC-II that the mean performance is higher when acquired knowledge is included (FCI=120.1) compared to processing tests only (MPI=118.7).**
- ❑ *Mean gifted group performance is lowest on the WJ III Cog (GIA Std=116), which my research has shown to be an especially poor measure of "g."*

***Note on methodology*: Most tests only require gifted program placement or IQ≥130 for inclusion in these studies. Differences between the samples can produce large differences in mean scores.**

Mean scores for students identified as gifted

Why Unavailable for Group Tests?

- Neither CogAT 7 nor OLSAT 8 technical materials report any research with giftedness, including mean scores in an independently identified gifted sample

Why?

- Group ability tests are often a central part of the criteria used to determine gifted program eligibility.

Beal (1996) OLSAT 6 Gifted Study

For *n*=155 third grade "gifted" students in Canada earning a WISC-III FSIQ ≥120 (Mean FSIQ=127.1):

OLSAT 6 Total SAI=122.6

Verbal SAI=120.6

Nonverbal SAI=121.7

Beal, A. L. (1996). A comparison of WISC-III and OLSAT-6 for the identification of gifted students. *Canadian Journal of School Psychology, 11(2),* 120-129.

Wasserman CogAT 6 GMU Sample

For *n*=58 second grade students applying for gifted program placement in Virginia earning a WISC-IV FSIQ ≥120 (*Mean* FSIQ=126.9, *SD*=5.7):

CogAT 6 Verbal SAS=116.8 (9.7)

Quantitative SAS=117.6 (9.0)

Nonverbal SAS.=119.2 (9.7)

Composite SAS=120.0 (7.9)

***Note*.** These students were administered the WISC-IV after having been found not eligible for advanced academic programs, possibly on the basis of their CogAT 6 scores. Accordingly, this sample should be considered an atypical "potentially gifted" sample because it excludes students who would have been admitted to a gifted program (without additional WISC-IV testing) on the basis of CogAT scores alone.

What are ability tests trying to measure?

Main Constructs in Test Scores

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Main constructs assessed (composite & factor names)	Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), Working Memory Index (WMI), Processing Speed Index (PSI)	Comprehension-Knowledge (Gc), Long-Term Retrieval (Glr), Visual-Spatial Thinking (Gv), Auditory Processing (Ga), Fluid Reasoning (Gf), Processing Speed (Gs), Short-Term Memory (Gsm)	Verbal IQ (VIQ), Nonverbal IQ (NVIQ); Fluid Reasoning (FR), Knowledge (KN), Quant. Reasoning (QR), Visual-Spatial Reasoning (VS), Working Memory (WM)	Verbal Ability, Nonverbal Reasoning Ability, Spatial Ability

KABC-II	CAS	RIAS	CogAT7	OLSAT8
Learning / Glr, Sequential/ Gsm, Simult. / Gv, Knowledge / Gc; Planning / Gf	Planning, Attn, Simultaneous Processing, Successive (PASS) Processing	Verbal Intelligence Index (VIX), Nonverbal Intelligence Index (NIX), Composite Memory Index (CMX)	Verbal SAS, Quantitative SAS, Nonverbal SAS	Verbal SAI and Nonverbal SAI

With students independently identified as gifted

Mean Cluster / Factor Scores

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Mean (*SD*) composite / factor scores (listed in descending order)	VCI=124.7 (11.0); PRI=120.4 (11.0); WMI=112.5(11.9); PSI=110.6 (11.5)	Gc=116 (10); Gf=115 (9); Gs=114 (17); Ga=113 (11); Gsm=109 (13); Gv=107 (11); Glr=103 (12)	VIQ=123.5 (8.8); VS=123.0 (11.3); NVIQ=122.2 (10.2); KN=121.7 (9.7); QR=121.6 (13.5); FR=121.0 (10.3); WM=115.8 (10.1)	Verb=125.4 (12.2); NVR=121.4 (12.8); Spat=117.8 (12.3); WMem=116.7(12.0); SchR=114.6 (9.0); PrSpeed=112.0 (13.3)

KABC-II	CAS	RIAS	CogAT7	OLSAT8
Knowl/Gc=118.4 (13.1); Sim/Gv=114.1 (13.9); Seq/Gsm=113.5 (13.8); Plan/Gf=113.4 (12.0); Learn/Glr=113.3 (12.3)	Sim=117.7 (11.5); Succ=115.8 (12.2); Plan=111.9 (11.8); Att=111.0 (12.6)	--	--	--

With students independently identified as gifted

Mean Cluster / Factor Scores

In multifactor batteries administered to independently-defined gifted samples

- ***Highest mean scores*** **tend to be in verbal acquired knowledge, followed by fluid reasoning (both high "*g*" abilities)**
- ***Lowest mean scores*** **tend to be in low "*g*" areas such as short-term memory and processing speed. This is even true for CAS, where Planning and Attention tasks are all speed-dependent.**

Can the test assess highly gifted?

Extended Norms / Test Ceilings

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Above range option	No	No	No	Yes
High ability norms	Yes	Yes	EXIQ only	Yes?
Ceiling scores (age 7:6)	FSIQ=160/210 GAI=160/210 (Std/Ext)	GIA (Ext)=200	FSIQ=160; EXIQ=225	GCA=170; SNC=170

KABC-II	CAS	RIAS	CogAT7	OLSAT8
Yes	No	No	Yes	Yes
No	No	No	No	No
FCI=160; MPI=160	FS=160 (Basic & Std. Batteries)	CIX=160	Composite SAS=160	Total SAI=150

A serious research challenge

The Ceiling Problem in Tests

- **Anytime that a subtest discontinue rule has not formally been reached by the end of the test, a ceiling effect has occurred and test results may underestimate the examinee's true ability level**
- ***Two tests (WISC-IV and WJ III NU Cog) have largely overcome the ceiling problem and extended IQ scores up through 200 or more***

Identification of highly gifted learners

Why do extended norms matter?

- Gifted learners above IQ of 130 are no more uniform and homogeneous than intellectually disabled learners with IQ below 70.
- *Without objective measurement, scientific study of highly gifted students, savants, and prodigies is made near impossible.*

Ability and intelligence tests

Practical Matters and Comparisons

Publication date, age range, and cost

Practical Comparisons as of 2013

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Year publish.	2003	2007	2003	2007
Age range	6:0-16:11	2:0-90:0	2:0-85:0	2:6-17:11
Cost per kit	$1069.00	$1036.50	$1087.00	$1237.00
Cost per admin.	$10.08	$4.76	$3.76	$7.45

KABC-II	CAS	RIAS	CogAT7	OLSAT8
2004	1997	2003	2012	2003
3:0-18:11	5:0-17:11	3:0-94:11	Grades K-12	Grades K-12
$925.00	$835.00	$440.00	NA	NA
$2.74	$4.40	$2.80	$6.31 (without scoring)	$5.60 (without scoring)

