Cognitive Skills Help Fashion Adaptive Minds

by Winston Sieck - October 26, 2013

https://www.globalcognition.org/cognitive-skills/

Which is the most useful kind of knowledge - general knowledge about how to think well, or specific knowledge within many subject areas?

The idea that we can train the mind to use core cognitive skills that are effective in a wide range of situations is really fantastic. But, maybe it's too fantastic.

General, learnable, and worthwhile cognitive skills – is there really anything to them, or do they belong within the realm of snake-oil?

General cognitive skills include strategies for problem solving, critical thinking skills, techniques for making decisions, learning and study skills, and metacognitive strategies among others.

The question of whether cognitive skills have anything to offer over topic knowledge is essential to how we design for education and training. Do we focus on teaching to develop knowledge of subjects, one after another? Or should we also invest in trying to build general cognitive skills?

David Perkins of Harvard University and his colleague Gavriel Salomon critically reviewed several decades worth of literature related to cognitive skills to address these issues. Their paper, "Are cognitive skills context-bound?" was published in *Educational Researcher*.

Perkins and Salomon concluded that general cognitive skills are indeed useful. They help avoid the brittle competency that comes from focusing solely on specific subject knowledge. Yet, cognitive skills are best learned when they are closely connected to topic knowledge. The key points of their paper are summarized below.

What do general cognitive skills look like?

Philosophers can deftly wield a general cognitive skill to enlighten or annoy. You make some off-the-cuff claim, and the philosopher often whacks you with a counterexample.

The topic of conversation rarely seems to matter. Counterexamples appear to come naturally whether the topic is politics, science, religion, or personal relationships. Some real knowledge of the topic does help the process along.

The strategy of looking for counterexamples to test claims is a cognitive skill of the critical thinking variety. It can be quite useful for carefully considering important issues, in the right setting.

Heuristic problem solving skills are also classic examples of general cognitive skills. A heuristic is a general strategy for approaching a problem that does not guarantee a solution, but often helps. George

[Polya wrote about general math heuristics](), such as:

- using diagrams to represent a problem in different ways
- when faced with a complex problem, first solving a simpler one of the same kind

Cognitive research on how to teach general math heuristics found large improvements in a few cases. Success depended on teaching the cognitive skills in the context of real math problems. This helped the students to connect the general strategies to their math knowledge.

General cognitive skills vs. specific knowledge

Two areas of research originally cast doubt on the value of cognitive skills. Studies of expertise and transfer in learning suggested that it was better to know a lot about a topic than to try for general ways of thinking across topics. Later research on these topics overturned the strong conclusion.

Early research into the [nature of expertise]() found that experts relied on deep knowledge of their specialty to perform. The expert thought process was fairly simple. Experts quickly recognized situations by matching to the wealth of patterns they held in memory, and reasoned forward from there to a solution. General cognitive skills appeared pale in comparison to the rich knowledge bases experts exercised in typical situations.

Later research began exploring not-so-typical situations in order to understand the flexibility of expertise. The idea is that experts are more than technicians. They don't just solve the old problems efficiently. They extend their field by addressing new problems. Research into how experts handle atypical problems suddenly saw general cognitive skills emerge from the depths of expert knowledge and reveal themselves.

When faced with unusual problems that defy straightforward approaches, the experts were found to apply general cognitive strategies, such as:

- drawing on analogies to systems they understand better
- investigate the target system with "extreme case" arguments, probing how it would work if various parameters were pushed to zero or infinity
- construct a simpler problem of the same sort, in hopes of solving that and importing the solution to the original problem

Another line of research also originally created problems for the idea of general cognitive skills. Many studies found that reasoning and other skills learned in one problem area are rarely used when reasoning in similar situations.

The early findings on [transfer]() were often taken to mean that cognitive skill depends mostly on specific knowledge. Humans have little ability to apply strategies in different domains. Later research has led to a somewhat more optimistic appraisal.

Transfer is possible, even though it doesn't come easily. Transfer success depends on how the is skill is learned, the variability of cases used in training, and related factors. When the right conditions are met, cognitive skills often do transfer.

Weaving cognitive skills and specific knowledge together

The early advocates of cognitive skills tried to push too hard and too far. They overlooked the importance of deep subject knowledge. They felt that cognitive skills would be readily applied to new situations. Studies that countered the original claims nearly ringed the death knell for cognitive skills.

At this point, it seems clearer that general cognitive skills can lead to more flexible, adaptive thinking. Yet they cannot stand alone. They need to be rather tightly connected to knowledge in several subject areas as they are being learned. Rather than trying to choose one over the other, we may realize the biggest gains by weaving cognitive skills together with subject knowledge in instruction.

Image Credit: ninahale

Perkins, D. N., & Salomon, G. (1989). Are cognitive skills context bound? *Educational Researcher, 18* (1), 16-25 : [10.3102/0013189X018001016](10.3102/0013189X018001016)