CHC Theory:

- CHC theory is derived from the concept that there are three strata of human cognitive abilities that differ in breadth and generality (p.1).[1]
- *Insight* subtests measure cognitive abilities that have been empirically linked to the emergence of development of specific academic functions (p.5).[1]

Crystallized Knowledge (Gc):

- The person's breadth and depth and application of acquired knowledge of the language, information, and concepts of a culture (p.3).[1]
- In the Crystallized Knowledge subtest of *Insight*, students are asked to identify how two things are alike (p.6).[2]
- The cognitive abilities associated with Gc are highly correlated with academic achievement. They serve as a good predictor of academic success and are a key indicator of giftedness.[3,4]

Visual Processing (Gv):

- The ability to generate, retain, retrieve, and transform well-structured visual images (p.3).[1]
- In the Visual Processing subtest of *Insight*, students are asked to identify the shape that can be made by combining two or more smaller shapes (p.7).[2]
- **Gv**, along with **Gf** and **Gc**, are "most frequently strong in those traditionally selected for intellectual giftedness" (p.857).[4]

Fluid Intelligence (Gf):

- The use of inductive, deductive, and quantitative reasoning to solve novel, "on-the spot" problems (p.3).[1]
- In the Fluid Reasoning subtest of *Insight*, students are asked to identify the shape that best fits into the missing part of a matrix pattern (p.8).[2]
- The cognitive abilities associated with **Gf** are highly correlated with academic success. Those with strong **Gf** ability are likely to excel in higher level thinking and reasoning. Such abilities are beneficial for solving novel problems, generating effective strategies, and thinking inductively and deductively.[3,4]

Short-Term Memory (Gsm):

- The ability to apprehend, maintain awareness of, and mentally manipulate elements of information in the immediate situation (p.3).[1]
- In the Short-Term Memory subtest of *Insight*, students are asked to identify whether or not the second string of numbers is the reverse of the first string (p.9).[2]
- "Above-average performance on memory tasks can indicate good attention. If information can be dealt with quickly, then the limited capacity system of short-term memory will not be overloaded, and more attention can be directed to higher-level tasks" (p.279).[3]

Long-Term Memory Retrieval (Glr):

- The ability to store and consolidate new information in long-term memory and later fluently retrieve the stored information through association (p.4).[1]
- In the Long-Term Memory Retrieval subtest of *Insight*, students are asked to identify the symbol that was earlier associated with a given meaning (p.10).[2]
- High performance on long-term retrieval tasks suggests that students will be successful on such tasks, while low performance suggests possible deficits.[3]

Auditory Processing (Ga):

- Abilities involved in discriminating patterns in sounds and musical structure, often against background noise or distorting conditions, or both (p.4).[1]
- In the Auditory Processing subtest of *Insight*, students are asked to discriminate sounds in words.
- A prerequisite for success in reading and spelling competence, **Ga** is important for understanding reading disabilities (p.277).[3]

Processing Speed (Gs):

- The ability to automatically and fluently perform relatively easy or over-learned cognitive tasks, especially when high mental efficiency (i.e., attention and focused concentration) is required (p.4).[1]
- In the Processing Speed subtest of *Insight*, students are asked to identify whether or not a presented shape has an exact match in an array of shapes that follow (p.12).[2]
- "High performance on processing speed tasks indicates that a person is able to process information quickly, freeing up resources for higher-level thinking. Low performance on processing speed tasks suggests that the person may process visual symbols slowly or be inattentive" (p.286).[3]

Footnotes:

1 Beal, A.L. (2011). *Insight. Understanding Insight: A Group Test of Cognitive Abilities*. Markham: CTC/Canadian Test Centre. **2** Beal, A.L. (2011). *Insight. Examiner's Manual*. Markham: CTC/Canadian Test Centre. **3** Mather, N., & Wendling, B. J. (2005). Linking cognitive results to academic interventions for students with learning disabilities. In D. P. Flanagan & P. L. Harrison (Eds.), *Contemporary Intellectual Assessment 2nd ed.* (pp.269-294). New York, NY: The Guilford Press. **4** Volker, M. A., Lopata, C., & Cook-Cottone, C. (2006). Assessment of children with intellectual giftedness and reading disabilities. *Psychology in the Schools*, 43(8), 855-869.

