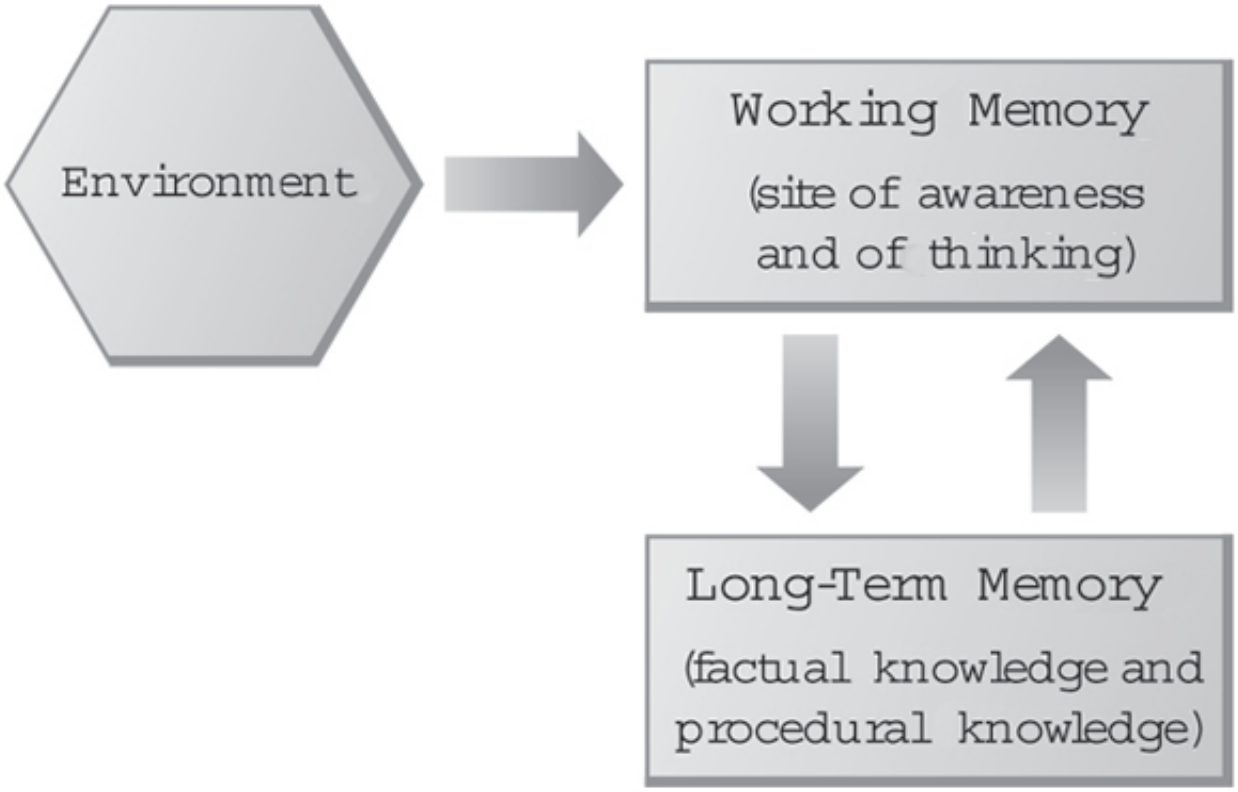
Why Don't Students Like School?

A Cognitive Scientist Answers Questions About How the Mind Works and What It Means For the Classroom

By Daniel T. Willingham

Figure 1

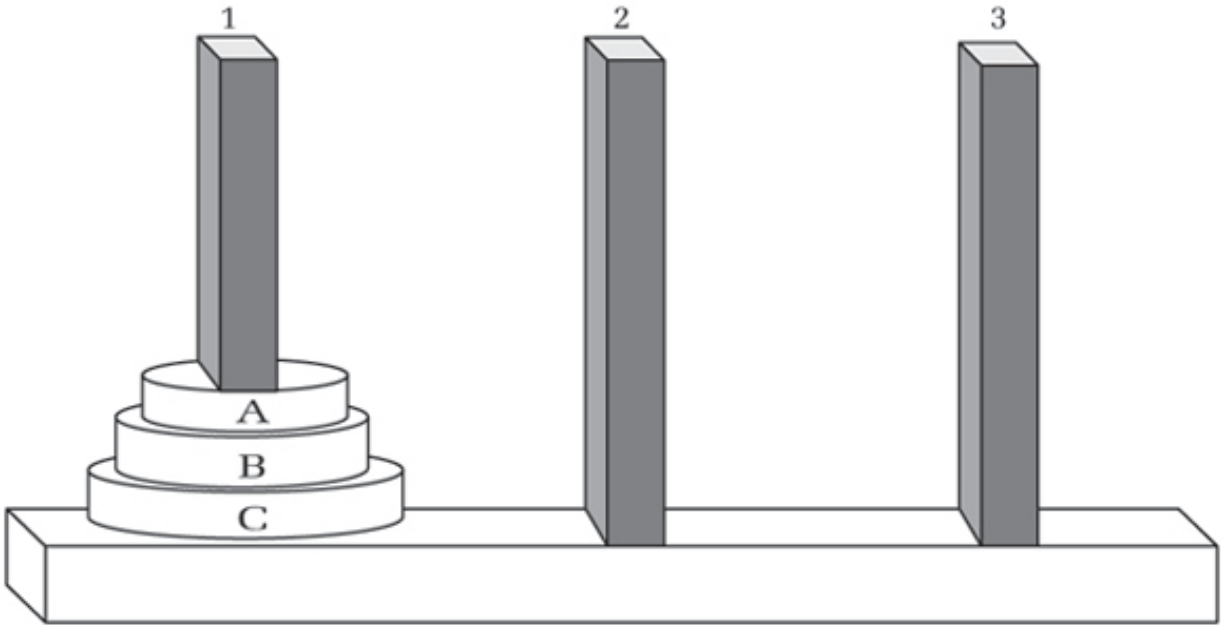
Just about the simplest model of the mind possible.



