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Cognitive Ergonomics and the Older Worker: Training that Works!

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Introduction

The baby boomer generation is defined as those born between 1946 and 1964. Until recently, it was anticipated that there would begin a mass exodus out of the workplace as the oldest of the boomers reached retirement age in 2011. Current financial trends have impacted the number of boomers who are able to retire and most plan to work past age 65. The job market is also seeing a move from part-time work for older workers to full-time. "Between 1995 and 2007, the number of older workers on full-time work schedules nearly doubled while the number working part-time rose just 19 percent. As a result, full-timers now account for a majority among older workers: 56 percent in 2007, up from 44 percent in 1995" (BLS, 2008, p. 1).

The trend for aging workers will continue. Not only do the baby boomers represent the largest working cohort in the United States, there is also a rise in workers over 65. "The number of workers between the ages of 65 and 74 and those aged 75 and up are predicted to soar by more than 80 percent" (BLS, 2008, p. 1). According the analysis by the Bureau of Labor Statistics (2008), "between 1977 and 2007, employment of workers 65 and over increased 101 percent, compared to a much smaller increase of 59 percent for total employment (16 and over). The number of employed men 65 and over rose 75 percent, but employment of women 65 and older increased by nearly twice as much, climbing 147 percent. While the number of employed people age 75 and over is relatively small (0.8 percent of the employed in 2007), this group had the most dramatic gain, increasing 172 percent between 1977 and 2007."

The implications are clear for those involved with safety training. Training must be responsive to older workers and how they learn best. Older people experience changes in cognition that affect their abilities to learn and perform tasks. Cognitive ergonomics fits their cognitive abilities to the task.

Adult Learning Theory

Safety trainers are exposed to principles of adult learning either through academics, publications, or conferences (Jackson, 2006). Adult learning theory, also known as

andragogy, purports that adults learn differently than children. Briefly, the six key principles of adult learning theory are:

1. The need to know why they need to learn something.
2. Their self concept which includes self-responsibility and decision-making rather than having decisions imposed on them.
3. Value of their life experiences within the framework of learning
4. A readiness to learn based on what they need to know in real-life circumstances.
5. An orientation to learning that is task or problem centered rather than subject centered.
6. Adults are more internally motivated to learn something.

These learning principles apply to adult learners. However, there are unique changes that occur in the brain that make learning different for the older worker. Understanding those changes will improve safety training. Increasing the effectiveness of safety training improves the health and safety of the workforce, decreases injuries, and has a positive financial impact.

Cognitive Ergonomics

The brain weighs about 3 lbs and is about the size of a medium cauliflower It contains about 100 billion nerve cells, also called neurons and about 100 trillion synapses to transmit information. As the brain ages it decreases in weight and volume. Some areas of the brain shrink more than others. This includes the frontal lobe which is responsible for certain executive functioning skills and the hippocampus where new memories are stored. This is one reason why repetition is so important when learning new information.

Old science once thought that the brain did not change. Brain cells died. When people had strokes there was not much hope for improvement. Now we know that the brain does change. Neuroplasticity is the term used to describe the brain's ability to reorganize itself and build new networks and pathways. Older people do not necessarily become victims of an aging brain.

The belief that older workers' intelligence markedly declines through the work years is supported by cross-sectional research studies. These studies measure intelligence across different age groups at the same time. The results of these studies show significant decline in intelligence between young, middle, and older adulthood.

Longitudinal studies are more accurate research that measure intelligence on the same individual over time. K.Warner Shaie's Seattle Longitudinal Study (SLS) is a landmark study that investigated cognitive changes for individuals over time. Schaie discovered some early longitudinal studies, indicating "strong evidence that most intellectual abilities were maintained at least into midlife and that some abilities remained stable beyond that period" (Schaie 35). In his summary of longitudinal data, Schaie reports that cognitive decline is less pronounced when the same individuals are studied across time. Modest decline begins in the early 60s and marked decline does not occur

until the 80's (Schaie). There are two exceptions: 1) Number Skills begin to decline in the 50's and 2) Verbal Meaning and Inductive Reasoning show a larger cumulative decline for men.

