STILL AT RISK?

by

E. D. HIRSCH JR.

# Not So Grand a

## A Nation at Risk *emphasized the importance of learning so-called "higher-order skills" in the early grades.* ***But even chess grand masters need to learn the basics first***

*A Nation at Risk* was mainly concerned with the high-school years. It wasn't until the report's last pages that it finally alluded to education in the early grades:

> *The curriculum in the crucial eight grades leading to the high-school years should be specifically designed to provide a sound base for study in those and later years in such areas as English language development and writing, computational and problem-solving skills, science, social studies, foreign language, and the arts. These years should foster an enthusiasm for learning and the development of the individual's gifts and talents.*

Throughout *Risk*, the authors expressed the concern that higher skills like comprehension and problem solving were being neglected in favor of mere basic skills such as number facts, phonics, and spelling. The path to education improvement was seen to lie not in the substance of what was taught in the first eight grades, but in the higher order proficiencies that were systematically inculcated. This emphasis on early-language and "problem-solving" skills rather than on early content was a fundamental mistake.

It was natural for the writers of *Risk* to seek reform where the most obvious declines had appeared. But it seems probable that the watering down of high school was less a cause of its lower scores than a consequence of a gradual decline of learning in the early grades. *Risk*'s attitude toward the early grades reminds me of the comment many years ago of a repairman who came to fix a leak in our washing machine. He asked my wife where the leak was, and she replied, "At the bottom." He looked at her knowingly and said, "Yeah, that's what they all say." The authors of *Risk* saw declines at the high-school level, so they focused attention there when the problems began elsewhere.

Research has shown that a student's reading competence in 1st grade predicts his achievement in 11th grade. Fortunately, reformers and legislators have recently begun to emphasize early literacy—a promising advance in thinking and policy. But this welcome new emphasis on the early grades may not yield the hoped-for improvements in equity and overall achievement if, while correcting for an earlier neglect, we persist in ignoring the content taught in students' formative years.

Consider the fact that some high-performing education systems, such as that of Japan, do not stress formal higher-order skills—such as "learning how to learn," or focusing on problem-solving skills—in early schooling. They pay much closer attention to the sequence and coherence of the content a child receives in the early grades. Nonetheless, the scores of their 8th graders on the so-called higher-order skills connected with reading and reckoning, such as comprehension and problem solving, are not only higher than ours, but are also more equitably distributed among social classes.

Moreover, these results have been achieved within the context of nationalized, bureaucratic, nonmarket education systems. This is not intended as a dismissal of cur-

PHOTOGRAPH BY MARK TOMALTY/MASTERFILE


Strategy

rent efforts to introduce more competition into American schooling. It's possible that nations like Japan would elicit even better results by experimenting with market-based reforms. But it does suggest that, at least in these nations, organizational schemes have been less critical to student outcomes than the ideas that have governed teaching and learning.


*The acquiring of academic skills, including a big vocabulary, consists of building efficient mental systems that enable us to perform huge feats of analysis and synthesis.*

## Higher-Order Skills

The writers of *Risk* believed that the goal of the early grades is to gain proficiency in the skills of reading, writing, thinking, and arithmetic in order to "provide a sound base" for high-school study. They assumed that any sensible content that develops the necessary foundational skills would do.

I have elsewhere called this concept—of skill building through arbitrary content—"educational formalism," the notion that the chief aim of early education is the attainment of formal skills. For the past 20 years our elementary schools have tried to follow the advice of the experts who contributed to *Risk*. They have taught such higher-order skills as "critical thinking," "problem solving," and "looking for the main idea." Yet these turned out to be the very skills on which our students continued to decline compared with students in Asian and European countries—countries that placed less emphasis on formal comprehension skills and more emphasis on coherent year-to-year subject matter.

Cognitive psychology has long since reached a level of sophistication that enables it to explain why it is highly ineffective to teach higher-order skills as formal structures. This finding is the most plausible explanation for the historical paradox that national systems that stress content more than skills nonetheless inculcate these higher-order skills more effectively than systems that try to teach higher-order skills as such. To teach content *is* to teach higher-order skills; to teach higher skills explicitly is to pursue a phantom.

Literate adults already possess the higher reading skills that *Risk* thought could be taught divorced from content. We can think critically about the words we read. But it is unlikely that we gained these proficiencies by being taught them explicitly as formal skills. Few of us learned to find the main idea by being taught to look for it (a favorite with the formalistic approach to comprehension skill). Few of us learned critical-thinking skills by taking formal lessons in critical thinking. How then did we gain these complex skills, and what is their nature?

## Working Memory

By the time *Risk* was published in 1983, cognitive psychology had achieved a degree of consensus about the fundamental nature of academic skills. Yet the science of psychology was not often alluded to in *Risk*. Even today, 20 years later, there is little crossover between cognitive science and education policy. *Risk* simply assumed that gaining an academic skill, such as reading, is independent of the curricular content through which the skill is taught. This formalistic conception continues to dominate American education circles. It is a misleading oversimplification that will have to be corrected if our schools are to teach "higher" skills successfully.

