The WJ III Cognitive CHC and GIA Clusters: Construct Validity Evidence Summaries

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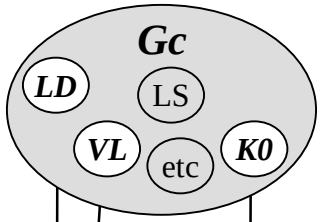
The following eight PowerPoint slides present, in a visual-schematic format, summaries of the extant validity evidence for the WJ III Cognitive CHC and GIA clusters. The footnote numbers in the figures correspond to reference numbers that will be found in a forthcoming chapter by Floyd, Shaver & McGrew, in a WJ III book edited by Scrhank and Flanagan and published by Academic Press.

Content Validity Evidence: Operational definitions of the broad and narrow *Gc* ability constructs are based on a "strong" psychological theory [4, 12, 26, 36, 37, 65, 81]

- *Language Development (LD):* General development, or the understanding of words, sentences, and paragraphs in spoken native language skills
- *Lexical Knowledge (VL):* Extent of vocabulary that can be understood in terms of correct word meanings.
- *General Information(K0):* Range of general verbal knowledge

The Verbal Comprehension subtests and the General Information test each have been reviewed by multiple CHC content experts at least twice [12, 26, 27, 64, 65, 73, 74, 102, 103]



CHC THEORETICAL DOMAIN: *Gc*

WJ III COG *Gc* MEASUREMENT DOMAIN

Comprehension-Knowledge (Gc) Cluster: Ability to use language and acquired knowledge effectively

Internal Validity Evidence: Top numbers indicate test *Gc* factor loadings in WJ III age 6-adult norm sample. Evidence also reported in four age-differentiated sub-samples. [74] Bottom numbers indicate the three Verbal Comprehension subtests (Picture Vocabulary, Antonyms-Synonyms, Verbal Analogies) loadings on the WJ-R *Gc* factor in the WJ-R K-Adult norm sample. Evidence also reported in six age-differentiated norm samples.[74] Additional internal evidence, primarily for the Verbal Comprehension subtests, has been reported in other sources. [4, 12, 64, 73, 74, 95, 102]

External Validity Evidence: WJ III *Gc* cluster relations with other measures & constructs

.92 **.88**

.75/.84/.41

Verbal Comprehension (VC)		
•Visual (pictures)	•Identifying objects	•Oral (word)
•Auditory (words)	•Provide antonyms/synonyms	

General Information (GI)		
•Auditory (questions)	•Identifying where objects are found and what people typically do with objects	•Oral (sentences)

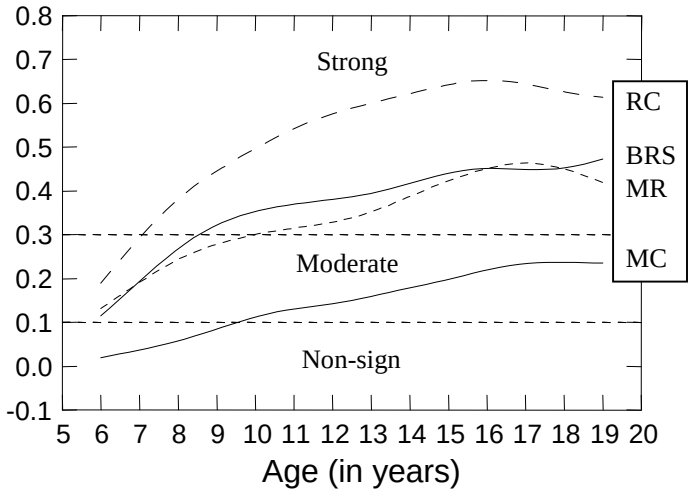
Response Process Evidence: Columns in test rectangles indicate logical task analyses of test stimuli, task requirements and response mode [74]

The *Gc* cluster growth curve demonstrates developmentally consistent relations with age and a trajectory that differs from the curves of most other CHC measures across the life-span. [67, 74] (Developmental Evidence)

Empirical analysis (bivariate correlations; confirmatory factor analysis) of WJ III *Gc* cluster/test relations with other *Gc* measures [30, 31, 34, 51, 74, 76, 83, 84, 85, 98] and/or CHC expert task analyses [26, 27, 64, 65, 103] suggest shared variance with the following <u>select</u> composite *Gc* measures (and their component tests):

