Cognitive Skills and Workforce Development

Every year U.S. companies and other employers spend over $100 billion on employee training and development.[1] They could be getting far more bang for all those bucks. This paper discusses the potential for recent discoveries in neuroscience to turn corporate workforce development into a productivity engine beyond most managers' imaginations.

Employee training ranges from programs to develop basic skills to job-specific training and executive development. But while the demands of the workplace escalate in globally competitive markets, the preparation and adaptability of the workforce appear to be falling behind. Recently the potential role of cognitive skills development in relationship to workforce development has begun to surface as an important topic. This paper looks at six areas where cognitive skills development is expected to become integral and far more widely adopted in the coming years:

1. Workforce Readiness and Remediation
2. Direct Enhancement of Critical Job-Related Skills
3. Development of Employees for the Jobs of the Future
4. Improving the Return on Investment of Other Training Initiatives
5. Enhanced Productivity of Aging Workers
6. Developing Leadership Skills

1. Workforce Readiness and Remediation

According to several measures, including the Workforce Readiness Report Card[2], there is a significant gap between the level and types of skills that employers seek in entry-level workers and the level of proficiency demonstrated by recent graduates, whether from high school, two-year colleges, technical schools or even four-year colleges. The report also points out that, while basic skills are necessary, they are not sufficient, and the workplace demands applied skills in addition to more basic ones. The table below lists the skills identified in the report as very important to success in the workplace.

Basic Knowledge / Skills	Applied Skills
English Language (spoken)	Critical Thinking / Problem Solving
Reading Comprehension (in English)	Oral Communications
Writing in English (grammar, spelling, etc.)	Written Communications
Mathematics	Teamwork / Collaboration
Science	Diversity
Government / Economics	Information Technology Application
Humanities / Arts	Leadership
Foreign Languages	Creativity / Innovation
History / Geography	Lifelong Learning / Self Direction
	Professionalism / Work Ethic
	Ethics / Social Responsibility

[1] American Society for Training and Development, *The State of the Industry, 2006*

[2] The Conference Board, the Partnership for 21st Century Skills, Corporate Voices for Working Families, and the Society for Human Resources Management, *Are They Really Ready to Work?* 2006

Of the skills listed in the preceding table, Professionalism / Solid Work Ethic, Communications, Teamwork / Collaboration and Critical Thinking / Problem Solving were reported to be severely lacking in new hires at all levels of education. For high school graduates, entry-level readiness was also found to be deficient in several basic skill areas, including Writing in English, Foreign Languages, and Mathematics. This group had no areas of excellence.

While two-year and four-year college graduates were judged to be better prepared than high school graduates, deficiencies were still identified for these groups with Writing in English and Written Communications (the applied skill) most frequently cited as deficient. For two-year college and technical school graduates, entry-level readiness was found to be deficient for seven "very important" skills – and only Information Technology Application was identified as "excellent" by more than 1 in 5 of employer respondents (25%). Four-year college graduates fared better, with nine skills in the excellence category, but even with this more educated group, three skill areas were still deemed deficient: Written Communications, Writing in English, and Leadership.

The gap between workplace requirements and workforce readiness is widening. In 2003, 87% of adults tested below the proficient level in prose literacy and even the average score of adults with graduate study was in the Intermediate range (the level below Proficient). Between 1992 and 2003, the average scores for all levels of education decreased in one or more measures of literacy.[3]

Level of Educational Attainment	Change Between 1992 and 2003
Less than or some high school	Down 9 points in prose literacy
High school graduate	Down 6 points in prose literacy
College graduate	Down 11 points in prose literacy and 14 points in document literacy
Graduate studies/degree	Down 13 points in prose literacy and 17 points in document literacy

Other studies have also identified significant gaps in the skills required for today's jobs, estimating that between 25% and 40% of the current workforce lacks the basic skills to understand written or verbal communications. This workforce illiteracy costs U.S. businesses an estimated $225 billion a year in lost productivity.[4]

When elementary and undergraduate education fails to prepare workers adequately, it falls to employers to provide remedial training. However, employers face many of the same challenges that schools and colleges face when educating their workers, including a broad diversity of backgrounds, learning styles, intellect and culture. Organizations that use the same techniques and approaches used by schools are likely to get the same result.