Older adults consistently do better in avenues of knowing termed crystallized intelligence. "As represented by tests of general information and vocabulary, crystallized intelligence is said to reflect the mental abilities that depend on experience with the world – on education in the broad sense, including both formal schooling and informal learning experiences in everyday life" (Schaie and Willis 362). This form of intelligence increases through aging, especially if the individual is actively engaged in adult educational experiences. This is sometimes referred to as the transition from information to knowledge; from knowing to wisdom.

The opposite of crystallized intelligence is fluid intelligence. Fluid intelligence "refers to the efficiency or effectiveness of processing at the time of assessment" (Salthouse 43). It reflects the ability to solve new problems based on current information.

Cognitive competence does not necessarily decline with age. However there are training methods that work more effectively for older workers. An AARP survey on lifelong learning reported that older adults are interested in what is happening in their world, especially in subjects that would improve the quality of their life, build on an existing skill, and improve their health. Older workers prefer methods that are easy to access, require small investments of time and money to get started and allow learning to begin immediately. Newspapers, magazines, books, and journals are most often the tools used for learning. The best learning occurs through direct, hands on experience and reflection. What older learners learn, they want to use right away or in the near future.

Situated Learning

Situated learning is a method of social learning in the workplace. It involves social participation. "Rather than asking what kinds of cognitive processes and conceptual structures are involved, they ask what kinds of social engagements provide the proper context for learning to take place" (Lave & Wenger, 2003, p. 14). Learning is not viewed as an individual process. It occurs through participation and is mediated by the different perspectives in a particular group. Learning requires action and practice in the real-world setting, not the classroom. Taken in relation to a single craft that is taught through "hands-on" participation, the ability to learn develops in close relation to the ability to perform tasks. On the other hand, a training program that consists of instructional settings separated from actual performance split the learner's ability to manage the learning situation apart from his ability to perform the skill.

In this type of learning, the novice worker initially observes, and then takes on parts of tasks before engaging in full activity. The newcomer is not required to perform at full capacity. Initially, the tasks should be short and simple. This method allows the individual to learn without being overwhelmed, to gain confidence in the parts and finally put together a whole.

Repeatedly, the theme of situated learning is the social nature of learning. The health and safety professional can make substantial strides in the safety culture of the workplace when safety is taught through an integration of safe work practice. Most traditional safety training methods take the employee out of the workplace and into a classroom for training. When the employee training in completed, they are sent back to the workplace. Machles (2003) references Baldwin, Ford, and Hoffman stating that "only 10-15% of the content from training conducted in the workplace is retained after one year" (p. 25). If this is the case, then the traditional method is clearly one of safety teaching, not learning.

Brain-based learning

One principle of brain-based learning is that stressful or threatening environments engage the "flight or fight" response. When this survival mode kicks in, learning that requires higher order thinking skills vanish. Ask any student to describe an embarrassing or intimidating classroom experience. More than likely, they can vividly recall the emotions and the experience but probably not what they learned.

Older learners work best in a collaborative learning environment. This also allows them to share their own experiences, which may offer invaluable lessons to other students. If the students are not familiar with each other, provide opportunity for introductions. If the group is too large, have them pair up. One of the best questions to ask is "What's in it for me." Learners become more engaged with each other while identifying meaning in the process.

When performing classroom training, apply the brain-based learning principle that the brain is a parallel processor. In other words, it is wonderful multi-tasking organism. It gets bored easily and works best with variety. This is one reason why using multimedia in a presentation keeps the learner more engaged. Another is that memories are located in different parts of the brain. Using a multimedia approach strengthens the neural pathways and accesses different parts of the brain.