Conventional test administration

Administrative Comparisons

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Admin. time	65 to 80 minutes (10 core subtests); 95 to 110 minutes (all 15 subtests)	35 to 45 minutes (Standard Battery); 80 to 100 minutes (Extended Battery)	15 to 20 minutes (Abbreviated Battery); 45 to 75 minutes (Standard Battery);	30-40 minutes (Six core); 75 to 95 (Extended Battery)
Admin. formats	Verbal and visual presentation; timed tasks; blocks as manipulables	Verbal and visual presentation timed tasks; no manipulables	Verbal and visual presentation; liberal response time response limits; several types of manipulables	Verbal and visual presentation; timed tasks; several types of manipulables

Conventional test administration

Administrative Comparisons

	KABC-II	CAS	RIAS	CogAT 7	OLSAT 8
Admin. time	25-30 minutes (Core battery at youngest age) to 50-70 minutes (Core battery in adolescence); 35-55 minutes (Expanded battery at youngest age) to 75-100 minutes (Expanded battery in adolescence)	40 minutes (Basic); 60 minutes (Standard)	20-25 minutes (Core battery); 30 to 50 minutes (Core battery and CMX)	Primary levels are teacher-paced; higher levels permit 10 minutes per test to total about 90 minutes	Levels A and B are teacher-administered and paced, and testing time rarely exceeds 75 minutes. Levels C through H will typically require 60 to 75 minutes.
Admin. formats	Verbal and visual presentation; timed tasks; several types of manipulables	Verbal and visual presentation timed tasks; no manipulables	Verbal and visual presentation; liberal response time limits; no manipulables	Verbal and visual presentation; reading required	Verbal and visual presentation; reading required

Special purpose test administration

Administrative Options

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Abbreviated version	No, but see WASI-II	Yes, three-subtest BIA	Yes, two-subtest ABIQ	No
Nonverbal version	No, but see WNV	No, but see BCA-LV in diag. supp.	Yes, five subtest NVIQ	Yes, NV, NVR, and SNC in lieu of GCA
Online version	No	No	No	No

Special purpose test administration

Administrative Options

	KABC-II	CAS	RIAS	CogAT 7	OLSAT 8
Abbreviated version	No, but see KBIT-2	No	Yes, in two-subtest RIST	Three-subtest CogAT Form 7 Screening Form	No
Nonverbal version	Yes, NVI	No	Yes, two-subtest NIX	Nonverbal SAS; also primary subtests only use pictures	Nonverbal SAI
Online version	No	No	No	Yes	Yes

Spanish language administration

Administrative Options

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Spanish language version	WISC-IV Spanish (Wechsler, 2005)	Batería III Woodcock-Muñoz	No	Spanish Standard Sentences for subtests that do not require a verbal response; others require an interpreter

KABC-II	CAS	RIAS	CogAT7	OLSAT8
Contains Spanish-language instructions and correct answers in English and Spanish	Spanish adaptation developed by W. C. Rodríguez Arocho (Transl.).	Yes (Santamaría & Fernandez, 2008)	Spanish Directions for Administration	No

Ability and intelligence tests

Qualities of Standardization and Norms

Psychometric Development

Standardization Sample Collection

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Year normed	2001-2002	1996-1999 (recalculated normative update with 2005 census targets)	2001-2002	2000-2006 for pilots, tryout, stdz
Sampling strategy	Stratified	Multistage stratified random	Stratified random	Stratified
Stratification variables	Race, Parent Education, and Geographic region	Sex, Race, Hispanic status, Education of adults, Type of school/college, Occupation of adults, Community size, Geographic region	Race/Ethnicity, Geographic region, and Educational level	Race/Ethnicity, Parent education, Geographic region

Psychometric Development

Standardization Sample Collection

	KABC-II	CAS	RIAS	CogAT7	OLSAT8
Year normed	2001-2003	1993-1996	1999-2002	2010-2011	2002
Sampling strategy	Stratified random	Stratified random	Stratified	Stratified random selection of schools	Stratified random selection of school districts
Stratification variables	Ethnicity, Geographic region, Parent education level	Race, Hispanic origin, Region, Community, Parent education	Ethnicity, (Parent- or Self-) Educational attainment, and Geographic region	School district Geographic region, District enrollment, Socioeconomic status, and Public/Private status	Community socioeconomic status, Urbanicity, and Ethnicity

Psychometric Development

Standardization Sample Reporting

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Normative sample size	*N*=2,200 across 11 age levels (*note*: 50% of standardization examinees not administered Arithmetic subtest)	*N*=8,782 across 25 age levels (*note*: as many as 75% of examinees not given all tests [e.g., Planning] at every age level)	*N*=4,800 across 30 age levels	*N*=3,480 across 18 age levels
Weighting	Unweighted	Weighted	Unweighted	Unweighted
Full reporting of stratification breakdowns*	Yes	No	Yes	Yes
Sampling adequacy for minorities	Yes	Large undersampling of Hispanics corrected with weighting.	Yes	Yes

* Demographic breakdowns such as age x ethnicity x parent educational level.

Psychometric Development

Standardization Sample Reporting

	KABC-II	CAS	RIAS	CogAT7	OLSAT8
Normative sample size	*N*=3,025 across 18 age levels	*N*=2,200 across 9 age levels	*N*=2,438 across 16 age levels	*N*=52,237	*N*=445,500
Weighting	Unweighted	Unweighted	Weighted	Weighted	Weighted
Full reporting of stratification breakdowns*	Yes	Yes	Yes	No	No
Sampling adequacy for minorities	Yes	Yes	Yes	Undersampled African Americans and densely populated school districts.	Large urban undersampling

* Demographic breakdowns such as age x ethnicity x parent educational level.

Psychometric Development

Norms Generation Procedures

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Norms development	Cumulative raw score frequency distributions were normalized and smoothed	Continuous norming; individual subject weighting followed by bootstrap resampling followed by polynomial norm curve-fitting procedures to derive W-scores	Continuous norming; score distributions fitted by polynomial regression, followed by hand-smoothing within and across ages	Inferential norming; score distributions fitted to polynomial regressions with smoothing of minor irregularities
Bootstrapping	No	Yes	No	No
Types of Norms	Age only	Age & Grade	Age only	Age only
Printed norms	Yes	No	Yes	Yes

Psychometric Development

Norms Generation Procedures

	KABC-II	CAS	RIAS	CogAT 7	OLSAT 8
Norms development	Score distributions normalized; smoothing vertically (within age) and horizontally (across ages)	Score distributions normalized; smoothing vertically (within age) and horizontally (across ages)	Continuous norming; score distributions were fitted to polynomial regression equations accounting for 98 to 99% of variance in mean subtest performance	Raw scores converted to 2P IRT universal scaled scores; score distributions smoothed within age groups aided by bootstrap resampling with replacement.	Raw scores converted to Rasch-based scaled scores; scores for each age group were normalized and smoothed, with linear transformation to SAIs.
Bootstrapping	No	No	No	Yes	No
Types of Norms	Age only	Age only	Age only	Age & Grade	Age & Grade
Printed norms	Yes	Yes	Yes	Yes	Yes

