



Assessing Cognitive Skills

Determining Learning Capacity by Measuring Brain Function

"The mind is not a complex network of general capabilities such as observation, attention, memory, judgment, and so forth, but a set of specific capabilities, each of which is, to some extent, independent of the others and is developed independently. Learning is more than the acquisition of the ability to think; it is the acquisition of many specialized abilities for thinking about a variety of things."

--Lev Vygotsky

When a task is given in school, why does one student take thirty minutes to complete it and another only eight minutes?

In this article, you'll come to understand the answer: students approach the task with varying learning tools. These tools are called cognitive skills, and these skills determine the quality, speed, and ease with which individuals learn and perform.

Cognitive skills are the foundational skills or tools a child uses to learn. These are not the same as the academic subjects taught in school; rather, cognitive skills are the mental tools needed to process and learn what is taught in an academic environment.¹ It's not how much you know (the information that has been taught in a classroom), but how effectively you process the information you have received that counts first. In other words, cognitive skills are the learning skills used to:

- 1) Attend to and retain information;
- 2) Process, analyze, and store facts and feelings; and
- 3) Create mental pictures, read words, and understand concepts.

Students struggle to learn for a reason. There can be factors other than weak cognitive skills, but recent studies by the National Institute of Health, the U.S. Department of Education, and others indicate that the source of over 80% of learning problems is weak cognitive skills.

Knowing when a student is weak in one or more of their core cognitive skill areas is the first step in helping them achieve their full learning and academic potential.

Is it possible to find clues to determine the relative strength of a child's cognitive skills without testing? Yes, it's possible to judge the strength of their cognitive skills by stepping back and observing him/her in the midst of their daily activities.

¹ These skills are also called *mental skills, intelligence, learning skills, learning tools, and processing skills*. These terms all refer to the same cognitive skills that are needed for consistent success in school, in the workplace, and in all areas of life.

In learning and working, each activity requires certain underlying capabilities. To determine strengths and weaknesses you can evaluate all the activities that your child is involved in on a daily basis. Think through the day.

- What's easy or hard for your child?
- What does he try to avoid?
- What is he eager to do?

Those are your first clues about underlying strengths and weaknesses. If your child's underlying cognitive skills are all strong, activities are easy and probably enjoyable. If an underlying skill is weak, an activity will be somewhat troublesome for your child.

There is a serious limitation with this approach in determining your child's cognitive strengths and weaknesses through performance. Doing this observation and activity analysis can take a considerable amount of time. It would require a comprehensive understanding of underlying skills and the role each plays in your child's activities. For example, if a child has difficulty completing a jig-saw puzzle, is it due to inattention, being able to see a piece rotated 90 degrees, or remembering where a piece was last put aside? Unfortunately, although symptoms are helpful they often fail to pinpoint the specific weakness.

Think of it this way. A highly trained and experienced mechanic would not rely solely on symptoms. Sure, if it's a flat tire, no problem, but if it's an engine problem, then what? What you described combined with what the mechanic observes is sometimes not enough for an accurate diagnosis. The car should be taken to the garage and hooked up to special diagnostic equipment for testing to verify his first round diagnosis.

Just as a mechanic uses diagnostic equipment to get an accurate diagnosis, cognitive tests are given to look into underlying mental skills to verify diagnoses made from observations.

Testing cognitive skills is one of the first steps in identifying and correcting weak skills. You can identify what's holding a person back from his learning or working potential by determining the quality of the learning tools a person possesses.

Work and academic performance is measured by grades, achievement tests, and production. Cognitive testing can tell you why there is a certain level of performance, and help direct the training program to target the most deficient skills. What was once weak can be made strong.

Evaluating Cognitive Skills Test Results

What Cognitive Skills Are Tested

"Learn avidly. Question repeatedly what you have learned. Analyze it carefully. Then put what you have learned into practice intelligently."

--Confucius

Evaluating an individual's capacity to learn examines how well he or she processes information in much the same way as vision and hearing tests screen for visual or auditory issues. It is impractical to fully isolate and measure only one mental skill. The skills are interdependent. While cognitive skill testing is a general indicator and not an absolute measurement, this does not lessen the value of testing.

Seventy different cognitive skills have been identified and measured. They are in seven core skill groups—attention, processing speed, working memory, long-term memory, logic and reasoning, auditory processing and visual processing. There are several different variations on cognitive skill testing depending upon the skills measured and the fidelity of the measurement used.