Teaching techniques that reduce the amount of working memory during training work well with older learners. One common strategy is making a list, which decreases the working memory load. A research study by Burack and Lachman (1996) examined the effects of list-making on older adults' ability to remember information. "List-making appears to improve older adults' ability to recall information even when there is no opportunity for them to refer back to their lists" (p. 9).

It was also interesting to note that those who organized their lists by subject recalled more words than those who did not. This applies to another principle of brain-based learning of pattern and meaning-making. The brain works to place new information into patterns it already recognizes. When presenting training material, give an overall

picture of what the learning is about. Start with the “big picture”. This allows the student to begin organizing information.

Another part of pattern and meaning-making uses a technique of chunking. This may be one reason why those in that study remembered more when they categorized words. Chunking is the term used to organize material in a more meaningful way. Here’s an example: “Look at the following list of letters: IBFVTNOJBLKF. Try to memorize them as presented. Now look at the next list of letters: JFK, LBJ, ON, TV, FBI. The second list is much easier to memorize even though they are the same letters.” (Roberts, 2002, p. 282). When looking for patterns and meaning, the brain is operating in working memory. It tries to hold the information until it determines whether it needs to remember it–if not, it is forgotten.

Safety Training

Safety trainers are busy meeting and exceeding regulatory requirements to ensure a safer workplace. Regulations change at an alarming rate and the number of required trainings that OSHA mandates increases every year. There are currently "…138 regulations that require employers to adopt written programs showing how a standard is being met, 366 regulations that require notices be provided, warnings or instructions given, documents be provided or maintained; and 400 regulations that require that an employer provide training or limit work assignments to employees who are 'certified', 'competent', 'designated', or 'qualified'" (Starr, p. 58).

Safety professionals are hired for the expertise on safety, not training, yet training is a primary function of their job. Teaching and learning are not the same thing. Mandatory safety training programs are not the most riveting material to capture an audience. Compared to action and suspense movies, videos on confined space and hazardous material lag far behind, even though more personally relevant.

Another factor to consider is that trainers often use methods they were taught throughout school. The teacher teaches and the student listens. This K-12th grade method of teaching works well for building blocks of knowledge. It isolates basic skills and builds on them. Examples include learning phonics to read and basic math before algebra. Workplace examples include the step-by-step process of learning a new computer program and learning about hazardous materials by first learning the information needed to understand a material safety data sheet.

What works best for adult learners however, is not what worked in their formative years of school. In college, lectures remain the education method most often used. It is no surprise that safety professionals train the way they were taught. In the real work world however, more effective ways are available for learning. Relating new learning to past experiences, accommodating for vision and hearing loss and establishing an acceptable pace for learning new information are all critical elements to retaining new information.

Summary

Laboratory experiments demonstrate decline in cognition with aging. However, people do not operate in a vacuum of the laboratory. Their external environment is complex and they exhibit a high ability to perform in the world. Work performance has not been demonstrated to decrease in relation to cognitive decline and learning improves brain function.

Charness states that: “Knowledge thus has three interrelated features. It consists of acquired information that can be activated in a timely fashion to generate an appropriate response” (104). Older learners compensate through knowledge and experience. Crystallized intelligence serves as a bank account for information. Most workers also perform better with familiar tasks and familiar environments.

“Knowledge can compensate, at least partially, for age related declines in cognitive efficiency. It does so more successfully when the task is one for which fact retrieval can substitute for computations of answers. A knowledgeable older adult will outperform a computationally swift but less knowledgeable young adult.” (Charness 112-113). Czaja also notes that there are many older adults who function at the same level or above than younger adults in the workplace.

The principal changes that occur in learning for the older worker is in the speed at which new information is learned and the physiological changes of vision and hearing. The safety trainer who understands these changes can impact all teaching that occurs in the workplace. The older worker can learn just as much at 60 as they did when they were 20, it just takes them longer. In addition, when the safety trainer provides an environment that accommodates for vision and hearing changes it ensures that all information is seen and heard. Whether training is classroom, workplace, or computer based, these techniques will increase the level of learning for the older worker.

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