Insight

READING

Crystallized Knowledge (Gc):

- When compared with other broad cognitive abilities, **Gc** is usually the strongest predictor of Basic Reading Skills (the ability to identify and pronounce individually printed letters, words, and phonically regular nonsense words).[1]
- When compared with other broad cognitive abilities, **Gc** is usually the strongest predictor of Reading Comprehension Skills (the ability to understand written text, generate synonyms and antonyms to given words, and complete analogies).[1, 2, 6]
- The knowledge of word meanings is one of the best predictor of students' reading comprehension abilities. This effect is found from kindergarten to the 12th grade.[4]

Fluid Intelligence (Gf):

- During childhood and adolescence, there is a significant association between **Gf** and Reading Comprehension Skills (the ability to understand written text, generate synonyms and antonyms to given words, and complete analogies).[5]

Processing Speed (Gs):

- **Gs** is important for the acquisition of most cognitive and academic skills. During elementary school years, there is a moderate relationship between **Gs** and reading achievement.[1]
- Passage Comprehension Skills (the ability to identify a key word that is missing from a reading passage) are significantly correlated with **Gs**.[2]
- **Gs** has a significant effect on Reading Decoding Skills (the ability to recognize and decode words, and the capacity to spell pseudo-words).[3]

Short-Term Memory (Gsm):

- Moderate relationships can be found between **Gsm** and Basic Reading Skills (the ability to identify and pronounce individually printed letters, words, and phonically regular nonsense words) and between **Gsm** and Reading Comprehension Skills (the ability to understand written text, generate synonyms and antonyms to given words, and complete analogies).[1]
- Reading decoding skills consist of the ability to recognize and decode words and the capacity to spell pseudo-words. Short-Term Memory demonstrated "consistent direct effects on reading decoding skills," although variance existed across different age levels (p.223).[3]

Long-Term Memory Retrieval (Glr):

- During the elementary school years, there is a moderate relationship between Long-Term Memory Retrieval and various components of reading achievement.[1]
- Long-Term Memory Retrieval, and especially the narrow cognitive ability Associative Memory, is strongly related to reading decoding skills (the ability to recognize and decode words, and the capacity to spell pseudo-words).[3]

Auditory Processing (Ga):

- During early adulthood, **Ga** is consistently and significantly correlated with Basic Reading Skills (the ability to identify and pronounce individually printed letters, words, and phonically regular nonsense words).[1]
- **Ga** demonstrates a moderate relationship with Reading Comprehension Skills (the ability to understand written text, generate synonyms and antonyms to given words, and complete analogies) during the elementary school years.[1]
- **Ga** demonstrates a significant correlation with Word Attack (decoding nonsense words through phonetic analyses).[2, 6]
- Current and future reading achievement are both highly correlated with phonetic coding abilities.[4]
- Individuals with reading difficulties often display a core processing deficit in phonological awareness tasks.[7]

Footnotes:

1 Evans, J. J., Floyd, R. G., McGrew, K.S., & Leforgee, M. H. (2002). The relations between measures of Cattell-Horn-Carroll (CHC) cognitive abilities and reading achievement during childhood and adolescence. *School Psychology Review*, 31(2), 246-262. **2** Flanagan, D. P. (2000). Wechsler-based CHC cross-battery assessment and reading achievement: Strengthening the validity of interpretations drawn from Wechsler test scores. *School Psychology Quarterly*, 15(3), 295-329. **3** Floyd, R. G., Keith, T. Z., Taub, G. E., & McGrew, K. S. (2007). Cattell-Horn-Carroll cognitive abilities and their effects on reading decoding skills: *g* has indirect effects, more specific abilities have direct effects. *School Psychology Quarterly*, 22(2), 200-233. **4** Garcia, G. M., & Stafford, M. E. (2000). Prediction of reading by Ga and Gc specific cognitive abilities for low-SES White and Hispanic English-speaking children. *Psychology in the Schools*, 37(3), 227-235. **5** McGrew, K. S. (1993). The relationship between the Woodcock-Johnson Psycho-Educational Assessment Battery-- Revised Gf-Gc cognitive clusters and reading achievement across the life-span. *Journal of Psychoeducational Assessment Monograph Series: Woodcock-Johnson Psycho-Educational Assessment Battery—Revised*, 39-53. Cordova, TN: Psychoeducational Corporation. **6** McGrew, K. S., Flanagan, D. P., Keith, T. Z., & Vanderwood, M. L. (1997). Beyond *g*: The impact of Gf-Gc specific cognitive abilities research on the future use and interpretation of intelligence tests in the schools. *School Psychology Review*, 26(2), 177-189. **7** Morris, R. D., Steubing, K. K., Fletcher, J. M., Shaywitz, S. E., Lyon, G. R., Shankweiler, D. P., Katz, L., Francis, D. J., & Shaywitx, B. A. (1998). Subtypes of reading disability: Variability around a phonological core. *Journal of Educational Psychology*, 90(3), 347-373.

Insight

Crystallized Knowledge (Gc):

- When compared with other broad cognitive abilities, **Gc** and **Gs** usually display the most consistent relationship with writing achievement across the age groups.[3]
- Basic Writing Skills (the knowledge of spelling, punctuation and capitalization rules) is moderately related to **Gc** abilities from ages 7 to 9, and strongly related from age 9 onwards.[2, 3]
- Written Expression (compositional fluency and compositional accuracy) is moderately related to **Gc** abilities from ages 8 to 10 and strongly related from 11 onwards.[3] A more recent study also supports this finding (moderate relationship from ages 7 to 10, and strong relationship from age 10 onwards).[2]
- "Comprehension-Knowledge was often the strongest and most consistent predictor of writing achievement across childhood and adolescence and that its strongest effects began as children enter upper elementary school (about age 10 years). It is logical that vocabulary knowledge and world knowledge would be highly related to knowledge of spelling, punctuation, and capitalization rules, as reflected in the basic writing skills analysis" (p.140).[2]

Processing Speed (Gs):

- When compared with other broad cognitive abilities, **Gs** and **Gc** usually display the most consistent relationship with writing achievement across the age groups.[3]
- Basic Writing Skills (the knowledge of spelling, punctuation and capitalization rules) is moderately related to **Gs** from age 7 until age 17 years.[2]
- Written Expression (compositional fluency and compositional accuracy) is moderately or strongly related to **Gs** throughout most of childhood and adolescence.[2]
- "Processing Speed is believed to be important to written expression because the more rapidly an individual can automatize basic skills, the more attention and memory resources can be allocated to higher-level aspects of task performance" (p.140).[2]

Long-Term Memory Retrieval (Glr):

- **Glr** has a strong effect on Basic Writing Skills (the knowledge of spelling, punctuation and capitalization rules) for participants who were 7 years of age. Subsequently, this relationship becomes moderate up until the age of 10 years.[2]
- **Glr** has a moderate effect on Written Expression (compositional fluency and compositional accuracy) in participants aged 6 to 7 years. However, the relationship between **Glr** and Written Expression is mostly negligible afterward.[2]

Fluid Intelligence (Gf):