Some employers give prospective hires pre-employment tests akin to intelligence tests, which are generally used as means to choose the "brightest" candidate, rather than as a diagnostic. It is unclear whether such employers assume that intelligence is fixed (the applicant can only ever be as smart as he/she was on the day of the test) or simply don't

[3] National Assessment of Adult Literacy, 2003, http://nces.ed.gov/NAAL/index.asp?file=KeyFindings/Demographics/Overall.asp&PageId=16

[4] http://ccbcmd.edu/ceed/wf_literacy.html.

want to invest in training to improve intelligence. Either way, the approach ignores what recent neuroscience research tells us about the plasticity of the brain[5].

In the 1970s, Arthur Whimbey documented a variety of interventions that enhanced the cognitive functioning of preschool children, that helped poorly performing college students take a more organized and effective approach to their academic work, and that improved individual performance on I.Q. tests.[6] Furthermore, the National Academy of Sciences recently published research suggesting that training in cognitive skills can very significantly increase human intelligence. As one of the researchers explained, the key part of this work is the demonstration that it is possible to improve fluid intelligence – the type of intelligence that measures how people adapt to new situations and solve problems they've never seen before.[7]

In fact, everyone has cognitive strengths and weaknesses and it is possible to improve these underlying skills using specific training techniques, even for adults. Developing these underlying skills can lead the way to more effective and efficient knowledge acquisition. Indeed, remediation of underlying cognitive skills is arguably a pre-requisite for improving the skill areas businesses expect their employees to master.

2. Direct Enhancement of Critical Job-Related Skills

Consider the fighter pilot who can see and aim at a target a hundredth of a second faster than the enemy. Consider the safety record of the semi-driver whose ability to sustain attention over long periods and peripheral vision are superior to other drivers in the fleet. Consider the professional basketball or football player whose mental picture of where the ball and the other players are on the court or field enables him/her to calculate where to position himself or herself more effectively than the opponent. Each of these examples demonstrates the importance of cognitive skills that are automatically processed without conscious thought. In some cases, military, professional sports teams and undoubtedly, public safety employees are already receiving training in the cognitive skills most applicable to their job performance. But most organizations are only beginning to scratch the surface of the kinds of improvements they could realize.

Now consider some other cognitive skills – say, sequencing – a skill required for accurate processing in a manufacturing environment, or in efficiently working through a series of interrelated steps in an office procedure. Or visualization – a skill needed in construction, in a concrete way, and in strategic planning, in a less tangible way. The same principles apply here. These are skills that can be developed and enhanced in virtually any individual. Organizations don't often think of developing them, assuming that employees come to them with as much or as little of these skills as they will ever have. That is a costly assumption, both for the organization and the individual.

Finally, consider some of the most prized skills in organizations – those underscored by the previously referenced Conference Board report as essential for success in this millennium – creativity, problem-solving, critical thinking and communications. Just like the attention, visualization, sequencing and other skills referred to above, these "21st Century Skills" are directly related to the ways our brains have developed, to the neural pathways we have and

[5] Plasticity refers to the ability of the brain to change and to continually form new connections and it persists throughout life.
[6] Arthur Whimbey, *Intelligence Can Be Taught*, Dutton Books, New York, 1980
[7] Alexis Madrigal, "Forget *Brain Age*: Researchers Develop Software That Makes You Smarter, " *Wired*, April 28, 2008

will create. And because the brain can and is constantly developing new pathways, each of us can further strengthen our strengths and mitigate our weaknesses. With appropriate exercise, we can build and strengthen the neural connections in our brains that will allow us to function more efficiently and effectively. We can get better at "changing our minds" (quite literally) in the face of new information, at combining information to discover something new or see it in a new way, or at seeing things from another's point of view so that it becomes clearer how to communicate with them. The potential payoff for organizations that support this kind of development in their employees is incalculable.