There are numerous cognitive test batteries, some designed for the purpose of generating an IQ score and others for determining the quality of specific cognitive skill levels. The specific skills tested that we will discuss include:

- **Attention:**

The ability to work and learn with focus, clarity, and purpose. Attention skills include sustained attention (staying on task), selective attention (ignoring distractions), and divided attention (attending to more than one task at a time). To measure attention, we have used an attention survey because of the difficulty of separating attention from other cognitive skills in testing.

Weakness in Attention often results in: *needing things repeated; poor listening; difficulty in following a conversation in a crowd; easily distracted, mind-wandering; missing important information; unable to keep things tidy; impulsive; and often has trouble getting started.*

- **Processing Speed:**

This test measures cognitive efficiency, more specifically the speed of processing simple concepts.

The subject is asked to locate and click on one of two identical numbers/letters in a row of six targets. This task increases in difficulty from single digit/letter to triple digit/letter combinations.

Weakness in Processing Speed often results in: *difficulty with basic reading skills, written expression, and math calculation; difficulty handling complex problems; slower performance; and frequently needing to have instructions repeated.*

- **Working Memory:**

This test measures the ease and capacity to hold data in memory while processing it. The test requires the individual to hold pictures and verbal statements in immediate awareness (memory) while performing other mental tasks before being required to respond.

Weakness in Working Memory often results in: *difficulty remembering names, telephone numbers; difficulty completing problem solving operations; needing instructions repeated. It may seem that students "just don't get it."*

- **Long-Term Memory:**

This test measures long-term storage and retrieval ability. The test requires the subject to store and retrieve a series of pictures and statements after time and numerous activities have intervened.

Weakness in Long-Term Memory often results in: *difficulty retrieving content for tests; a need for more practice and repetition than most; difficulty recalling math facts and blending sounds in reading; difficulty recalling names and facts; frequent use of general descriptors/words in written language rather than specific; showing inconsistent performance (A's and F's); "It's on the tip of my tongue but I can't quite remember it"*

- **Visual Processing:**

This test measures visual spatial relationships as well as recognition and manipulation of visual images - the ability to perceive, analyze, synthesize, and think using visual patterns. The subject is shown a complete puzzle and pieces and then is asked to select the piece that best matches a highlighted part of the puzzle.

Weakness in Visual Processing often results in: *difficulty with rapid sound/symbol processing and copying tasks; not rapidly recognizing "whole" words; reading slowly; reduced creativity; problems understanding information from graphics.*

- **Auditory Processing (phonological awareness):**

This test measures the ability to manipulate and understand spoken sounds - which is the crucial underlying skill for reading and spelling. The test consists of a segmenting subtest which asks the subject to unglue the individual sound in a word and a drop subtest requiring the subject to identify a word after one of its sounds is removed.

Weakness in Auditory Processing often results in: *difficulty with phonetic reading activities and beginning spelling skills development; poor listening and reading comprehension/language and vocabulary acquisition.*

- **Logic and Reasoning:**

This test measures the ability to reason and draw conclusions from given conditions - the ability to reason, form concepts, and solve problems using unfamiliar information or novel procedures. The subject is presented with a set of patterns with one pattern missing and is to select from a set of five choices the pattern that best completes the set.

Weakness in Logic and Reasoning often results in: *difficulty with math including algebra, statistics, and geometry; difficulty with transfer and generalization of learning; trouble with rule-bound systems of reading; being "slower on his/her feet" when required to cope with a new situation; and poor creative writing.*

- **Word Attack:**

This test measures the ability to sound out unfamiliar words and accurately recognize letter combinations. The subject hears a made-up-word and then selects one of four different letter combinations that best represents the made-up-word. (Note: "Word Attack" is not a cognitive skill but a measure of the subject's knowledge of phonic and structural analysis to read words. Normally poor word attack ability is related to poor

auditory processing, however good word attack when auditory processing is poor reflects that the subject has likely had extensive phonetics instruction. It has been included in this test battery because of its importance in reading and spelling).

Weakness in Word Attack often results in: *not knowing the sound-letter relationships required to read and spell resulting in poor reading fluidity (choppy reading) which then reduces comprehension.*

Evaluation of Four Common Examples of Test Findings with Case Histories

Many students that are having difficulties with learning fall into one of the four typical categories discussed below. Each category is illustrated with a brief case history of a student, cognitive test results, and noteworthy findings on a Learning Skills Report Survey (LSRS). As you read through these examples, please note the cause and effect relationship between cognitive skills and academic and work performance.