The conscious mind, where higher-order skills mostly take place, is limited by a universal, highly democratic constraint called "working memory," whose narrow limits are on average the same for child and adult, rich and poor. It is the "place" where we put things together and create meaning, where we solve problems and process language.

> "To teach content is to teach higher-

In the 1950s George Miller wrote a famous article about the limitations of working memory called "The Magical Number Seven, Plus or Minus Two." The title was Miller's way of saying that the number of bits of information we can handle in the brief span of working memory is very, very limited—five to nine items at most. The acquiring of academic skills, including, notably, a big vocabulary, consists of building efficient mental systems that enable us, despite this very constrained bottleneck, to perform huge feats of analysis and synthesis.

A famous experiment conducted by Dutch psychologist

PHOTOGRAPH BY BOB GOMEL/TIMEPIX

Adrian de Groot illustrated this universal bottleneck in human processing skills. He noticed that chess grand masters have a remarkable skill that we amateurs cannot emulate. They can glance for five seconds at a complex mid-game chess position of 25 pieces, perform an intervening task of some sort, and then reconstruct the entire chess position on a blank chessboard without making any mistakes. Performance on this task correlates almost perfectly with one's chess ranking. Grand masters make no mistakes, masters a very few, and amateurs can get just five or six pieces right. (Remember the magical number seven, plus or minus two.)

On a brilliant hunch, de Groot then performed the same experiment with 25 chess pieces in positions that, instead of being taken from an actual chess game, were just placed at random on the board. Under these new conditions, the performance of the three different groups—grand masters, masters, and novices—was exactly the same, each group remembering just five or six pieces correctly.

The experiment suggests the skill difference between a master reader who can easily reproduce the 16 letters of "the cat is on the mat" and a beginning reader who has trouble reproducing the same letters: t-h-e-c-a-t-i-s-o-n-t-h-e-m-a-t. If, instead of providing expert and child with that sentence, we change the task and ask them to reproduce a sequence of random letters, the performance of the 1st grader and the master reader will become much closer. If the 16 letters were "rtu kjs vb fw nqi pgf," the expert would exhibit little skill advantage over the novice; on average, neither will get more than a short sequence of the letters right.

Practiced readers, chess grand masters, and other experts do not possess any special mental equipment that novices lack, and they do not perform any better than novices on formally similar yet unfamiliar tasks. Nonetheless, experts are able to perform remarkable feats of memory with real-world situations such as mid-game chess positions and actual sentences. How do they manage?

## Activating the Knowledge Bank

The sentence "The cat is on the mat" consists of six words that are easily remembered. Expert readers can easily reproduce the 16 letters, not because the letters are individually remembered, but because they are reconstructed from previous knowledge of written English. What de Groot found, and subsequent research has continually confirmed, is that the difference in higher-order skill between a novice and an expert lies not in mental muscles but in what de Groot called "erudition," a vast store of available, relevant, previously acquired knowledge.

Despite the narrow limitations of working memory, the wealth of contents that can be manipulated by experts through this previously acquired "erudition" is immense. If I already know a lot about baseball, the term "sacrifice fly" can represent a page or two of exposition. Such shorthand representation is a chief timesaving technique of higher-order skills. A short, manageable element (like a phrase) can represent a much larger complex of already-learned meaning. The phrase "World War II" is short and therefore easily remembered, but the content represented by the phrase is enormous. It cannot be grasped by those who, however skillful in other ways, lack that relevant knowledge.

I use this example as a rapid way of indicating why an academic skill like reading depends on learning much more than the foundational ability to form sounds from symbols, turn the sounds into words, and put the words together in sentences. While such formal skills are critically important, they are quite insufficient to comprehend a passage about World War II in the absence of relevant background knowledge. A shorthand way of saying this is that the skill of reading (and listening) depends on, among other things, a previous knowledge of what most of the words in a text mean and refer to.

## Developing Expertise

De Groot showed that being an expert in chess does not improve one's memory for randomized chess positions. Tracing the implications of that discovery, psychologists have found that being a critical thinker in chess is even less likely to improve one's skills in areas that are still more remote from chess, like mathematical problem solving or the ability to think logically about politics.

Being good at one mental skill does not necessarily train the mind to be skilled in other domains. This is one of the most solid findings in psychology, confirmed and reconfirmed many times—tested so often possibly because it has been such a surprising and unwelcome finding. People who have just finished a course in logic are barely more logical than those who have never taken such a course. People who have been carefully trained how to solve a problem in one domain are rarely able to solve a problem that has identical structure but lies in a different domain. Those who are skilled at diverse tasks in various domains are people who have managed to acquire broad general knowledge that includes knowledge relevant to those diverse domains. Such generalized skill is in fact a practical aim of a broad, general education. Students who score well on the verbal SAT invariably possess a broad vocabulary that represents broad general knowledge—which is hardly surprising,