- For Basic Writing Skills (the knowledge of spelling, punctuation and capitalization rules), **Gf** has "primarily negligible effects until age 15 years" (p.138). However, in the oldest age levels observed in this study (15 to 18 years), **Gf** shows a moderate relationship.[2] An earlier study demonstrates a moderate relationship from ages 6 to 11 years.[3]
- The effect of **Gf** and Written Expression (compositional fluency and compositional accuracy) is mostly negligible, with the exception that moderate effects were found in participants who were 15 and 16 years of age.[2] Another study has found moderate relationship for Written Expression from ages 7 to 12 years.[3]

Auditory Processing (Ga):

- Before the age of 11, **Ga** is significantly related to both Basic Writing Skills (the knowledge of spelling, punctuation and capitalization rules) and Written Expression (compositional fluency and compositional accuracy).[3]
- A moderate relationship exists for **Ga** and Written Expression (compositional fluency and compositional accuracy) from ages 15 to 17.[2]
- Memory for sound patterns at the phonetic level (non-semantic) is a good predictor for measuring spontaneous spelling ability in written composition.[1]
- "Phonological coding, defined as segmenting spoken words into component syllables or phonemes, had concurrent validity for predicting achievement in reading real words and non-words and spelling real words" (p.163).[1]

Short-Term Memory (Gsm):

- Moderate relationships can be found between **Gsm** and Basic Writing Skills (the knowledge of spelling, punctuation and capitalization rules) and between **Gsm** and Written Expression (compositional fluency and compositional accuracy). For both, such relationship began after age 7, and continued throughout the ages included in this analysis (until age 18 years).[2] A previous study has resulted in similar findings, but the relationship occurs after age 10.[3]

Footnotes:

1 Berninger, V. W., Cartwright, A. C., Yates, C. M., Swanson, H. L., & Abbott, R. D. (1994). Developmental skills related to writing and reading acquisition in the intermediate grades: Shared and unique functional systems. *Reading & Writing*, 6(2), 161-196. **2** Floyd, R. G., McGrew, K. S., & Evans, J. J. (2008). The relative contributions of the Cattell-Horn-Carroll cognitive abilities in explaining writing achievement during childhood and adolescence. *Psychology in the Schools*, 45(2), 132-144. **3** McGrew, K. S., & Knopik, S. N. (1993). The relationship between the WJ-R Gf-Gc cognitive clusters and writing achievement across the life-span. *School Psychology Review*, 22(4), 687-695.

Insight

Fluid Intelligence (Gf):

- When compared with other broad cognitive abilities, **Gf** has the strongest association with applied mathematics skills for early elementary aged students.[2]
- When compared with other broad cognitive abilities, **Gf** holds the most consistent relationship with Basic Mathematics Skills (the ability to perform mathematical operations, and display one's knowledge of mathematical concepts).[3]
- **Gf** has a moderate relationship with Math Calculation Skills (the ability to calculate and perform basic mathematical operations fluently) throughout childhood and adolescence.[1]
- **Gf** has a moderate to strong relationship with Math Reasoning Skills (the ability to use mathematics operations in applied, real-world scenarios) throughout childhood and adolescence.[1,3]

Short-Term Memory (Gsm):