The charts below show the relative strengths and weaknesses for an individual in nine cognitive skill areas. The (x) axis is the diagram is the age equivalency line.



Example 1: Ken A Bright Student But Poor Reader And Speller

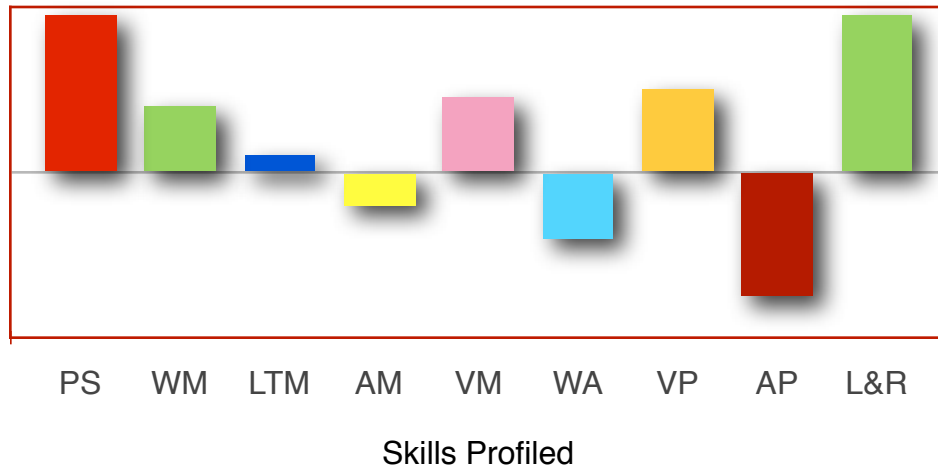


Figure.1: Cognitive Test Results For Ken

RESULTS: Auditory learning was the only problem indicated.

DISCUSSION:

Ken is considered bright with an IQ around 140, but he has problems with reading and spelling. Because of some very strong compensation skills he developed in high school, he was able to continue his education and went on to earn a doctorate degree. He wanted to study law, but the writing requirements were too difficult for him so he decided to go into the medical sciences field.

Ken has mixed memory skills. In elementary school, he would study his spelling words five minutes before the spelling test and usually scored one hundred percent. He failed the six-week review tests though because he wasn't able to retain the spelling words in long-term memory. Because of his difficulty with spelling, his writing was grueling and quite laborious. He dropped out of two foreign language courses, and almost every year his lowest grades were in English.

In Ken's school, the students were taught to read by the whole-word method. His memory was above average so he was able to read fairly well the first few years of grade school. It became apparent in fourth grade though that reading was not easy for him. A student can only retain a certain number of words in visual memory. Because his vocabulary was growing, he could no longer compensate by memorizing the 40,000 – 50,000 words needed for reading comprehension.

The reason Ken struggled with reading and spelling was because his auditory processing skills were weak. He looked for words within words and considered the content of the sentence to determine unknown words. Also, illustrations helped him in comprehending what he had just read. He did not have the skills needed to sound out unknown words.

If Ken's teachers had taught Ken utilizing a phonics program, without strengthening his auditory processing skills, he would have still had difficulty in reading and spelling.

However, had he received auditory analysis skills training before learning to read, he would have developed his ability to segment and blend sounds and become a good reader.

In graduate school, Ken had difficulty in classes such as bacteriology and pharmacology because the scientific words were long and difficult to remember. Despite being a doctor, in church and small groups, Ken refused to read passages of the Old Testament out loud for fear that he would sound like a fool. In his field he is extremely successful, but he avoided many things he wanted to achieve because of the difficulty he experienced when reading and writing.

In conclusion, strengthening weak auditory processing skills during childhood could have made a major difference in Ken's life. If evaluated by today's standards, he would be considered dyslexic. The right option for Ken, auditory processing training, was not available and thus he has struggled with reading, spelling and writing throughout his life.