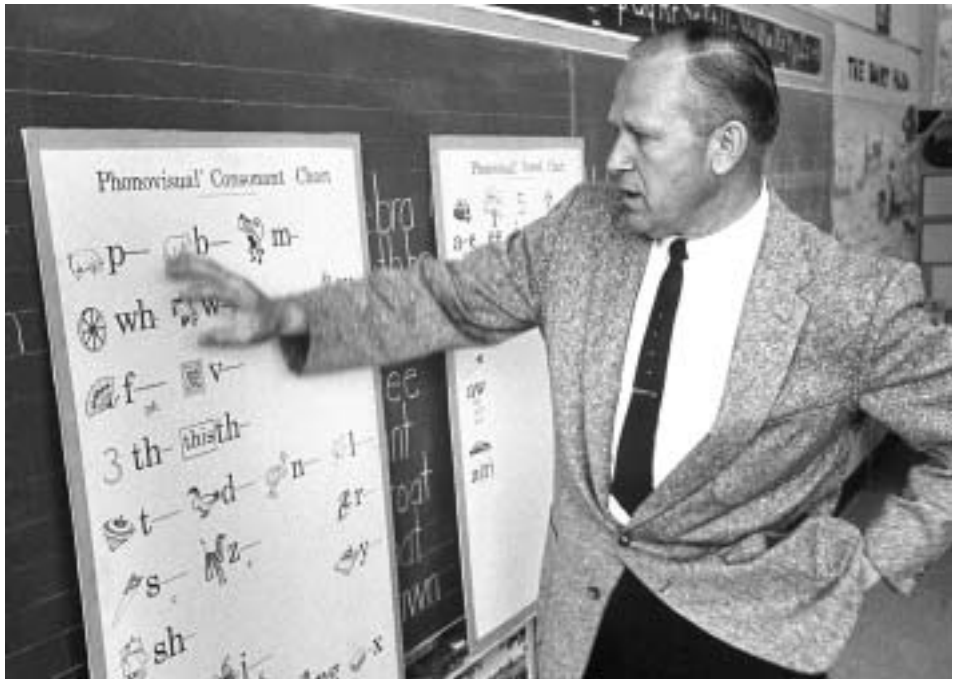
**order skills. To teach higher skills explicitly is to pursue a phantom.”**

> "The difference in higher-order skill between a novice and an expert lies not in mental muscles but in 'erudition,' a vast store of previously acquired knowledge."

given that the verbal SAT is essentially an advanced vocabulary test.

For practical purposes there are no such things as transferable higher skills of problem solving and reading comprehension. The ability to solve a math problem depends on having a specifically relevant and available math vocabulary. The ability to comprehend a printed text depends on having a specifically relevant and available linguistic vocabulary that comprises at least 90 percent of the words of the text. The vague hope that students will be able to apply what they know in depth about supermarkets to new domains is not sustained by experience or psychological theory.

This is not to say that the mental transfer of structure from one problem to another never occurs. On the contrary, one of the features of expert performance in a domain (after about ten years of practice) is the ability to intuit the deep structure of problems and their connections with other problems in that domain. But this is a kind of skill that comes after long experience.




*The ability to comprehend a printed text depends on having a specifically relevant and available linguistic vocabulary.*

If mental transfer is difficult among problems within a domain, it is exceedingly rare from one domain to another. It represents the pinnacle of human thought, the epitome of creative thinking. When it happens, a new art form or field of thought is born. The great physicist Erwin Schroedinger wrote a little book entitled *What Is Life?* in which he suggested that life is a kind of crystal that enables the living molecule to replicate itself, as do the molecules of a crystal. This thought transfer from physics to biology was so captivating that it caused a whole generation of physicists to turn their attention to biology, resulting in the Crick-Watson discovery of DNA, and ultimately in the transformation of modern biology and medicine. For most of us, though, most of the time, such leaps of thought are very rare precisely because they are so difficult.

## A Coherent Curriculum

Our American faith that teaching students biology will teach them "the nature of science" or that teaching students to think critically about the Civil War will teach them how to think critically about current affairs is supported neither by large-scale research nor by the laboratory. The practical result of our faith in the transferability of higher skills has been an incoherent curriculum that is especially damaging to those students who have not gained broad academic knowledge outside of school.

There are clear policy implications to be drawn from understanding the domain- and content-specific character of higher-order skills. These do not include continuing to follow popular slogans about local control of curriculum and letting a thousand flowers bloom. The goal of a literate citizenry can be reached only by offering ideas for education reform that specify a coherent curriculum. The writers of *Risk* did not recommend a coherent, specified grade-by-grade elementary curriculum because its writers did not understand as fully as we do now the degree to which higher skills are dependent on a sound base of general knowledge. Schools cannot be sure of offering all students a sound base of general knowledge until the states *specify* the core content of the early curriculum.

*–E. D. Hirsch Jr. is a professor emeritus of English and education at the University of Virginia, founder of the Core Knowledge Foundation, and a visiting fellow at the Hoover Institution.*

PHOTOGRAPH BY BOB GOMEL/TIMEPIX