Psychometric Derivation of …

Start and Discontinue Rules

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Derivation of start/basal rules	All start point items have pass rates of at least 95% in all relevant age groups	Not reported.	Basal rules designed to result in efficient testing time and accurate estimation of ability without sacrificing potentially credited item responses; no further details reported	Start point placed so that no more than a very small percentage of child would need to drop back.
Derivation of stop/ discontinue rules	Discontinue rules set after specified number of scores of 0 if proportion of examinees passing additional items less than 2%	Not reported.	For routing subtests, 95% of standardization sample achieved no additional raw score points beyond discontinue; no further details reported	Rasch-based probability of answering additional items correctly after failing a specified number of successive items; item sets and decision-points used rather than discontinue rules

Psychometric Derivation of …

Start and Discontinue Rules

	KABC-II	CAS	RIAS	CogAT 7	OLSAT 8
Derivation of start/basal rules	90% of examinees meet basal criterion at the recommended start point for their age	Not reported.	Start items and basal rules set so they result in reliabilities that are nearly equal to the reliabilities that would be obtained if all items were administered	Not applicable.	Not applicable.
Derivation of stop/ discontinue rules	Rasch-based probability of correctly answering additional items beyond discontinue rule examined, with discontinue rules determined by frequency distribution of additional points	Not reported.	Discontinue rules set to ensure that examinees would receive their maximum score; reliabilities nearly equal between all items administered and items with start/discontinue rule	Not applicable.	Not applicable.

Enhanced Interpretation with …

Empirically Linked/Conormed Tests

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Linkages & Conormed Tests	Linked to the WIAT-II (*n*=550) and WIAT-III (*n*=117)	Co-normed with WJ III NU Ach	Linked to WJ III Ach (*n*=472) and WIAT-II (*n*=80)	Linked to WIAT-II (*n*=371); WIAT-III (*n*=120); KTEA-II (*n*=85); WJ III Ach (*n*=85)

Enhanced Interpretation with …

Empirically Linked/Conormed Tests

	KABC-II	CAS	RIAS	CogAT 7	OLSAT 8
Linkages & Conormed Tests	Co-normed with KTEA-II	Linked to WJ-R (*n* = 1,600)	Co-normed with Reynolds All Range Reading Test; linked to the WRAT4 (*n*=410)	Co-normed with the Iowa Assessments	Co-normed with the SAT-10

Ability and intelligence tests

Evidence of
Test Score Reliability

On Psychometric Reliability

- *Reliability* is the psychometric characteristic that summarizes the consistency, accuracy, and uniformity of test scores across testing occasions, time, and samples.
- Reliability is essentially a measure of the trustworthiness of test scores. This issue is particularly critical in school districts in which a score range is part of the gifted placement decision-making process, since all test scores lie within a confidence band determined by measurement error.

Application-centered psychometrics

Test Score Reliability as an example

- The idea that reliability is a fixed property of a test or scale has been described as the primary myth about reliability still ubiquitous in test manuals.
- "Reliability is a property of the scores on a test for a particular population of examinees" (Leland Wilkinson and the APA Task Force on Statistical Inference, 1999, p. 596)

Application-centered psychometrics

Test Score Reliability as an example

- **“The traditional reliability coefficient that describes how a test works for an entire group (such as all children of a particular age) may be an inappropriate guide to selecting tests for individual children who are near either the low or the high end of the ability distribution for their age” (Colin D. Elliott, 2007, p. 123)**

Elliott, C. D. (2007). *Differential Ability Scales, Second Edition. Introductory and technical handbook.* Minneapolis, MN: Pearson.

Application-centered psychometrics

Test Score Reliability as an example

- **"The concerns associated with SEMs [and therefore test score reliability] are actually substantially worse for scores at the extremes of the distribution … Commonly the SEM is two to four times larger for very high scores than for scores near the mean" (Lohman & Foley Nicpon, 2012).**

Lohman, D. F., & Foley Nicpon, M. (2012). Ability testing and talent identification. In S. L. Hunsaker (Ed.), *Identification: The Theory and Practice of Identifying Students for Gifted and Talented Education Services* (pp. 283-335). Mansfield Center, CT: Creative Learning Press.

Reliability in gifted ranges on CogAT 7

Local Reliability: Conditional SEMs

Level	SAS Score Range	Verbal	Quantitative	Nonverb
8	130–139	7.2	4.1	5.2
8	140–160	7.6	4.0	5.1
9	50–69	4.8	5.7	5.6
9	70–79	4.4	5.4	5.2
9	80–89	3.9	4.8	4.7
9	90–99	3.8	4.0	4.5
9	100–109	4.2	3.8	4.9
9	110–119	4.8	4.1	5.5
9	120–129	5.6	4.5	6.4
9	130–139	5.7	5.0	7.0
9	140–160	5.8	5.2	7.4
10	50–69	4.9	6.2	6.2
10	70–79	4.6	5.7	5.6
10	80–89	4.3	4.7	4.9
10	90–99	4.4	4.1	4.6
10	100–109	5.0	3.9	4.9
10	110–119	5.6	4.2	5.5

- ***SEMs are inversely related to reliability***
- **SEMs for scale scores are smallest near the mean and largest in extreme, gifted ranges**
- ***The confidence interval with 95% confidence is the observed score ± (1.96*SEM).***

Ongoing identification process?

Stability of Gifted Score Elevations

Lohman (2012) writes, "For tests of general intelligence administered to elementary-age children, the drop-off after one year is about 50% of those children who scored in the top 3% on the first year … For every child who drops out of the top group, another moves into it. Changes are particularly great in the early elementary years."

Lohman, D. F. (2012). Decision strategies. In S. L. Hunsaker (Ed.), *Identification: The Theory and Practice of Identifying Students for Gifted and Talented Education Services* (pp. 217-248). Mansfield Center, CT: Creative Learning Press.

Lohman, D. F., & Korb K. (2006). Gifted today but not tomorrow? Longitudinal changes in ITBS and CogAT scores during elementary school. *Journal for the Education of the Gifted, 29,* 451-484.

Specific to gifted learners

Evidence of Test Score Reliability

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Internal consistency for gifted sample	**Yes** (p. 36 in tech manual)	**No**	**No**	**Yes** (p. 129 in tech hdbk)
Gifted range score stability	**No**	**No**	**No**	**No**
Local reliability (near +2 SD)	**No**	**No**	**No**	**Yes** (p. 134, 234+ in tech hdbk)

These indices tell how precise and how stable are gifted range scores.

Specific to gifted learners

Evidence of Test Score Reliability

	KABC-II	CAS	RIAS	CogAT7	OLSAT8
Internal consistency for gifted sample	No	No	No	No	No
Gifted range score stability	No	No	No	Yes (pp. 58-60 in Res. Guide)	No
Local reliability (near +2 SD)	No	No	No	Yes (Personal SEM & Conditional std errors)	No

These indices tell how precise and how stable are gifted range scores.