Managers sometimes refer to these as "soft skills," largely because they are harder to measure than factual knowledge. But another view holds that these skills are in some ways "harder" than factual knowledge. These skills are even more fundamental, as they might even be considered structural; they are, in essence, how the brain works through its neural connections. Creativity, problem-solving and critical thinking all rely on basic cognitive skills – the ability to see patterns, to see things from a different point of view, to coordinate the activities of multiple areas of the brain at the same time, to hold several ideas in the mind while thinking about them, and so forth. These skills can be developed with appropriate training, rehearsal and mediation.[8]

3. Development of Employees for the Jobs of the Future

According to former Secretary of Education Richard Riley, the top 10 jobs that will be in demand in 2010 didn't exist in 2004. And the amount of new technical information is doubling every 2 years. For students starting a 4-year technical or college degree, this means that half of what they learn in their first year of study will be outdated by their third year of study.[9] As one leading researcher characterizes it, "Today's central managerial challenge is to inspire and enable knowledge workers to solve, day in and day out, problems that cannot be anticipated."[10]

In their book *Know Your Child's IQ*[11], Glen Wilson and Diana Grylls outline occupations typical of various IQ levels:

IQ Level	Typical Occupation
140	Top Civil Servants; Professors and Research Scientists
130	Physicians and Surgeons; Lawyers, Engineers (Civil and Mechanical)
120	School Teachers, Pharmacists; Accountants; Nurses; Stenographers; Managers
110	Foremen; Clerks; Telephone Operators; Salesmen; Policemen; Electricians
100+	Machine Operators; Shopkeepers; Butchers; Welders; Sheet Metal Workers
100-	Warehousemen; Carpenters; Cooks/Bakers; Small Farmers; Truck/Van Drivers
90	Laborers; Gardeners; Upholsterers; Farmhands; Factory Packers and Sorters

In 21st century America, the demand for machine operators, sheet metal workers and warehousemen is in decline. The jobs that remain require a higher level of functioning and comfort with technology.

What happens in our workplaces, however, when the demand for workers at higher I.Q. levels increases while the jobs suitable for lower I.Q levels declines?

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[8] Donalee Markus, *Retrain Your Business Brain: Outsmart the Corporate Competition*, Dearborn Trade Publications, 2003

[9] http://www.glumbert.com/media/shift, www.oecd.org/sti/ict/broadband

[10] Amy Edmondson, "The Competitive Imperative of Learning," *Harvard Business Review*, March 2008

[11] Glen Wilson, Know Your Child's IQ, Pocket Guides, 1977

Fortunately, there is growing evidence, as described above, that intelligence can be taught – not just for remediation, but to improve fluid intelligence[12]. In a multi-site controlled study, researchers evaluated three different methods of improving fluid intelligence skills – a memory training program, an inductive reasoning skills program and a computer-based program to train processing speed. All three groups who went through an initial five-week intervention improved and retained a significant percentage of the improvement when tested five years later. The most pronounced results were experienced by the group who used the computer program. Of greatest importance, the enhanced cognitive skills developed by the subjects in the study transferred to everyday tasks, such as finding an item on a crowded pantry shelf, reading medication bottles, and reacting to road signs.[13]

4. Improving the Return on Investment of Other Training Initiatives

While there is considerable evidence of the value of workforce training, many organizations have difficulty establishing the link between training and business performance.[14] A couple of fundamental questions haunt managers and trainers – how much do our employees remember of what we teach them, and how well do they apply it on the job? These fundamental questions beg some other questions: Do they understand the written, verbal and visual information they are provided during training courses? How well can they relate it to the workplace? How automatic are their responses in a workplace situation in recalling the information needed? And how effectively do they apply it in the right situations?