- DAS Verbal Ability
- KAIT Crystallized
- Stanford-Binet IV Verbal Reasoning
- Wechsler Verbal Comprehension and Verbal IQ

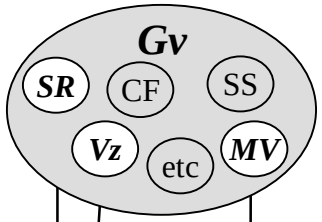
Smoothed *Gc* regression coefficients from multiple regression analyses in 14 nationally representative samples of children (ages 6 to 19) indicate moderate to strong relations with basic reading skills (BRS), reading comprehension (RC), math calculation (MC) and math reasoning (MR). [22, 28]



Content Validity Evidence: Operational definitions of the broad and narrow *Gv* ability constructs are based on a "strong" psychological theory [4, 12, 26, 36, 37, 65, 81]

- *Spatial Relations (SR):* Ability to rapidly construct specified visual patterns or to understand the how visual stimuli relate to each other.
- *Visualization (Vz):* Ability to hold visual stimuli and spatial forms in mind and to alter them in some way.
- *Visual Memory (VM):* Ability to retain representations of visual stimuli in mind and to recognize or recall them soon afterward.

The Spatial Relations and Picture Recognition tests each have been reviewed by multiple CHC-content experts at least twice [12, 26, 27, 64, 65, 73, 74, 102, 103]



CHC THEORETICAL DOMAIN: *Gv*

WJ III COG *Gv* MEASUREMENT DOMAIN

Visual-Spatial Thinking (Gv) Cluster: Ability to identify spatial relationships and to hold and manipulate mental representation of visual stimuli in mind.

Internal Validity Evidence: Top numbers indicate *Gv* factor loadings from WJ III age 6 to adult norm sample. Factor loadings also reported for four age-differentiated sub-samples. [74] Bottom numbers indicate the loadings on the WJ-R *Gv* factor in the WJ-R K-Adult norm sample. Evidence also reported in six age-differentiated norm samples. [74] Additional internal validity evidence reported for WJ-R Spatial Relations and Picture Recognition tests has been reported in other sources [4, 12, 64, 73, 74, 95, 102]

External Validity Evidence: WJ III *Gv* cluster relations with other measures and constructs

.67 **.42**

.14 **.56**

Spatial Relations (SR)

•Visual (drawings)	•Identifying the subset of pieces needed to form a complete shape	•Oral (letters) •Motoric (pointing)

Picture Recognition (PR)

•Visual (pictures)	•Identifying a subset of previously presented pictures within a field of distracting pictures	•Oral (words) •Motoric (pointing)

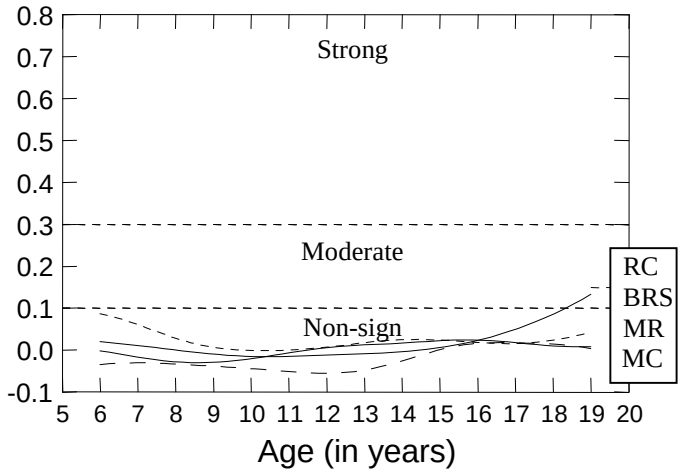
Response Process Evidence: Columns in test rectangles indicate logical task analyses of test stimuli, task requirements, and response modalities. [74]

The *Gv* cluster growth curve demonstrates developmentally consistent relations with age and a trajectory that differs from the curves of most other CHC measures across the life-span. [67, 74] (Developmental Evidence)