Across all school age students

Reliability Indices Meeting Criteria

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Percent of composite scores with median internal consistency ≥ .90	**80%** (median across all age groups)	**84%** across all age groups (includes extended battery and diagnostic supplement)	**100%** (median across all age groups)	**75%** (Early Years Battery); **88%** (School-Age Battery)
Percent of composite score test-retest correlations with corrected stability coefficient ≥ .90	**40%** across all ages	**Composite score stability not reported**	**50%** across all ages	**13%** across all ages

Across all school age students

Reliability Indices Meeting Criteria

	KABC-II	CAS	RIAS	CogAT7	OLSAT8
Percent of composite scores with median internal consistency ≥ .90	**100%** (average across all ages for ages 3-6); **63%** (average across ages for ages 7-18)	**50%** (median across all age groups); 40% for the Basic Battery; 60% for the Standard Battery	**100%** across all age groups	**80%** (Total VQN, Verbal, and Quantitative but not Nonverbal)	33% (Total SAI but not Verbal SAI or Nonverbal SAI)
Percent of composite score test-retest correlations with corrected stability coefficient ≥ .90	**26%** across all ages	**0%** (Basic Battery); 0% (Standard Battery)	**26%** across all ages	**0%** over span of 1 year	**None provided**

Across all school age students

SEM Score Reliability Evidence

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Overall composite mean SEM	2.7 FSIQ in standard score points	GIA (Std) is 3.00 GIA (Ext) is 2.60	2.1 FSIQ in standard score points	2.9 GCA and 3.0 SNC standard score points
Other composite mean SEMs	VCI is 3.8; PRI is 4.2; WMI is 4.3; PSI is 5.2	Gc=4.0; Glr=5.4; Ga=5.0; Gf=3.4; Gv=6.9; Gs=4.5; Gsm=5.4	VIQ=3.0; NVIQ=3.7; FR=5.0; Know=4.9; QR=4.7; VSP=4.7; WM=4.7	Verb Ability=5.0; Nonv Reas Ability=4.2; Spatial Ability=3.5; Schl Read.=5.1; W Memory=3.5; Proc Speed=4.8

Across all school age students

SEM Score Reliability Evidence

	KABC-II	CAS	RIAS	CogAT7	OLSAT8
Overall composite median SEM	3.0-2.8 FCI; 3.2-3.5 MPI; 4.2-4.8 NVI	3.1 FS Std; 5.4 FS Basic	3.0 CIX std score points	3.3 Composite SAS points	5.7 Total SAI points
Other composite median SEMs	Seq/Gsm=4.5-5.0; Sim/Glr=4.3-5.1; Lrn/Glr=4.0-4.3; Plan/Gf=5.3; Know/Gc=4.1-4.7	*Basic* Plan=5.7; Sim=5.0; Att=6.2; Succ=4.8; *Standard* Plan=5.1; Sim=4.3; Att=5.3; Succ=4.2	VIX=3.7; NIX=3.4; CMX=3.4	Verbal=4.8; Quant=4.3; Nonv=5.6; Screen=4.8 in SAS points	Verbal=5.6; Nonv=5.7 in SAI points

Some concluding observations

Evidence of Test Score Reliability

- Internal consistencies tend to be fairly adequate for most full range intelligence and ability tests (CAS and OLSAT 8 are lowest)
- *Few tests measure internal consistency in the gifted ranges (but DAS-II and CogAT 7 do), where reliability may fall considerably*
- Test-retest stability tends to be fairly low for most full range tests
- *Important questions about the stability of gifted range scores need to be researched*

Evidence of
Test Score Validity

On Test Score Validity

- The *validity* of a test score addresses its meaning and application, specifically the degree to which a test score measures what it purports to measure and not extraneous constructs.
- For students who are potentially academically gifted, a test valid for placement decisions should correctly identify students with the potential to succeed in a gifted classroom while rejecting students who are unlikely to succeed.

What abilities determine total composite score?

Review of Content: Abilities - 1

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Acquired knowledge	**30%** (based on 3 VCI subtests)	**20-24%** (based on 2 Gc tests and GIA Std/Ext weights ages 5-17)	**20%** (based on 2 Knowledge subtests)	**33%** (based on 2 Verbal Ability subtests)
Fluid reasoning	**20%** (based on 2 PRI subtests, PConc & MReas.)	**17-20%** (based on 2 Gf tests)	**20%** (based on 2 Fluid Reasoning subtests)	**33%** (based on 2 Nonv Reasoning subtests)
Math reasoning	**0%** (Arithmetic suppl.)	**8-9%** (Analysis-Synthesis; Number Series & Number Matrices suppl.)	**20%** (based on 2 Quant. Reasoning subtests)	**17%** (based on Seq. Quant. Reasoning subtest)

Which tests best capture prior learning?
Exceptional reasoning skills?
Mathematical precociousness?

continue

What abilities determine total composite score?

Review of Content: Abilities - 2

	KABC-II	CAS	RIAS	CogAT 7	OLSAT 8
Acquired knowledge	**20%** (based on 2 Gc subtests)	**0%**	**50%**	**33%** (based on Verbal subtests)	**~50%** (based on Verbal cluster)
Fluid reasoning	**20%** (based on 2 Gf subtests)	**~25%** (based on Kranzler & Keith, 1999)	**50%**	**33%** (based on Nonverbal subtests)	**~50%** (based on Nonverbal Cluster)
Math reasoning	**10-20%** (based on Rover and BlCounting subtests)	**0%**	**0%**	**33%** (based on Quant subtests)	**10- 31%** (based on Arith & Quant Reasoning)

Which tests best capture prior learning?
Exceptional reasoning skills?
Mathematical precociousness?

What processes drive the total composite score?

Review of Content: Processes - 1

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Auditory processing	**??** (possibly in Digit Span & LN Seq. subtests)	**9-12%** (based on 2 Ga tests and GIA Std/Ext weights ages 5-17)	**0%**	**0%** (Phono Processing subtest is suppl. diagnostic)
Visual processing	**10%** (based on Block Design subtest)	**8-10%** (based on 2 Gv tests)	**20%** (based on 2 Gv subtests)	**33%** (based on 2 Spatial Ability subtests)
Working memory	**20%** (based on Digit Span & LN Seq. subtests)	**13-15%** (based on 2 Gsm tests)	**20%** (based on 2 Working Memory subtests)	**0%** (Working Memory subtests are suppl. diagnostic)
Processing speed	**20%** (based on Coding & Symbol Search subtests)	**10-13%** (based on 2 Gs tests)	**0%**	**0%** (Processing Speed subtests are suppl. diagnostic)

Which tests to avoid for students with central auditory processing disorders? Which tests have the highest speed demands?

What processes drive the total composite score?

Review of Content: Processes - 2

	KABC-II	CAS	RIAS	CogAT 7	OLSAT 8
Auditory processing	**0%**	**0%**	**0%**	**0%**	**0%**
Visual processing	**20%** (based on 2 Gv subtests)	**??** (possibly simultaneous subtests, based on Kranzler & Keith, 1999)	**0%**	**9-10%** (based on Paper Folding subtest as a measure of Gv)	**0%**
Working memory	**20%** (based on 2 Gsm subtests)	**25%** (successive subtests, based on Kranzler & Keith, 1999)	**0%** (Memory subtests are optional)	**0%**	**0%**
Processing Speed	**0%**	**50%** (planning and attention subtests have high speed demands)	**0%** (Effects of time limits on Nonverbal subtests are unknown)	**0%** (lowest levels untimed; remaining levels10 minute per subtest time limit based on 75% student attempt of every item)	**0%**

Speed in Gifted Learners on the WISC-IV

The Processing Speed Problem

- In Wasserman's GMU gifted sample of *n*=219, defined by a consecutive series of students who earned WISC-IV FSIQ ≥120, we found that
  - A. In 59.4% of the sample, PSI is the lowest of the four index scores
  - B. In 47.5% of the sample, PSI falls in the average range or lower *AND* PSI is the lowest index score
- As Kaufman (1992) stated "it is well known that gifted children, as a group, don't excel quite as much in sheer speed" (p. 157).