***Example 2: Steve
A Slow Learner***

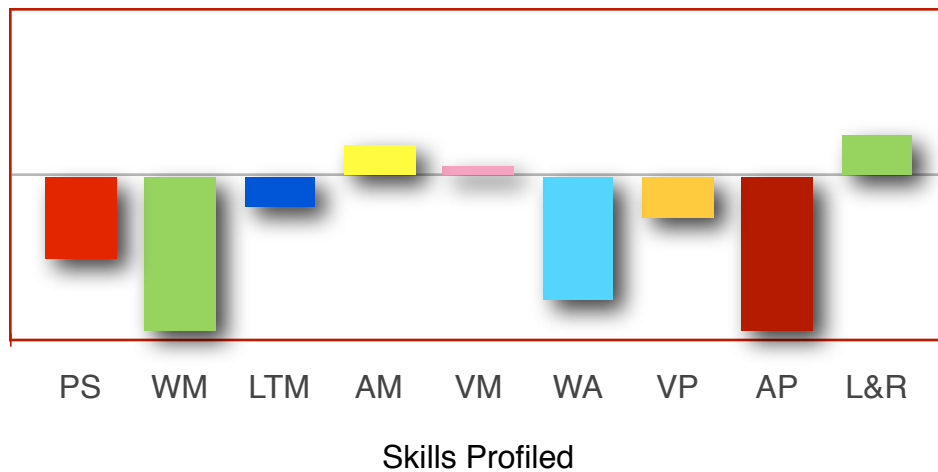


Figure.2: Cognitive Test Results For Steve

RESULTS: Indications of problems in all areas: attention, auditory learning, visual learning skills and school performance.

DISCUSSION:

Steve has deficiencies in most of the areas tested. The deficiencies are apparent in school because all classes are difficult for him. He does not have the skills needed to succeed academically.

He does not qualify to receive special services because according to his skill levels (scores shown above) and achievement scores, he is considered to be working at his potential. The teachers consider him as slow and modify his class work so that he can

perform at his current skill level. This does not allow for him to progress in skills so that he can perform at the same level as his classmates.

His weak skills can be improved. It will take longer than average to improve his skills because he is low across the board but improvement can be made. If Steve were to enter a mental skills training program followed by an intensive sound-to-code reading program, he would have much better tools to allow for success in the classroom and in life.

***Example 3: Andy
An Average Learner/Reader
With Reduced Comprehension***

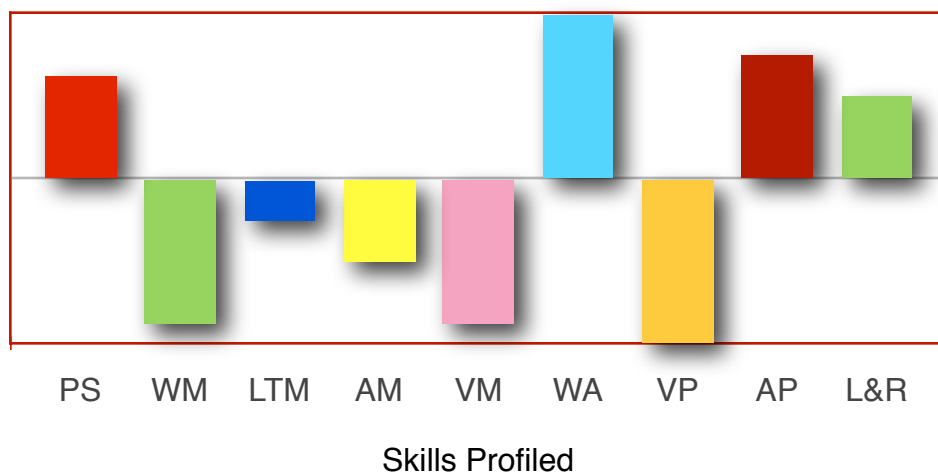


Figure 3: Cognitive Test Results For Andy

RESULTS: Indications of problems with learning in general and with academic performance.

DISCUSSION:

Andy has difficulty with reading comprehension. He can read fluently and has a great vocabulary but he cannot remember what he has just read. The difficulty with comprehension also affects his math ability. Word problems are especially difficult for Andy.

One of the causes of Andy's difficulties in reading comprehension and math is poor visual imagery. Good reading comprehension requires that reading fluency, memory, visual imagery, and vocabulary are all strong. For Andy, two of those skills are weak which inhibits him from remembering what he just read.

Visual imagery is the ability to create mental pictures in your mind, which allows for better comprehension. Visual pictures aid comprehension because pictures are much easier to remember than if you had to just remember the words you just read.

In completing math word problems, visual imagery is a critical skill. You need to be able to picture the problem so that you know how to take the appropriate steps in finding the solution.