Low levels of retention and application of training in the corporate environment should not be surprising, given that those programs generally operate in the same ways as prior schooling, which, as discussed above, has been woefully inadequate in preparing workers. Training for workplace content (procedural skills and information) relies on learned curriculum (reading, math, etc.), but it also assumes that workers have the underlying cognitive skills that will enable them to take in process, absorb, retain, and recall the information we want them to know. Unless cognitive skills are well-developed, an employee will spend most of his/her effort decoding and trying to process the information being presented. Conversely, when the decoding and processing skills function automatically, he or she can think at higher levels and develop deeper understanding of what is being learned. Corporate training, like K-12 education, assumes adequate development of cognitive ability, something not all employees have.

Improving cognitive skills improves understanding, memory, retrieval ability and retention. Thus, we can expect better retention of information/content contained in training programs by building stronger cognitive skills. What would it be worth if employees could improve their retention of the material presented in training by 10% or 20% or 50% or more, or be trained in half the time it currently takes?

5. Enhancing the Productivity of Aging Workers

As baby boomers reach retirement age and birth rates in the developed world fall, employers are increasingly concerned about a shrinking workforce. Labor shortages are bringing

[12] Fluid intelligence is the ability to solve new problems and to to think creatively and flexibly.
[13] Willis et al, "Long-Term Effects of cognitive Training on Everyday Training on Everyday Functional Outcomes in Older Adults," *Journal of the American Medical Association*, December 2006
[14] Shari Caudron, *Workforce Magazine*, January 2000.

greater competition for skilled workers and older employees are increasingly motivated to remain in the workplace, whether to sustain their sense of self-worth or for financial reasons.

While older workers generally have many advantages, including experience, loyalty, institutional memory, and a strong work ethic, productivity can become an issue.[15] Organizations have a compelling interest in ensuring that these workers retain the mental acuity and agility to perform optimally in their roles. Moreover, as discussed above, we can count on those roles changing. In an era of rapidly advancing technology, older workers will have to learn new things in order to be effective, not just in the jobs they know, but in the jobs that have yet to be invented.

Indeed the changing nature of jobs will affect all workers, not just those over a certain age. However, older workers do have some particular characteristics worth considering. For example, while many factors contribute to older workers' job satisfaction, one key is ongoing professional development.[16] Continuing to find one's job interesting is important to older workers. According to an AARP poll, 87% of workers who say they plan to work in retirement will do so because of a desire to remain mentally active, and 50% because of a desire to learn new things.[17]

While staying active through work may, by itself, help deter the cognitive decline associated with aging, targeted training to sustain cognitive well-being, especially in the areas of attention, memory and processing speed may enable older workers to be even more effective even later in life. Indeed, brain fitness has the potential to become an integral part of corporate wellness programs.

Recent research documents the explosive growth in corporate wellness programs around the world and one trend places more emphasis on technology to enable greater personalization.[18] Indeed, just as organizations focus on preventive health programs to support physical well-being (and lower health care costs), it is expected that they will add preventive brain health to their initiatives.[19]

6. Developing Leadership Skills

In the last ten years, researchers in schools of management have increasingly focused on "social intelligence" as a key to leadership. Much of the discussion has centered on the role of empathy and self-knowledge. Very recently, however, the biological underpinning of social intelligence has become apparent. Specifically, the discovery of mirror neurons starts to provide an explanation for the mechanisms at work when we consciously or unconsciously detect another's emotions, creating a sense of shared experience.[20]

Other elements of brain circuitry with implications for leadership have also been identified, including spindle cells which make extremely rapid connections within our neural networks when we have to choose one response among many or when we need to asses another

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[15] Rainer Strack, "Managing Demographic Risk," *Harvard Business Review*, February 2008
[16] Barbara Jaworski, "Aging workers, changing values: employers that want to benefit from aging workers' changing value will need to show they are committed to their ongoing development and respectful of their unique needs," *The Journal of Employee Assistance* 2005
[17] AARP, *Staying Ahead of the Curve*, 2003
[18] Buck Consultants, *Working Well, A Global Survey of Health Promotion and Workplace Wellness Strategies,* 2007
[19] Sharp Brains, Inc., *The State of the Brain Fitness Software Market*, 2008
[20] Goleman and Boyatzis, Social Intelligence and the Biology of Leadership, *Harvard Buisness Review,* September 2008

person's character or truthfulness in a fraction of a second (thin-slicing). Oscillators are cells that help us physically regulate how our bodies move together – imagine the importance of well-functioning oscillators for a symphony conductor or members of a basketball team or any task requiring collaboration.

