Application of SB5 Results to Learning in the Classroom

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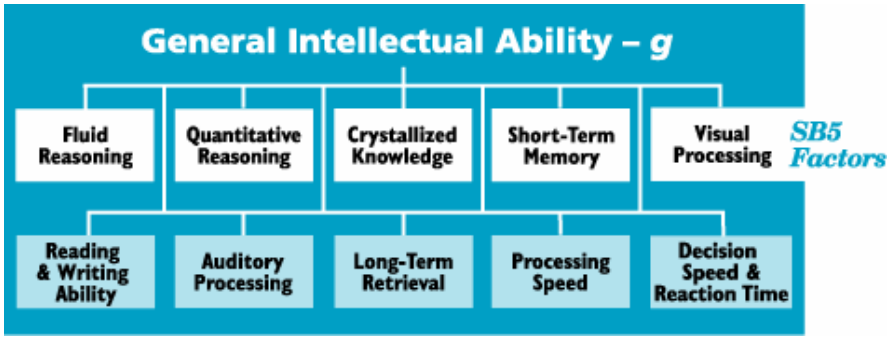
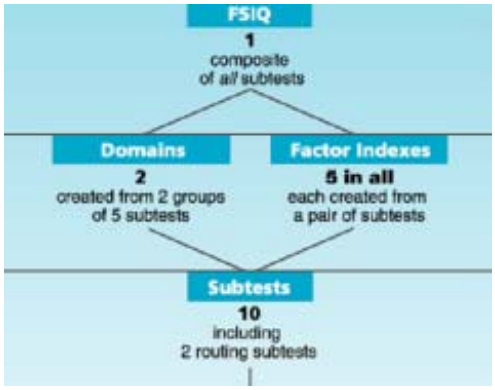
The *Stanford-Binet Intelligence Scales,* Fifth Edition (SB5) (Roid, 2003a) provides a basis for assessing abilities within the Cattell-Horn-Carroll (CHC) theory of abilities (around which the test was explicitly designed) and across a wide age-span (age 2-0 through 85 and higher). The SB5 Interpretive Manual (Roid, 2003b) provides discussion of ability-performance relationships across major life arenas, including learning, work, and daily life. This poster outlines suggestions for making practical use of SB5 results—as indicators of constructs from the CHC theory of abilities—for learning in classroom, and therefore for classroom instruction. It also identifies several possible research projects to provide empirical tests of these recommendations.

CHC theory assumes that abilities are organized hierarchically. The typical way of representing this is through narrow tests at stratum (level) 1 contributing to broad abilities at stratum 2, and culminating with *g* at stratum 3. The following figure shows how the five broad (stratum 2) abilities of the SB5 combine to provide an indicator of *g*. Additional broad abilities may be measured through cross-battery assessment.



Two subtests—one verbal and one nonverbal—provide the basis for measuring each factor, or "factor index." Although the technical documentation provides confidence for interpreting profiles at the subtest level, the primary focus in SB5 interpretation is at the level of broad abilities (factor indexes) and higher in the CHC hierarchy. The following figure shows the organization of the five

factor indexes, two domains (the sets of 5 verbal and 5 nonverbal subtests), and FSIQ, the indicator of *g*.



SB5 Broad Abilities: Relevance for Instruction, Associated Learning Styles, and "Instructional Hooks"

Insert Table 1 about here

Characteristics of Students High and Low on Each SB5 Broad Ability.

Insert Table 2 about here

Relative Strength of SB5 Ability Domain (Nonverbal and Verbal) to Preferences for Learning Activities. If the Verbal Domain is relatively stronger, the student is more likely to engage in learning via verbal means, such as through reading, oral communication, and through practice activities that emphasize the roles of speech and language. If Nonverbal Domain is relatively stronger, the student may be more likely to engage in learning activities that permit practice through less highly verbally mediated means.