Empirical analysis (bivariate correlations; confirmatory factor analysis) of WJ III *Gv* cluster/test relations with other *Gv* measures [30, 31, 34, 51, 55, 74, 76, 81, 83, 84, 85, 98] and/or CHC expert task analyses [26, 27, 64, 65, 103] suggest shared variance with the following select composite *Gv* measures (and their component tests):

- DAS Spatial Ability
- K-ABC Simultaneous Processing
- Stanford-Binet IV Abstract/Visual Reasoning
- Wechsler Perceptual Organization &Performance IQ

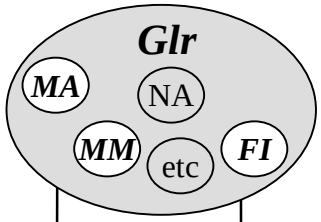
Smoothed *Gv* regression coefficients from multiple regression analyses in 14 nationally representative samples of children (ages 6 to 19) indicate nonsignificant relations with the components of reading and math achievement. [22, 28]



Content Validity Evidence: Operational definitions of the broad and narrow *Glr* ability constructs are based on a "strong" psychological theory [4, 12, 26, 36, 37, 65, 81]

- *Associative Memory (MA):* Ability to recall one part of an unrelated pair of items when the other part is presented.
- *Meaningful Memory (MM*): Ability to recall items that are meaningfully related.
- *Ideational Fluency (FI):* Ability to rapidly produce items from a specified category.

The Visual-Auditory Learning and Retrieval Fluency tests each have been reviewed by multiple CHC-content experts at least twice [12, 26, 27, 64, 65, 73, 74, 102, 103]



CHC THEORETICAL DOMAIN: *Glr*

WJ III COG *Glr* MEASUREMENT DOMAIN

Long-term Retrieval (Glr) Cluster: Ability to store and to access information in long-term memory

Internal Validity Evidence: Numbers indicate *Glr* factor loadings from WJ III age 6 to adult norm sample. Factor loadings also reported for four age-differentiated sub-samples. [74] Bottom numbers indicate the loadings on the WJ-R *Glr* factor in the WJ-R K-Adult norm sample. Evidence also reported in six age-differentiated norm samples. [74] Additional internal validity evidence reported for WJ-R Visual-Auditory Learning has been reported in other sources [4, 12, 64, 73, 74, 95, 102]

.80 **.67** **.33**

Visual-Auditory Learning (VA)

- Visual (rebuses)
- Auditory (words) in the learning condition
- Visual (rebuses) in the recognition condition
- Learning and recalling pictographic representations of words
- Oral (sentences)

Retrieval Fluency (RF)

- Auditory (directions only)
- Naming as many examples as possible from a given category
- Oral (words)

Response Process Evidence: Columns in test rectangles indicate logical task analyses of test stimuli, task requirements, and response modalities. [74]

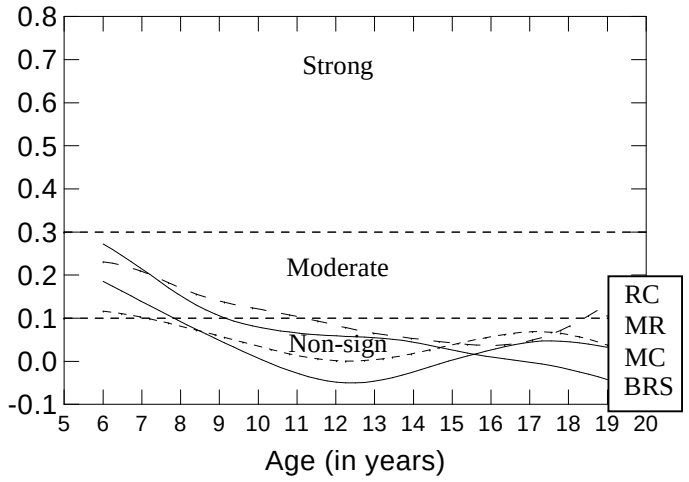
External Validity Evidence: WJ III *Glr* cluster relations with other measures and constructs

The *Glr* cluster growth curve demonstrates developmentally consistent relations with age and a trajectory that differs from the curves of most other CHC measures across the life-span. [67, 74] (Developmental Evidence)

Empirical analysis (bivariate correlations; confirmatory factor analysis) of WJ III *Glr* cluster/test relations with other *Glr* measures [34, 74, 82] and/or CHC expert task analyses [26, 27, 64, 65, 103] suggest shared variance with the following select *Glr* test measures:

- KAIT Rebus Learning & Rebus Delayed Recall
- WMS-III Verbal Paired Associates I & II
- WJ-R Memory for Names
- WJ III Rapid Picture Naming

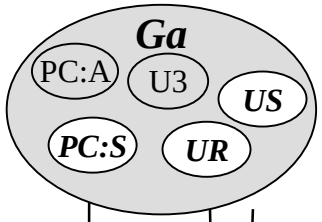
Smoothed *Glr* regression coefficients from multiple regression analyses in 14 nationally representative samples of children (ages 6 to 19) indicate moderate relations with basic reading skills (BRS), reading comprehension (RC), and math calculation (MCS) during the elementary school-age years. [22, 28]



Content Validity Evidence: Operational definitions of the broad and narrow *Ga* ability constructs are based on a "strong" psychological theory [4, 12, 26, 36, 37, 65, 81]

- *Phonetic Coding: Synthesis (PC:S):* Ability to blend small units of speech sounds into larger units
- *Speech-Sound Discrimination (US*): Ability to discriminate between different speech sounds.
- *Resistance to Auditory Stimulus Distortion (UR*): Ability to comprehend speech sounds that are masked by non-speech sounds.

The Sound Blending and Auditory Attention tests each have been reviewed by multiple CHC content experts at least twice [12, 26, 27, 64, 65, 73, 74, 102, 103]



CHC THEORETICAL DOMAIN: *Ga*

WJ III COG *Ga* MEASUREMENT DOMAIN

Auditory Processing (Ga) Cluster: Ability to attend to, discriminate, and manipulate units of speech and other sounds

Internal Validity Evidence: Top numbers indicate *Ga* factor loadings from WJ III age 6 to adult norm sample. Factor loadings also reported for four age-differentiated sub-samples. [74] Bottom numbers indicate the loadings on the WJ-R *Ga* factor in the WJ-R K-Adult norm sample. Evidence also reported in six age-differentiated norm samples. [74] Additional internal validity evidence reported for WJ-R Sound Blending tests has been reported in other sources [4, 12, 64, 73, 74, 95, 102]

.65

.67

.37

Sound Blending (SB)		
•Auditory (phonemes)	•Synthesizing language sounds (phonemes)	•Oral (word)

Auditory Attention (AA)		
•Auditory (words)	•Identifying pictures amid increasingly intense background noise	•Motor (pointing)

Response Process Evidence: Columns in test rectangles indicate logical task analyses of test stimuli, task requirements , and response modalities. [74]

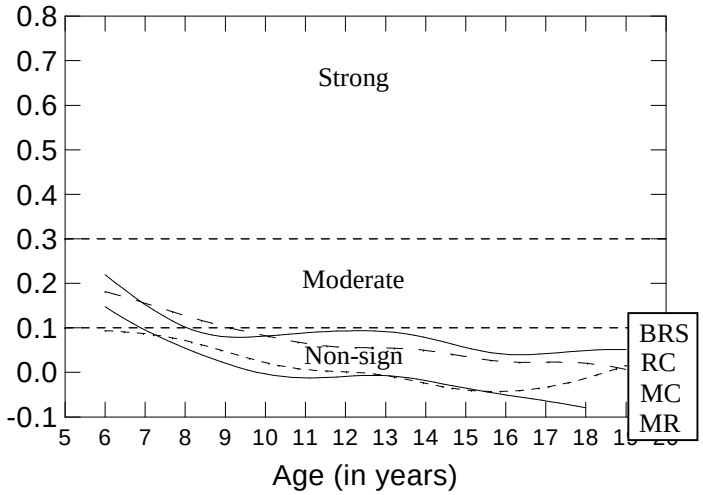
External Validity Evidence: WJ III *Ga* cluster relations with other measures and constructs

The *Ga* cluster growth curve demonstrates developmentally consistent relations with age and a trajectory that differs from the curves of most other CHC measures across the life-span. [67, 74] (Developmental Evidence)

Empirical analysis (bivariate correlations; confirmatory factor analysis) of WJ III *Ga* cluster/test relations with other *Ga* measures [74] and/or CHC expert task analyses [26, 27, 64, 65, 103] suggest shared variance with the following select *Ga* test measures:

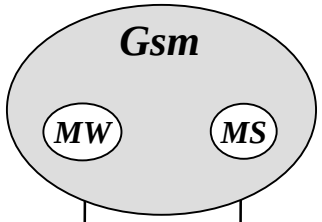
- GFW Test of Auditory Discrimination
- TOPA Test of Phonological Awareness
- WJ-R/III Incomplete Words
- WJ-R Sound Patterns

Smoothed *Ga* regression coefficients from multiple regression analyses in 14 nationally representative samples of children (ages 6 to 19) indicate moderate relations with basic reading skills (BRS), reading comprehension (RC), and math calculation (MC) during the elementary school-age years. [22, 28]



Content Validity Evidence: Operational definitions of the broad and narrow *Gsm* ability constructs are based on a "strong" psychological theory [4, 12, 26, 36, 37, 65, 81]

- *Working Memory (MW):* Ability to temporarily hold "in mind" and mentally manipulate phonological stimuli to produce a response.
- *Memory Span (MS):* Ability to attend to and immediately recall a series of phonological stimuli in their correct order.



The Numbers Reversed and Memory for Words tests each have been reviewed by multiple CHC content experts at least twice [12, 26, 27, 64, 65, 73, 74, 102, 103]

CHC THEORETICAL DOMAIN: *Gsm*

WJ III COG *Gsm* MEASUREMENT DOMAIN

Short-term Memory (Gsm) Cluster: Ability to retain and manipulate phonological stimuli in one's immediate awareness

External Validity Evidence: WJ III *Gsm* cluster relations with other measures and constructs

Internal Validity Evidence: Top numbers indicate *Gsm* factor loadings from WJ III age 6 to adult norm sample. Factor loadings also reported for four age-differentiated sub-samples. [74] Bottom numbers indicate the loadings on the WJ-R *Gsm* factor in the WJ-R K-Adult norm sample. Evidence also reported in six age-differentiated norm samples. [74] Additional internal validity evidence reported for WJ-R Numbers Reversed and Memory for Words tests has been reported in other sources [4, 12, 64, 73, 74, 95, 102]

.71 **.63**

.33 **.81**

Numbers Reversed (NR)

•Auditory (numbers)	•Holding numbers in immediate awareness and reversing their sequence of presentation	•Oral (numbers)

Memory for Words (MW)

•Auditory (words)	•Repeating a list of unrelated words in correct sequence	•Oral (words)

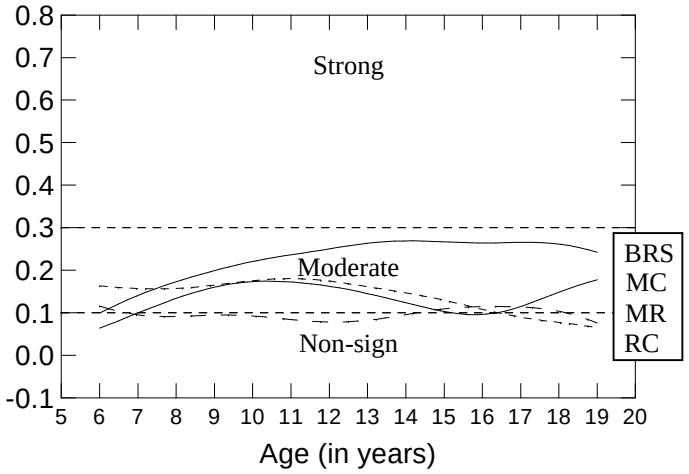
Response Process Evidence: Columns in test rectangles indicate logical task analyses of test stimuli, task requirements , and response modalities. [74]

The *Gsm* cluster growth curve demonstrates developmentally consistent relations with age and a trajectory that differs from the curves of most other CHC measures across the life-span. [67, 74] (Developmental Evidence)

Empirical analysis (bivariate correlations; confirmatory factor analysis) of WJ III *Gsm* cluster/test relations with other *Gsm* measures [24, 30, 31, 34, 47, 51, 74, 76, 83, 84, 85, 98] and/or CHC expert task analyses [26, 27, 64, 65, 103] suggest shared variance with the following select composite *Gsm* measures (and their component tests):