Speed in Gifted Learners on the WISC-IV

The Processing Speed Problem

- **Processing speed contributes 20% to WISC-IV Full Scale IQ and will easily depress the FSIQ**
- **Mean PSI=110.6 (*SD*=11.5) in both the WISC-IV intellectually gifted research sample and my GMU Gifted Assessment Program sample (*n*=219, Mean PSI=110.4, *SD*=12.2) relative to Mean VCI of 124 (TPC) to 127 (GMU)**
- **Based on differences between index scores required for statistical significance (VCI-PSI critical value of 12.6 at p=.05 for all ages), <u>the average intellectually gifted student will show a relative weakness in processing speed</u>**

Additional forms of …

Evidence of Test Score Validity

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Developmental evidence	No	Yes	Yes	No
Exploratory factor analyses	Yes	No	No	No
Confirmatory factor analyses	Yes	Yes	Yes	Yes
Effect size std. difference typical/gifted	1.49 for FSIQ (Large)	Not reported	Not reported	1.74 for GCA; 1.44 for SNC (Large)

Additional forms of …

Evidence of Test Score Validity

	KABC-II	CAS	RIAS	CogAT7	OLSAT8
Dev’pmental evidence	No	No	Yes	No	No
Exploratory factor analyses	No	Yes	Yes	No	No
Confirmatory factor analyses	Yes	Yes	Yes	Yes	No
Effect size std. difference typical/gifted	~1.3 for FCI; ~1.2 for MPI (Large)	None	None	None	None

Correlations with intelligence/achievement tests

Evidence of Convergent Validity

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Intelligence tests	*r* =.83 to .86 with WASI FSIQ	DAS GCA, SB-IV, WISC-III, WPPSI-R FSIQ (median *r* =.73-.74)	WAIS-III, WISC-III, WJ III Cog, WPPSI-R FSIQ (median *r* =.82-.83)	WISC-IV with GCA yields *r* =.84; SNC has *r* = .78
Achievement tests	WIAT-II, WIAT-III Total (median *r* =.82-.87)	WJ III Ach Total Ach (r=.75 for GIA-Std and *r* =.76 for GIA-Ext)	WIAT-II Total, WJ III Ach Academic Applications (*r* =.80-.84)	KTEA-II, WIAT-II, WIAT-III, WJ III Ach Total (median *r* =.80)

Correlations with intelligence/achievement tests

Evidence of Convergent Validity

	KABC-II	CAS	RIAS	CogAT7	OLSAT8
Intelligence tests	KAIT, WISC-III, WISC-IV, WJ III Cog, WPPSI-III FSIQ (median FCI *r* =.81; median MPI r =.76-.77)	WPPSI-R, WISC-III FSIQ (median *r* =.66-.69)	WAIS-III, WISC-III, (median *r* =.75-.76)	*r* =.76 with WISC-IV FSIQ	None reported
Achievement tests	PIAT-R, WIAT II, WJ III Ach Total (median *r*=72-.73 for FCI; median r=.67-.69 for MPI)	CAS FS with WJ-R Skills *r* =.73-.74	RIAS CIX with WIAT Total Comp. (*r* =.69)	For the Composite SAS, median *r* =.82 with Iowa Assessments Complete Composite with Computation score; *r* =.70 with Reading Total; *r* =.73 with Math Total	For the Total SAI, median *r* = .68 with SAT10 Total Reading; median *r* =.73 with Total Math

Ecological Validity

- Ecological validity relates test performance to various aspects of person-environment functioning in everyday life.
- *Example*: In a sample *n* = 406, WISC-IV FSIQ correlates at *r* =.53 with teacher ratings on the Intellectual scale and *r* =.54 with teacher ratings on the Academic Ability scale of the Gifted Rating Scales (GRS-S), but less with the Leadership scale (*r* = .29).

Consequential Validity

- As formulated by Messick (1989, 1995), *consequential validity* refers to the actual and potential consequences of test use (e.g., disparate or discriminatory impact on protected groups)
- *After a comprehensive survey of validity research, Cizek, Bowen, and Church (2010) reported that consequential validity research was "essential nonexistent in the professional literature" (p. 732).*

Some concluding observations

Evidence of Test Score Validity

- **Ability and intelligence tests vary in the degree to which they measure knowledge, reasoning, and mathematical abilities**
- ***Tests vary in their auditory/visual processing demands and speed requirements***
- **All tests with gifted samples report large typical student – gifted student differences**
- ***Most tests report composite correlations r > .70 with other ability tests and achievement tests***

Some concluding observations

Evidence of Test Score Validity

<u>Highest mean test scores in gifted samples</u> **tend to be on high "g" tests with content emphasizing verbal acquired knowledge, followed by fluid reasoning (both high "*g*" abilities)**

<u>Lowest mean test scores in gifted samples</u> **tend to be on low "*g*" tests and cognitive processing tests, that tap processes such as performance speed**

Areas for future research

Evidence of Test Score Validity

- What about our tests predicts success in gifted curriculums?
  - Correlations with multiple indices of outcome in the gifted classroom and curriculum.
  - Effects of verbal, visual, learning, speed on classroom performance
- Does "*g*" still define giftedness at higher levels, or something else?
  - Structural invariance and g loadings to test Spearman's Law of Diminishing Returns.
  - Are all good "*g*" tests the same? Spearman's Indifference of the Indicator.

Ability and intelligence tests

Evidence of Test Score Fairness

On Test Score Fairness

- The broad concept of ***test fairness*** extends from the statistical properties of test items across particular groups through the application of test scores for decision-making, and finally extending through the consequential social impact of the decision.

On Test Score Fairness

- Test score ***bias*** is a statistically-identified problem that refers to systematic introduction of measurement error for a particular group of interest.
- ***Fairness*** refers in a more global sense to how test scores are used to make decisions.
- ***Equity*** refers to the societal values attached to intended and unintended consequences of using test scores to make decisions.