Verbal mediation provides an extremely efficient means (via verbal symbol systems) to facilitate most kinds of learning. Persistence in a preference for less verbally mediated learning may

therefore lead to a persistent specialization in a particular domain in which verbal mediation of learning is less critical. Such domains might include the visual arts, music, and athletics.

Also important is the reason for the nonverbal domain score being relatively higher. If it is a possibly transitory situation—say, for an English language learner—the preference for nonverbal learning activities may abate as the individual gains increased competence in the specific verbal skills required for successful performance.

Relations Between FSIQ Score (Indicator of g) and Recommended Methods of Instruction. Extending from Gottfredson's (1997) discussion of the importance of *g* in everyday life, Roid (2003b) proposed a set of hypothesized relations between general ability (as indicated by FSIQ on the SB50 and optimal method of instruction.

Insert Table 3 about here

Opportunities for Research

The hypotheses expressed in this paper suggest a range of testable questions of interest to both practitioners and to psychologists interested in the nature of abilities and their links to instruction. The author encourages interested investigators to contact him to discuss these and related research ideas.

References

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Table 1: Relevance for Instruction, Learning Styles, and Instructional Hooks

	Relevance	Learning Style	Instructional Hooks
Fluid Reasoning	Solving novel, less structured problems requiring modeling of complex information. Can be very useful across *all subjects*, particularly *scientific* ones at the secondary level..	Associated learning style emphasizes a general preference for planning and mental rehearsal.	Problem-based learning methods. Reframe learning as inquiry and puzzle-solving. Reward necessary fact-learning with chances to solve problems from the facts just acquired.
Quantitative Reasoning	Solving mathematical problems; important for *mathematical* studies, *accounting/ economics*, and traditional *computer programming*.	Logical-mathematical orientation associated with emphasis on creating logical models, and evaluating them for their possible applications to problems.	A variation of general problem-based learning methods may work. Difficulty is again to balance learning of necessary facts with exploration of the implications of the facts for solving mathematical problems.
Visual-Spatial Processing	Relevant for any subjects when tasks involve processing of visual-spatial information; especially important for *visual arts, vocational technology/ mechanical drawing, short-hand*.	Associated learning style involves mental imagery, including creation of dynamic visual models of structures and processes.	Learning can be visual or verbal, but if verbal should be about visualizable things. Learning and practice using physical, hands-on activities, particularly allowing for three-dimensional manipulation.
Working Memory. *Note:* Because this ability is distinct from long-term memory and retrieval, individuals with good working memory may still need to transfer information to durable, external records, such as a notebook or personal digital assistant (PDA).	Relevant for any tasks with requirements for juggling information in short-term memory; especially relevant for *music, speech/debate, writing* (because one needs to remember what one wants to say), *short-hand/dictation*.	Especially important for learning tasks involving positional (successive) information. Learning style often involves a preference for visual or auditory modalities, based on relative nonverbal or verbal strengths.	Allow selective opportunities to juggle information and arrive at ways to mentally sort it into new configurations. The tasks should vary between auditory and visual in nature. *Note:* Teachers must use caution in providing whole-class instruction that taxes working memory because students low in the ability will find it so difficult and may become discouraged.
Knowledge	Relevant for all courses; especially those placing emphasis on the memorization of content, such as *history, literature, vocabulary, spelling/grammar*, and *science* at the elementary/middle school levels. Because this factor continues to exhibit growth throughout most of the adult years to an extent greater than the other factors, adult education may capitalize on strengths in this area.	May work through other abilities, but strengths reflect learning style that has an omnivorous and typically generally interested approach to learning information.	The trick is to make the demonstration of one's knowledge enjoyable outside of the graded (high-stakes) test. Any activity in which one may rehearse one's knowledge with proper feedback can become enjoyable. *Note:* Be cautious about making students high in knowledge self-conscious before their peers for "always knowing the answer."