- CAS Successive Scale
- K-ABC Sequential Processing
- Stanford-Binet IV Short-Term Memory
- Wechsler Working Memory & Freedom From Distractibility

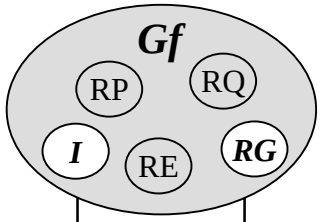
Smoothed *Gsm* regression coefficients from multiple regression analyses in 14 nationally representative samples of children (ages 6 to 19) indicate moderate relations with basic reading skills (BRS), math calculation (MC) and math reasoning (MR) at most age levels. [22, 28]



Content Validity Evidence: Operational definitions of the broad and narrow *Gf* ability constructs are based on a "strong" psychological theory [4, 12, 26, 36, 37, 65, 81]

- *Induction (I):* Ability to identify the concept or rule that underlies a problem or set of stimuli
- *General Sequential Reasoning (RG):* Ability to start with stated rules and engage in steps to reach a solution to a novel problem.

The Concept Formation and Analysis-Synthesis tests each have been reviewed by multiple CHC content experts at least twice [12, 26, 27, 64, 65, 73, 74, 102, 103]



CHC THEORETICAL DOMAIN: *Gf*

WJ III COG *Gf* MEASUREMENT DOMAIN

Fluid Reasoning (Gf) Cluster: Ability to perceive logical relationships and to solve problems using unfamiliar stimuli

Internal Validity Evidence: Top numbers indicate *Gf* factor loadings from WJ III age 6 to adult norm sample. Factor loadings also reported for four age-differentiated sub-samples. [74] Bottom numbers indicate the loadings on the identical WJ-R *Gf* factor in the WJ-R K-Adult norm sample. Evidence also reported in six age-differentiated norm samples. [74] Additional internal validity evidence reported has been reported in other sources [4, 12, 64, 73, 74, 95, 102]

.76 **.73**

.67 **.65**

Concept Formation (CF)		
•Visual (images of shapes)	•Identifying, categorizing, and determining rules	•Oral (words)

Analysis-Synthesis (AS)		
•Visual (drawings)	•Analyzing puzzles (using symbolic formulations) to determine missing components	•Oral (words)

Response Process Evidence: Columns in test rectangles indicate logical task analyses of test stimuli, task requirements, and response modalities. [74]

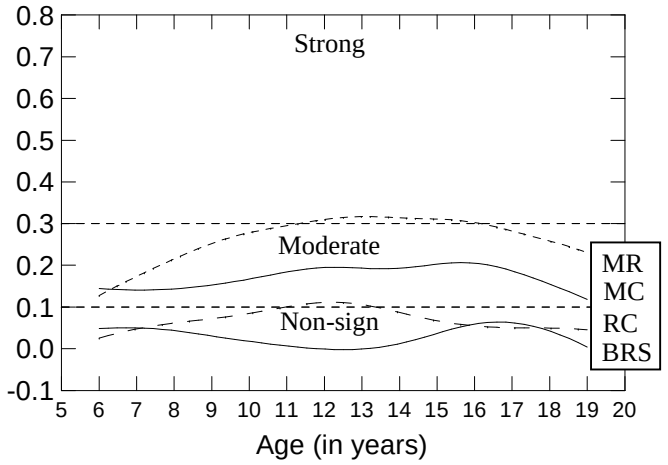
External Validity Evidence: WJ III *Gf* cluster relations with other measures and constructs

The *Gf* cluster growth curve demonstrates developmentally consistent relations with age and a trajectory that differs from the curves of most other CHC measures across the life-span. [67, 74] (Developmental Evidence)

Empirical analysis (bivariate correlations; confirmatory factor analysis) of relations between *Gf* cluster and other *Gf* measures [24, 30, 31, 34, 47, 51, 56, 74, 76, 82, 98] and/or CHC expert task analyses [26, 27, 64, 65, 103] suggest shared variance with the following select composite *Gf* measures (and their component tests):

- CAS Simultaneous Processing
- Differential Ability Scale Nonverbal Reasoning Ability & Nonverbal Ability
- KAIT Fluid
- WAIS-III Perceptual Organization