Conventional evidence of fairness

Fairness of Theory and Content

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Test theory addresses fairness	No	No	No	No
Bias content review panel	Yes	No	Yes	Yes

KABC-II	CAS	RIAS	CogAT7	OLSAT8
Yes	Yes	No	No	No
Yes	No	Yes	Yes	Yes

Conventional evidence of fairness

Statistical Indices of Fairness

	WISC-IV	WJ III NU Cog	SB5	DAS-II
DIF analyses reported	No	No (conducted but inadequately reported)	Yes	Yes (using IRT procedures)
Structural invariance reported	No	Yes	Yes	No
Reliability generalization	Yes (for special populations, but not race/ethnic groups)	No	No	Yes (for special populations, but not race/ethnic groups)

KABC-II	CAS	RIAS	CogAT7	OLSAT8
Yes	Yes	Yes	Yes	Yes
No	No	Yes	Yes	No
No	No	Yes	Yes	No

Conventional evidence of fairness

Fair Prediction and Outcome

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Equivalent prediction of achievement	No	No	Yes	Yes
Group mean score differences	Yes (published separately)	No	No	No

KABC-II	CAS	RIAS	CogAT7	OLSAT8
No	Yes	No	Yes	No
Yes	Yes (published separately in a series of Naglieri articles)	No	Yes	No

US DOE Office of Civil Rights

Minority Gifted Underrepresentation

- The problem of minority underrepresentation in gifted education programs has long been recognized and is the main reason for the rise of nonverbal tests in the identification process
- Any minority-group child who is or may be gifted is protected by civil rights laws that prohibit discrimination based on race or national origin.
- The Office of Civil Rights can be enormously effective in ordering school districts to change gifted identification practices.

Specific to gifted learners

Evidence of Test Score Fairness

	WISC-IV	WJ III NU Cog	SB5	DAS-II
Evidence of Proportionate identification in gifted programs	No	No	No	No

KABC-II	CAS	RIAS	CogAT7	OLSAT8
No	No	No	Yes	No

Ability and intelligence tests with gifted learners

Overview of Test Strengths and Limitations

Wechsler (2003) WISC-IV

Wechsler Intelligence Scale for Children

- Normed for ages of 6 to16 years
- Consists of 10 core and 5 supplemental subtests; the WISC-IV Integrated includes optional process-based subtests in each of the four factor-defined domains on the WISC-IV
- The Wechsler intelligence scales are decidedly atheoretical, beyond their emphasis on *g*, and in recent years they have exemplified a test in search of a theory.

WISC-IV Strengths

Wechsler Intelligence Scale for Children

1. **Far and away the industry standard for gifted assessment (Robertson, Pfeiffer, & Taylor, 2011)**
2. **Emphasizes reasoning and knowledge (60% of subtests) relative to processing capacity and speed (40% of subtests)**
3. **Offers the General Ability Index (GAI) as a purer measure of “g” than FSIQ**
4. **Extended Norms represent a technical innovation with huge implications for gifted learners**

WISC-IV (2003) Limitations, Part 1

Wechsler Intelligence Scale for Children

1. Some 40% of WISC-IV FSIQ allocated to cognitive efficiency, which is low "g" and of questionable predictive power for at least half of gifted students
2. Processing speed is a common relative weakness among gifted learners. In 47.5% of our GMU consecutive gifted referral sample, PSI falls in the average range or lower *AND* PSI is the lowest index score

WISC-IV (2003) Limitations, Part 2

Wechsler Intelligence Scale for Children

3. The inexplicable omission of Arithmetic as a test with high “g” from core subtests reduces the test’s capacity to detect mathematically precocious gifted students.
4. As the industry leader, the WISC must develop improved evidence of fairness and meaningful linkage to educational interventions if the construct of intelligence is to survive sociopolitical battles in education.

Woodcock, McGrew, & Mather (2001, 2007) WJ III NU Cog

WJ III NU Tests of Cognitive Abilities

- An assessment battery normed for ages 2 through 90 plus years and conormed with a leading achievement test, the WJ III NU Ach.
- Consists of two batteries: a 10-test standard battery and a 20-test extended battery. A *Diagnostic Supplement* includes an additional 11 tests.
- Based on the CHC theory of cognitive abilities.

WJ III NU Cog Strengths, Part 1

WJ III NU Tests of Cognitive Abilities

1. ***A study (n=34) by Margulies and Floyd (2009) with independent GT identification criteria showed Gf (mean=117.4, SD=9.9) and Gc (mean=115.3, SD=10.3) best differentiated gifted from nongifted matched students***
2. **The WJ III is technically progressive in its use of item response theory, including its pioneering applications of Rasch logit scores (transformed to W scores)**

WJ III NU Cog Strengths, Part 1

WJ III NU Tests of Cognitive Abilities

3. ***Conormed with industry-leader achievement test, the WJ III NU Tests of Achievement***
4. **Elegant exemplar of the Cattell-Horn-Carroll factorial model of cognitive abilities; however, no hierarchical exploratory factor analysis (of the type previously conducted by Carroll) has been yet published with the WJ III Cog**

WJ III NU Cog Limitations, Part 1

WJ III NU Tests of Cognitive Abilities

1. *Yields the lowest scores of all seven intelligence tests with known gifted samples (GIA Std=116, SD=10).*
2. **Numerous serious technical problems, including the need for a normative update a mere six years after initial publication and the absence of printed norms.**

WJ III NU Limitations, Part 2

WJ III NU Tests of Cognitive Abilities

3. *Largest contribution to GIA consistently comes from the Verbal Comprehension test (Gc), and Gf is "a rather weak, poorly defined factor" according to John Carroll (2003). GIA is most defined by knowledge.*
4. **A pattern of overstated claims, technical omissions, and selective reporting of research findings. See Wasserman & Maccubbin (2003) and Wasserman (2013).**

Roid (2003) SB5
Stanford-Binet Intelligence Scales

- Normed for ages 2 through 85+ years
- Consists of 10 subtests, with the tasks comprising subtests administered in an age-appropriate spiral omnibus format
- The SB5 features age-appropriate tasks and endeavors to integrate the CHC model with the traditional verbal-nonverbal dichotomy

SB5 Strengths

Stanford-Binet Intelligence Scales

1. The SB5 provides a good measure of the general ability factor, "*g.*" All SB5 subtests (9 out of 10) but Nonverbal Fluid Reasoning have high (>70) *g* loadings.
2. The spiral omnibus age-scale format keeps assessments varied, brief, and fast-moving.

SB5 Strengths
Stanford-Binet Intelligence Scales

3. In reporting the SB5 gifted sample (Roid, 2003), the test performs well with known gifted learners; however, in the Minton and Pratt (2006) study the SB5 performed quite poorly with WISC-III identified gifted learners
4. The Extended IQ score (EXIQ) is unresearched but promising.

SB5 Limitations, Part 1

Stanford-Binet Intelligence Scales

1. **Support is poor for the SB5 division of test content into verbal and nonverbal. Inexplicably, some nonverbal tests require the examinee to verbally express an answer (e.g., Picture Absurdities which is part of Nonverbal Knowledge). In hierarchical EFA, "… some of the SB-5 'nonverbal' subtests actually account for more verbal factor variance than nonverbal factor variance …" Canivez (2008, p. 539).**

SB5 Limitations, Part 2

Stanford-Binet Intelligence Scales

2. Factor analyses do not support the SB5 five factor interpretive structure (FR, KN, QR, VS, WM) (e.g., Canivez, 2008).
3. All Experimental Gifted Composites perform poorly (Minton & Pratt, 2006).
4. Only about 10 to 20% of the SB5 explicitly measures verbal knowledge of the type that is so predictive of academic success.