The second cause of Andy's difficulty is working memory. This skill is needed to retain information long enough to process it. For example, when you are asked to do mental math, you need to be able to hold the numbers in your memory long enough to determine the answer and then you can move on to the next problem. When reading, strong working memory skills allow you to make connections to allow for a more complete concept formation.

In looking at his academic performance, teachers would assume he was an average student with average abilities. It's quite frustrating for Andy because his teachers and parents feel he just needs to try harder, to focus more while reading and doing math.

Looking at Andy's performance in isolation, not looking at the entire picture, the teachers are missing the cause of Andy's difficulties. If Andy were to be involved in cognitive training, his skills would be strengthened so that his reading comprehension and math skills wouldn't be so difficult. In turn, his self-esteem would most likely increase.

Example 4: Felicia A Good Learner

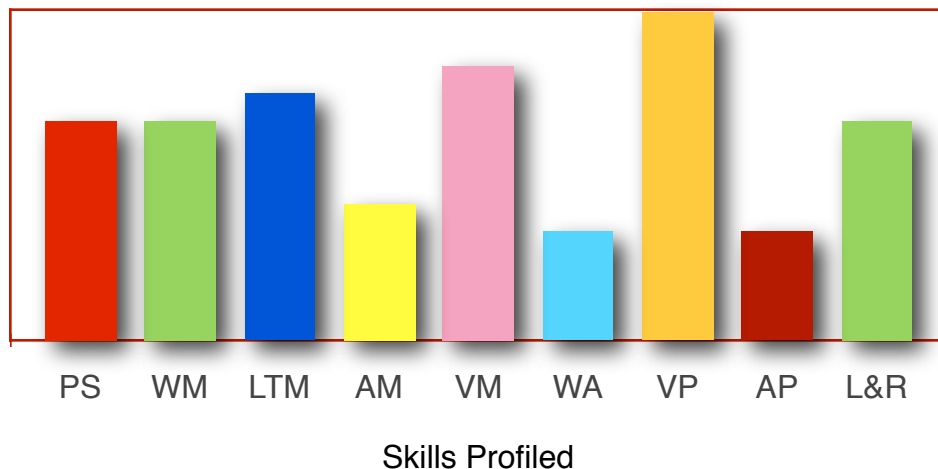


Figure 4: Cognitive Test Results For Felicia

All of Felicia's scores are above her age equivalency line

RESULTS: No significant problems.

DISCUSSION:

Felicia is a student who is considered very bright and does not have any significant problems with learning. Her teachers and parents feel she is doing well in school. Even though her cognitive skills are strong, she could benefit from cognitive skill training.

In a highly academic world, strengthening her skills even more could give her a competitive edge. Learning could be easier and more efficient for Felicia, which could make the difference between attending a state college or an Ivy League University.

Effects Of Delay

The clues to a child's learning problems are often not recognized or acted upon until serious damage has been done. The National Center for Learning Disabilities states that at least 44% of parents who noticed their children exhibiting signs of problems with learning waited a year or more before acknowledging there might be a serious problem.

Often, parents fear that being labeled as learning disabled will have a negative effect on their child's self-esteem. Nearly two-thirds (63%) of parents feel that children with learning disabilities view themselves as different and not as good as other children. (Rogers, 2000)

Early detection of learning and reading struggles is critical for recovery. The barriers rise so quickly around students who struggle in the early years of education that they become psychological obstacles. Recovery is more difficult as they get older.

This doesn't mean parents of older students should despair. Kids can be helped successfully in most instances. The goal and glaring need is to save parents and children the years of frustration by helping them as early as possible.

Science has opened up new possibilities for learning improvement.

Perhaps the most important encouragement science has provided is that we need not settle for what appears as a limitation or a lifetime disability. The human brain is capable of amazing change and modification. An individual's cognitive skills can be tested for relative strengths and weaknesses; the brain is capable of expanding to accommodate greater cognitive capacity. By training the brain to work faster and more efficiently, learning success can be dramatically improved. We can set new courses for ourselves, acquire new skills, and set our sights on new horizons with the assurance that our motivation can carry us (and our brains) much farther than we might imagine. We must only be willing to do the work and arm ourselves with the right kind of training tools. The brain is truly incredible!

For additional information or to learn more about current breakthroughs in assessing cognitive skills contact Cognitive First™ 6946 N. Academy Blvd., Ste. 123, Colorado Springs, CO 80918
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