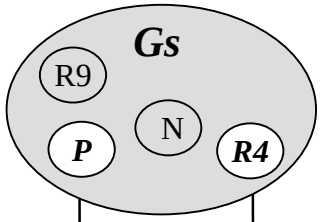
Smoothed *Gf* regression coefficients from multiple regression analyses in 14 nationally representative samples of children (ages 6 to 19) indicate moderate relations with math reasoning (MR) and math calculation (MC) and non-significant relations with reading comprehension (RC) and basic reading skills (BRS). [22, 28]



Content Validity Evidence: Operational definitions of the broad and narrow *Gs* ability constructs are based on a "strong" psychological theory [4, 12, 26, 36, 37, 65, 81]

- *Perceptual Speed (P):* Ability to rapidly search for and compare visual symbols or patterns and make a simple response
- *Semantic Processing Speed (R4):* Ability to rapidly identify basic conceptual relationships among stimuli.

The Visual Matching and Decision Speed tests each have been reviewed by multiple CHC content experts at least twice [12, 26, 27, 64, 65, 73, 74, 102, 103]



CHC THEORETICAL DOMAIN: *Gs*

WJ III COG *Gs* MEASUREMENT DOMAIN

Processing Speed (Gs) Cluster: Ability to speedily perform simple visual-motor tasks

External Validity Evidence: WJ III *Gs* cluster relations with other measures and constructs

Internal Validity Evidence: Top numbers indicate *Gs* factor loadings from WJ III age 6 to adult norm sample. Factor loadings also reported for four age-differentiated sub-samples. [74] Bottom numbers indicate the loadings on the WJ-R *Gs* factor in the WJ-R K-Adult norm sample. Evidence also reported in six age-differentiated norm samples. [74] Additional internal validity evidence reported for WJ-R Visual Matching test has been reported in other sources [4, 12, 64, 73, 74, 95, 102]

.71 **.71**

.79

Visual Matching (VM)

- Visual (numbers)
- Rapidly locating and circling identical numbers from a defined set of numbers
- Motoric (circling with pencil)

Decision Speed (DS)

- Visual (pictures)
- Locating and circling two pictures most similar conceptually in a row
- Motoric (circling with a pencil)

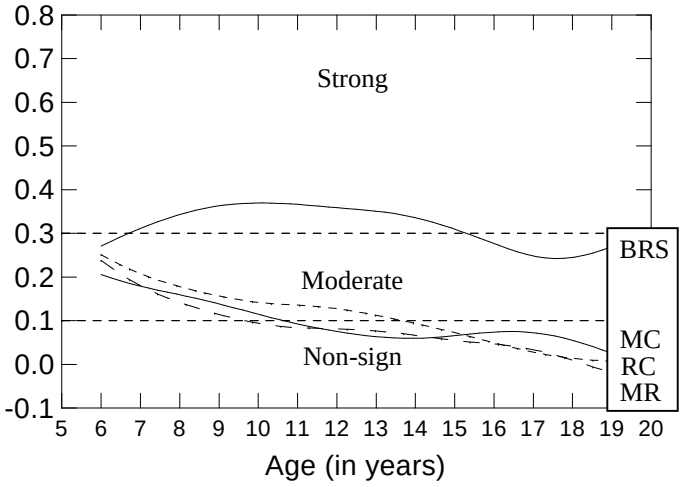
Response Process Evidence: Columns in test rectangles indicate logical task analyses of test stimuli, task requirements, and response modalities. [74]

The *Gs* cluster growth curve demonstrates developmentally consistent relations with age and a trajectory that differs from the curves of most other CHC measures across the life-span. [67, 74] (Developmental Evidence)

Empirical analysis (bivariate correlations; confirmatory factor analysis) of WJ III *Gs* relations with other *Gs* measures [24, 31, 34, 47, 82, 83, 85] and CHC expert task analyses [26, 27, 64, 65, 103] suggest shared variance with the following select composite *Gs* measures (and their component tests):

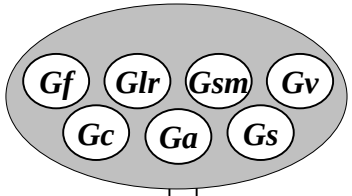
- CAS Planning & Attention
- Wechsler Processing Speed