Elliott (2007) DAS-II

Differential Ability Scales-II

- offers efficient ability profiling divided into two overlapping batteries standardized for ages 2½ through 17 years
- consists of four core subtests (lower level) or six core subtests (upper level) for the Early Years Battery (ages 2:6-6:11) and six core subtests for the School-Age Battery (ages 7:0-17:11).
- developed to accommodate diverse perspectives, but it now aligns most closely with the Cattell-Horn-Carroll model

DAS-II Strengths, Part 1

Differential Ability Scales-II

1. Provides a superior measure of general ability (GCA) that effectively captures the abilities of known gifted learners in the test handbook's special population study (mean GCA=125.4 [*SD*=10.3]; see Elliott, 2007)
2. Psychometrically rigorous, advanced, and comprehensive relative to other intelligence tests; exceptionally well-constructed

DAS-II Strengths, Part 2

Differential Ability Scales-II

3. **Adequate specificity for all subtests and cluster scores for their individual interpretation independent of "g", thereby potentially facilitating identification of twice-exceptional students (Elliott, 2007)**
4. ***Co-norming of the Early Years Battery with the School-Age Battery for ages 5:0 to 8:11 permits earlier identification of gifted preschoolers***

DAS-II Limitations

Differential Ability Scales-II

1. ***Much subtest content appears redundant with the WISC-IV, probably explaining the similar results to assessment with the WISC-IV GAI***
2. **The Copying subtest, a paper and pencil measure of visual-motor integration, contributes to the GCA from ages 3:6 to 6:11 but does not effectively discriminate gifted from matched nongifted students (Elliott, 2007, pp. 186-187)**
3. **Needs independent research on giftedness**

Kaufman & Kaufman (2004) KABC-II

Kaufman Assessment Battery-II

- measures processing and cognitive abilities from age 3 years through 18 years and is conormed with the KTEA-II
- Depending on age and theoretical framework, batteries consist of 5 to 10 core subtests and 3 to 7 supplemental subtests.
- Developed with an unusual dual theoretical foundation, lending itself to interpretation with either the CHC framework or a Luria (PLSS) neuropsychological processing framework.

KABC-II Strengths

Kaufman Assessment Battery-II

1. Endeavors to minimize the impact of cultural and linguistic differences in assessment, reporting data showing lower group mean score differences between majority and minority groups
2. The Kaufmans continue to be progressive and innovative in their psychometric test development work
3. May well identify a different type of gifted learner than that identified with knowledge-loaded tests like the WISC-IV

KABC-II Limitations, Part 1

Kaufman Assessment Battery-II

1. **Processing subtests yield lower overall composite mean scores than traditional tests (mean KABC-II FCI=120.1 [11.8] and MPI=118.7 [11.9] in gifted sample, replicating K-ABC findings (e.g., McCallum, Karnes, & Edwards, 1984; Naglieri & Anderson, 1985)**
2. **Dual theoretical foundation (CHC and Luria) is unusual and raises issues about construct validity**

KABC-II Limitations, Part 2

Kaufman Assessment Battery-II

3. **Contents and processes involved in subtest performance not always clear; for example, the Rover subtest was designed to measure Planning/Gf but ended up on Simultaneous/Gv scale on the basis of factor analyses.**
4. **Needs independent research with gifted**

Naglieri & Das (1997) CAS

Cognitive Assessment System

- cognitive processing battery intended for use with children and adolescents 5 through 17 years of age.
- available in two batteries: an eight subtest basic battery and a twelve subtest standard battery
- derived from Luria’s three functional units in the brain to yield Planning, Attention, Simultaneous, Successive (PASS)

CAS Strengths

Cognitive Assessment System

1. Introduces assessment of executive function into intelligence testing
2. Tends to yield lower group mean score differences between majority and minority groups more than most other intelligence tests (e.g., Wasserman & Becker, 2000)
3. May well identify a different type of gifted learner than that identified with knowledge-loaded tests like the WISC-IV

CAS Limitations, Part 1

Cognitive Assessment System

1. **No independent research on gifted applications**
2. **Some 50% of this test (planning and attention scales) is speeded, putting many gifted students at a disadvantage**
3. **Processing subtests yield lower overall composite mean scores than traditional tests (mean CAS Full Scale=118.2 [10.0] in gifted sample according to Naglieri & Das, 1997)**

CAS Limitations, Part 2

Cognitive Assessment System

4. **Problems with theory and test factor structure (little evidence to differentiate planning and attention; see e.g., Wasserman, 2012)**
5. **Canivez (2011a, 2011b, 2011c, 2011d) reports that after the variance due to general intelligence is removed, the four PASS factors account have inadequate specificity for valid interpretation**

Reynolds & Kamphaus (2003) RIAS

Reynolds Intellectual Assessm’t Scales

- A four- or six-subtest normed for use with individuals between the ages of 3 years and 94 years
- Intended to measure general intelligence and two primary components, verbal (crystallized) and nonverbal (fluid) intelligence
- Two memory subtests may also be administered to generate a composite memory index

RIAS Strengths
Reynolds Intellectual Assessm’t Scales

1. **Administered in less than a half-hour, this is the most time efficient of intelligence tests (but then why not give a WASI-II?)**
2. ***A number of technical innovations in test development (e.g., reporting score internal reliabilities, g loadings, and factor structure by gender and ethnicity)***

RIAS Limitations, Part 1

Reynolds Intellectual Assessm’t Scales

1. ***Independent hierarchical exploratory factor analyses have yielded only fair g-loadings for the four core subtests across nearly all age ranges (Dombrowski, Watkins, & Brogan, 2009).***
2. **Factor analyses have yielded mixed results, with the nonverbal index subtests failing to support clear extraction of two factors in addition to a general factor (Beaujean, McGlaughlin, & Margulies, 2009; Nelson, Canivez, Lindstrom, & Hatt, 2007).**

RIAS Limitations, Part 2

Reynolds Intellectual Assessm't Scales

2. (Continued) Dombrowski, Watkins, and Brogan (2009) state: "The verbal subtests produced fair to poor factor loadings with the verbal factor, whereas the nonverbal subtests produced poor factor loadings on the nonverbal factor across all age ranges" (p. 501).
3. *No published research with gifted samples yet in spite of misleading article titles: "The RIAS and Assessment of Intellectual Giftedness" by Brueggemann, Reynolds, & Kamphaus (2006)*

RIAS Limitations, Part 3

Reynolds Intellectual Assessm't Scales

4. **Anecdotal evidence exists that the RIAS discontinue rules of two or three consecutive item scores of 0 dramatically lower the scores of gifted learners, who often succeed on more difficult items but may miss easier items. Bobbie Gilman reports instances in which a 30-point reduction in the CIX results when RIAS scores for all items administered versus scores with the formal discontinue rules are compared.**

Lohman (2011, 2012) CogAT 7

Cognitive Abilities Test, Form 7

- A group-administered, multiple choice, ten-level ability test normed for use with students between the ages of 5 to 18 (grades K to 12)
- *Intended to measure inductive and deductive reasoning (fluid ability) through verbal, quantitative, and nonverbal item content*
- Three test batteries yield a Composite SAS, Verbal SAS, Quantitative SAS, and Nonverbal SAS (normative *mean*=100, *SD*=16)
- *Impressive innovations in ELL testing at the early primary school levels.*

CogAT 7 Strengths, Part 1

Cognitive Abilities Test, Form 7

1. *Updated norms and co-normed with the Iowa Assessments.*
2. The nine subtests in CogAT 7 are now continuous and developmentally appropriate across the entire school-age range of the test.
3. *At every level, nearly 100% of students attempted 75% of the items. Test ceilings and floors appear very good.*
4. CogAT 7 offers more accurate confidence intervals and reliability estimations for gifted students than almost any other measure.