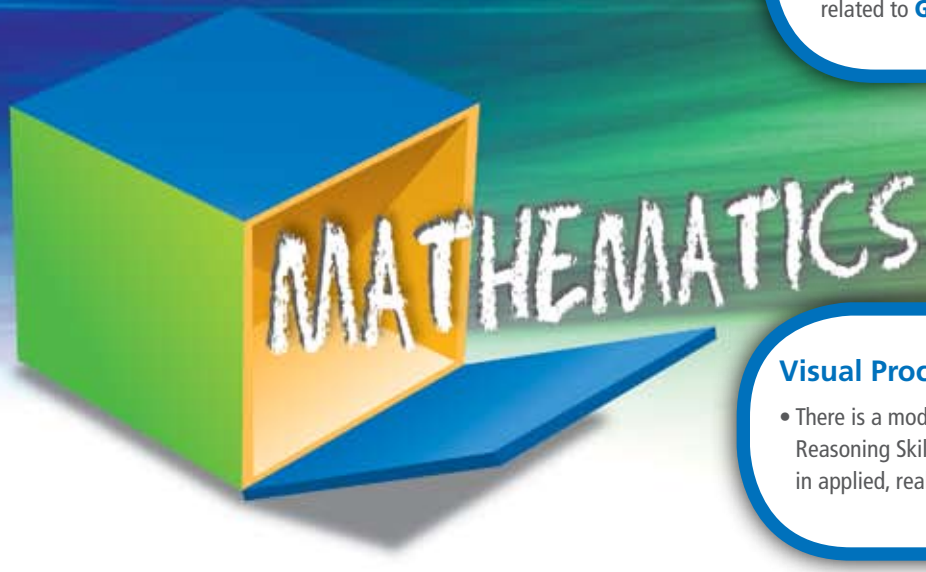
- Between the ages of 7 and 17, **Gsm** is moderately related to Math Calculation Skills (the ability to calculate and perform basic mathematical operations fluently).[1]
- During the elementary school years, **Gsm** has a moderate relationship with Mathematics Reasoning Skills (the ability to use mathematics operations in applied, real-world scenarios).[1,3]

Processing Speed (Gs):

- Speed of processing plays an important role during the early stages of acquiring most cognitive and academic skills. Specifically, the speed of processing demonstrates a significant and strong influence on mathematics performance.[1]
- **Gs** has a moderate to strong relationship with Math Calculation Skills (the ability to calculate and perform basic mathematical operations fluently). This effect is evident throughout the lifespan.[1]
- **Gs** has a moderate relationship with Mathematics Reasoning Skills (the ability to use mathematics operations in applied, real-world scenarios).[1,3]
- A consistent relationship can be found between **Gs** and Basic Mathematics Skills (the ability to perform mathematical operations, and display one's knowledge of mathematical concepts). This effect is strongest from ages 5 to 11 years.[1]

Crystallized Knowledge (Gc):

- When compared with other broad cognitive abilities, **Gc** is usually the strongest predictor of mathematics achievement throughout the school-age years.[1,3]
- Math Calculation Skills (the ability to calculate and perform basic mathematical operations fluently) is moderately related to **Gc** abilities.[1]
- Math Reasoning Skills (the ability to use mathematics operations in applied, real-world scenarios) is moderately related to **Gc** abilities.[1,3]



Long-Term Memory Retrieval (Glr):

- A moderate relationship can be found between **Glr** and Math Calculation Skills (the ability to calculate and perform basic mathematical operations fluently) and between **Glr** and Math Reasoning Skills (the ability to use mathematics operations in applied, real-world scenarios).[1]
- Basic Mathematics Skills (the ability to perform mathematical operations, and display one's knowledge of mathematical concepts) is less consistently related to **Glr**, and the relationship occurs only during late adolescence and early adulthood.[1,3]

Visual Processing (Gv):

- There is a moderate relationship between **Gv** and Math Reasoning Skills (the ability to use mathematics operations in applied, real-world scenarios).[3]

Footnotes:

1 Floyd, R. G., Evans, J. J., & McGrew, K.S. (2003). Relations between measures of Cattell-Horn-Carroll (CHC) cognitive abilities and mathematics achievement across the school-age years. *Psychology in the Schools*, 40(2), 155-171. **2** McGrew, K. S., Flanagan, D. P., Keith, T. Z., & Vanderwood, M. L. (1997). Beyond *g*: The impact of Gf-Gc specific cognitive abilities research on the future use and interpretation of intelligence tests in the schools. *School Psychology Review*, 26(2), 177-189. **3** McGrew, K. S., & Hessler, G. L. (1995). The relationship between the WJ-R Gf-Gc cognitive clusters and mathematics achievement across the lifespan. *Journal of Psychoeducational Assessment*, 13(1), 21-38.

Insight