Smoothed *Gs* regression coefficients from multiple regression analyses in 14 nationally representative samples of children (ages 6 to 19) indicate generally strong relations with basic reading skills (BRS), moderate relations with math reasoning (MR) from ages 6 to 14, and moderate relations with math calculation (MC) and reading comprehension (RC) from ages 6 to 10. [22, 28]



CHC THEORETICAL DOMAIN: *g*

Content Validity Evidence: Operational definition of general intelligence (*g*) is based on a strong psychological theory. [12, 41]



Internal Validity Evidence: 1st principal component *g*-factor loadings calculated for the 7 Std and 14 Ext GIA tests at 22 age groups from ages 6 to 100 (example is for age 9). [74]

External Validity Evidence: Relations with other measures and constructs

The GIA-Ext, GIA-Std, and BIA clusters have demonstrated strong and significant correlations with the following measures of general intelligence. [74]

	Ext	Std	BIA
CAS FS [24]			.70
DAS GCA [31, 76]	.73/.76	.67/.76	.67/.70
KAIT Composite [31]		.75	.68
SB-IV Composite [82]	.71	.76	.60
WIPPSI-R FS IQ [31]	.74	.73	.67
WISC-III FS IQ [83]	.76	.71	.69
WAIS-III FS IQ [34]		.67	.62

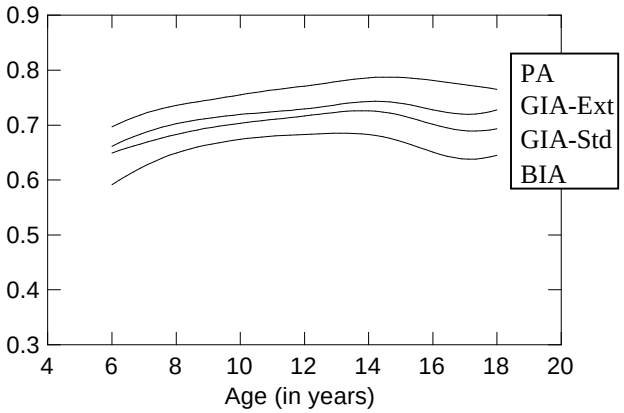
g ldg =	*.79*	*.73*	*.73*	*.79*	*.66*	*.60*	*.57*	*.57*	*.54*	*.58*	*.55*	*.48*	*.43*	*.38*	
Test [a]	**VC** *Gc*	**CF** *Gf*	**GI** *Gc*	**VA** *Glr*	**AS** *Gf*	**NR** *Gsm*	**SB** *Ga*	**VM** *Gs*	**MW** *Gsm*	**RF** *Glr*	**DS** *Gs*	**SR** *Gv*	**AA** *Ga*	**PR** *Gv*	
g Weights	.12	.10	.10	.09	.09	.07	.06	.06	.06	.07	.06	.05	.04	.03	= GIA-Ext
	.20	.19		.17		.13	.12	.10				.09			= GIA-Std
	.33	.33						.33							= BIA
	.31	.02		.14		.15	.13	.21				.01			→ BRS
	.31	.20		.04		.16	.03	.22				.04			→ MR

Multiple Reg. Prediction

Predicted Achievements (PA): The respective PA weights for the 7 COG tests were derived from multiple regression with each of the WJ III Achievement clusters at 22 age groups from ages 6 to 100.[74] The two examples above are for Basic Reading Skills (BRS) and Math Reasoning (MR) at age 9. Conceptually, the PAs represent "differential scholastic aptitudes."

Internal Validity Evidence: GIA-Std and GIA-Ext clusters based on *g*-weighted (*g*-component loadings transformed to weights) combination of 7 and 14 tests, respectively, with weights varying as a function of development or age (example weights are for age 9). [74] BIA cluster based on equal weighting of 3 tests at all ages.

External Concurrent/Differential Prediction Evidence: Smoothed correlations (multiple correlations for PA option) for GIA-Ext, GIA-Std, BIA, and PA with WJ III Reading Comprehension in 13 nationally representative samples of children (ages 6 to 18). [74] Similar evidence is presented for all other WJ III achievement clusters in the *WJ III Technical Manual*. [74]



WJ III COG GENERAL ABILITY MEASUREMENT DOMAIN

[a] Abbreviations for test names are presented in Figures 1through 7