Recall that leadership is one of the qualities employers identify as among the most important for employees to bring to the workplace and that leadership is required at all levels of an organization. Social intelligence is vital not just for CEOs and presidents; but at every level and in every interaction. Research has shown a large gap between the performance of socially adept leaders and those with low social intelligence. As Goleman and Boyatzis comment in the article cited above,

> Hard-bitten executives may consider it absurdly indulgent and financially untenable to concern themselves with such theories in a world where bottom-line performance is the yardstick of success. But as new ways of scientifically measuring human development start to bear out these theories and link them directly with performance, the so-called soft side of business begins to look not so soft after all.

Bringing Cognitive Skills Training to the Workplace

As organizations begin to incorporate cognitive development into their training programs, there are a number of factors they should take into consideration in their approach and their selection of a program or methodology.

1	Are there scientists and a scientific advisory board behind the program?
2	What is the research that supports the use of the program? For example, are there published, peer-reviewed scientific papers that demonstrate results?
3	What are the specific benefits claimed for using this program and how do those fit with the needs of your organization?
4	Does the program explain which cognitive skills are being developed and relate that to changes expected to be seen in the workplace? Does the program tell me what part of my brain or which cognitive skill I am exercising, and is there an independent assessment to measure my progress?
5	How will results be measured? If you expect certain outcomes and behaviors in the workplace, how will you track that?
6	Is it a structured program with guidance on how many hours and days per week to use it?
7	Do the exercises vary and teach me something new? Is it comprehensive and is skill development integrated the way the brain functions. Is it well-rounded (like a physical cross-training program) so that new skills become fully integrated into behavior patterns?
8	Does the program challenge users or does it feel like it would become easy once learned? Cognitive development takes place at the outer edges of an individual's capabilities. The appropriate level of challenge is critical.
9	Is the program engaging and motivating?
10	Is the program scalable to the size of your organization?
11	Does the program have the ability to track progress and usage across your employee base for management purposes?

Conclusion

Cognitive skills underlie the ability to learn and perform in the workplace. New tools and techniques have been developed that enable cognitive skills to be developed, rapidly and dramatically. Improved cognitive skills can help organizations address key workforce issues including:

- Remediating Deficiencies in Workforce Readiness
- Direct Enhancement of Critical Job-Specific Technical Skills
- Addressing Social Intelligence Gaps
- Training in Critical "21st Century" Applied Skills (e.g., Critical Thinking)
- Improving Workforce Productivity
- Improving the Return on Investment of Other Training Initiatives
- Enhancing Productivity of Aging Workers
- Improving the Skills Good Leaders Need
- Improving the Learning Capacity of All Workers

It is becoming increasingly clear from neuroscience research that intelligence is not fixed and that the component skills that make up intelligence and learning capacity can be trained, at any age. This means that there is reason to hope that ill-prepared entry-level workers will be able to make significant improvements in their ability to meet workplace requirements and to benefit from corporate training programs. It means that all workers can enhance their higher-order thinking and communications skills in a very short time. It means that older workers can be effective longer and grow in their roles. In other words, it is possible today to train skills such as attention, visualization, working memory and auditory processing. It is possible to develop social intelligence as well as neurological intelligence.

If our employees are deficient in these skills, those deficiencies can be remedied. If they are strong, they can become stronger. Indeed, by developing the underlying cognitive skills that allow employees' minds to function more effectively, we should be able to develop a nation of workers at significantly more advanced levels of functioning and achievement. What is required is that organizations begin to train the skills they need rather than bemoaning the lack of skills in those they hire.