CogAT 7 Strengths, Part 2

Cognitive Abilities Test, Form 7

5. ***Factor structure shows that all subtests but one at every level have their highest loadings on "g."***
6. **Primary levels use a picture-format with items that were developed to be equally understandable to English and Spanish speakers. Levels at and after age 9 still require reading.**

CogAT 7 Strengths, Part 3

Cognitive Abilities Test, Form 7

7. ***ELL Innovation*****:** ***For use with ELL students at the three youngest levels (5/6, 7, and 8, corresponding to age), CogAT 7 contains picture-based formats with generic instructions that may be delivered in English or Spanish; only one optional subtest requires item-specific prompts in English or Spanish. Preliminary research suggests that this approach significantly improves identification of gifted ELL students, but only independent research will confirm this promise.***

CogAT 7 Strengths, Part 4

Cognitive Abilities Test, Form 7

8. **Potential Innovation in integration of CogAT 7, Iowa Assessments, and Renzulli teacher rating scale that has not elsewhere been tried.**
9. ***David Lohman ranks as one of the preeminent scholars in intelligence of this era, and CogAT 7 may solve one of the major challenges in cognitive assessment and produce more equitable identification.***

CogAT 7 Limitations, Part 1

Cognitive Abilities Test, Form 7

1. **The norms undersampled African Americans and densely populated school districts.**
2. ***Why is reading still required (at and after age 9) for an ability test?***
3. **Lost opportunity to scale CogAT above 160 to enable scientific research on highly gifted.**
4. **The author and previous test authors have cautioned against using the Composite SAS for gifted eligibility, because scores may be depressed by one area deficit. This is true for all ability and intelligence tests.**

CogAT 7 Limitations, Part 2

Cognitive Abilities Test, Form 7

5. The author recommends the use of local norms rather than national norms for the purposes of gifted eligibility determination. If they were gathered carefully and with adequate sampling as it would appear, the national norms are likely to be optimally stable.
6. Too much CogAT research to date comes only from David Lohman, suggesting that research with this test is overcontrolled and highly selected. The absence of independent scholarship is a red flag.

Otis & Lennon (2003) OLSAT 8

Otis-Lennon School Ability Test, 8th ed.

- A group-administered, multiple choice, multilevel test normed with 7 levels for use with students between the grades of Kindergarten through 12 (dates back to Otis, 1918)
- *OLSAT 8 is a broad range ability test "designed to measure those verbal, quantitative, and figural reasoning skills that are most closely related to scholastic achievement."*
- OLSAT 8 generates three School Ability Indexes (Total SAI, Verbal SAI, and Nonverbal SAI) with a normative mean of 100 and a SD of 16.

OLSAT 8 Strengths, Part 1

Otis-Lennon School Ability Test, 8th ed.

1. **Large scale norms (*N*=445,000)**
2. ***Highly diverse verbal and nonverbal content that may enhance its predictive validity (contains 21 multiple-choice item types designed to tap five content clusters, two in the Verbal area and three in the Nonverbal area)***
3. **Intermixing of item types and item difficulties (at all but the youngest ages) may offer advantages, but they are not demonstrated or reported.**

OLSAT 8 Strengths, Part 2

Otis-Lennon School Ability Test, 8th ed.

4. ***Linked to Stanford Achievement Test 10th edition (SAT10)***
5. **The OLSAT is an effective predictor of academic achievement, even in low income urban settings (Karrh, 2009; Pearson, 2005; Wojcik, 2008).**

OLSAT 8 Limitations, Part 1

Otis-Lennon School Ability Test, 8th ed.

1. **Unsystematic and theory-lite sampling of tasks in the verbal and nonverbal batteries.**
2. ***OLSAT 8 appears to be based primarily on classical test theory, not benefitting from analysis with item response theory psychometrics.***
3. **Normed with a large urban undersample.**
4. ***Score reliabilities for the Verbal SAI and Nonverbal SAI need improvement unless the composite reliabilities (in the .80s) is offset by improved predictive validity.***

OLSAT 8 Limitations, Part 2

Otis-Lennon School Ability Test, 8th ed.

5. **Inadequate evidence of test score validity presented, especially relative to the intended applications of this test, including identification of giftedness**
6. ***No factor analyses to affirm its structure.***
7. **Needs contemporary research on test score fairness.**
8. ***Needs independent research with gifted students.***
9. **Needs effective academic proponents to guide research and development.**

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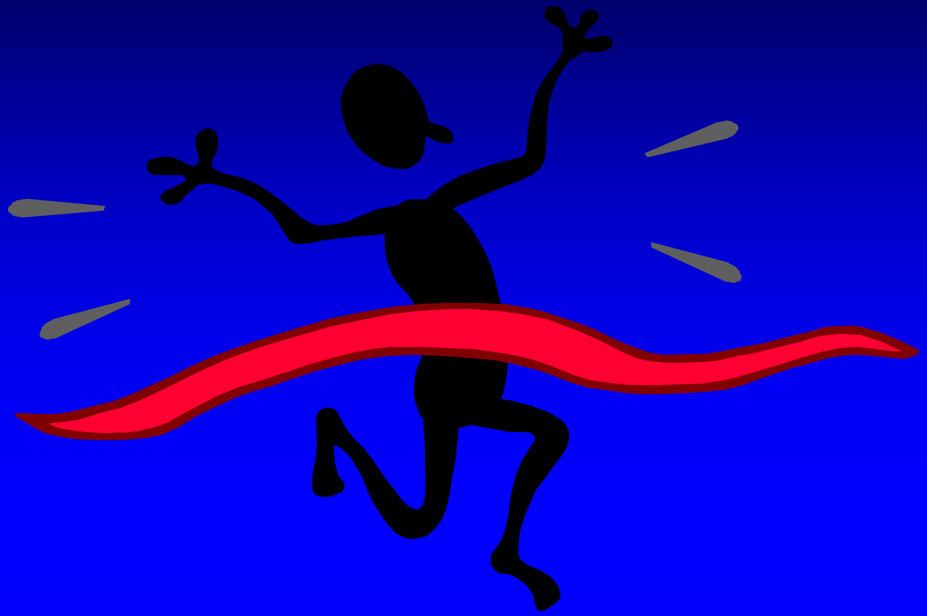

If you have comments or would like a complete reference list, please send me an email. I can be reached in my Virginia practice at j.d.wasserman@cox.net or by telephone at (703) 349-4520.