Table 2. Characteristics of Students High and Low on Each SB5 Broad Ability

	High (special concern for gifted instruction)	Low (special concern for special education instruction)
Fluid Reasoning	Appears to think through problems seemingly more quickly than others, and may therefore appear "creative," especially as solutions may simply "appear" to the individual. May rely on reasoning skills to argue with others to seek to influence others. Others may view such individuals as "bright" but possibly arrogant or critical.	Tends to avoid unstructured problems, especially those with high-stakes consequences. Prefers the tried and true, and highly practiced behaviors. Becomes frustrated when others demand too much sustained efforts to reason through novel problems, or at least when others demand that solutions be obtained rapidly. Others may view such individuals as "dull" and possibly plodding and overly cautious.
Quantitative Reasoning	Because this is a fairly narrow (but important) ability, it may not be appear to affect general behavior greatly except that the individual prefers to work with numbers (or at least logical arguments). However, when the individual does work and reason with numbers (or logic), and can reach decisions on the basis of such reasoning, he or she may appear to others to be "unreasonably" sure of things; yet that sense of assurance arises from the confidence they have come to feel regarding their logical-mathematical reasoning skills.	Prefer to use calculators following scripted approaches to problems. Tends to avoid use of this ability in any context outside of obviously mathematical activities, and even there as infrequently as possible. Given enough time and a correct method of calculation, can still obtain the correct solution, although possibly with little understanding of how this was achieved (except through assiduously following a set of rules).
Visual-Spatial Processing	Often creates drawings to help "think-through" problems. Constant creation of mental images that are explored for insight (literally) into issues. May appear to "space-out" to others not high in ability. May use hand gestures more then speaking. May have difficulty verbalizing some complex (in terms of spatial structure) thoughts.	Finds it difficult to visualize problems through the imagination, but may compensate by heavy reliance on verbal imagery and words. May therefore gravitate away from the world of tangible, physical objects, and toward that of words and social experience.
Working Memory.	Remembers assignments and commitments and therefore gets work in on time, and is able to remain focused on duties. Good memory for details picked up in conversations. Can juggle several (small) tasks at once. May assume that there is no need to record information in more permanent form.	Viewed as distracted, forgetful, and perhaps inattentive by others. May compensate through development of note-taking skills and use of related devices (e.g., notebooks, PDAs). In the long-term, development of habits of reliance on externalized memory aids may serve to completely compensate (and then some) for earlier deficiencies.
Knowledge	Relies on large store of information (at extreme levels, a "walking encyclopedia") as basis for completing tasks. Can fill in "gaps" in instruction with previously learned information and skills, which generally works but may cause interference with recently (and incompletely) learned material. Although generally being high on knowledge is useful, some may view such individuals as being.	Several studies have shown that many American students lack important knowledge about history, geography, and word meanings; this results in difficulties in following current events reported in newspapers and other media. Individuals may compensate by relying on trusted others for the adoption of attitudes toward politics and other issues. May feel ill at ease when seeking to communicate with individuals with higher levels of education or knowledge.

Table 3. Relations Between FSIQ Score (Indicator of *g*) and Recommended Methods of Instruction

Ability Level and FSIQ	Optimal Method of Instruction
Borderline Delayed (70-79)	Ensure that learning is at an appropriate slow speed, simple, and supervised. A teacher or assistant may provide ongoing support for learning through an inclusion setting.
Low Average (80-89)	Provide very direct, hands-on instruction. At lower range, may benefit from plenty of direct supervision.
Average (90-109)	Provide plenty of time for student to master assignments (mastery learning), allow hands-on learning. Especially in elementary grades, can benefit from direct instruction. At upper level of the range, and especially at older ages, student can learn well from reading written materials and practice.
High Average (110-119)	In general, students can thrive in learning in a traditional classroom format, with mixed lecture, reading, and group and individual review. At higher levels, can more readily acquire skills in collecting and gathering their own information.
Superior (120-129) and above	Create opportunities for these individuals to seek and find their own information, and provide instruction as needed, particularly in these information search skills. These individuals may enjoy reasoning things through on their own. Use more direct methods as needed, but remember that traditional classroom teaching methods may become boring for these students.

Note: Abbreviations: FSIQ = Full Scale IQ.