Simple diagram of the mind: © Anne Carlyle Lindsay

Figure 2

The figure depicts a playing board with three pegs. There are three rings of decreasing size on the leftmost peg. The goal is to move all three rings from the leftmost peg to the rightmost peg. There are just two rules about how you can move rings: you can move only one ring at a time, and you can't place a larger ring on top of a smaller ring.



Tower of Hanoi game: © Anne Carlyle Lindsay

Figure 3

A depiction of your mind when you're working on the puzzle shown in Figure 2.

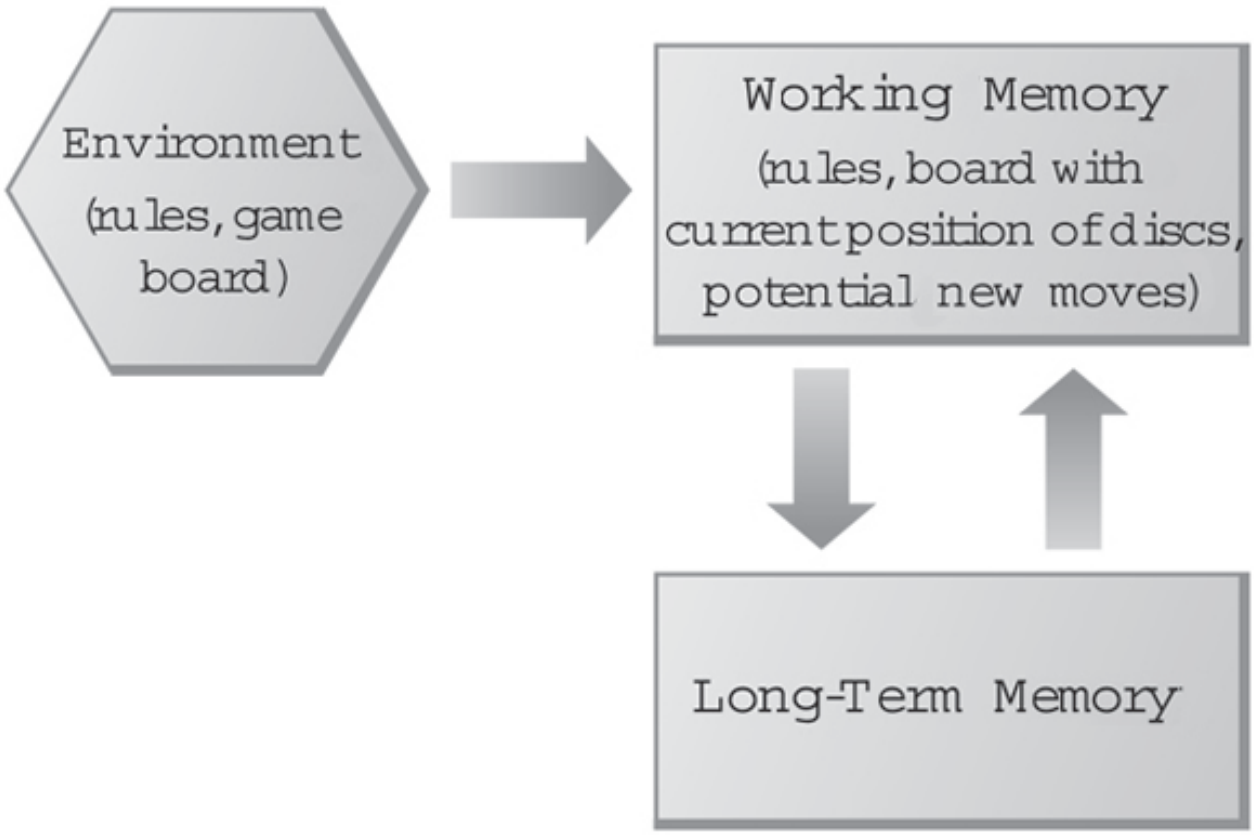
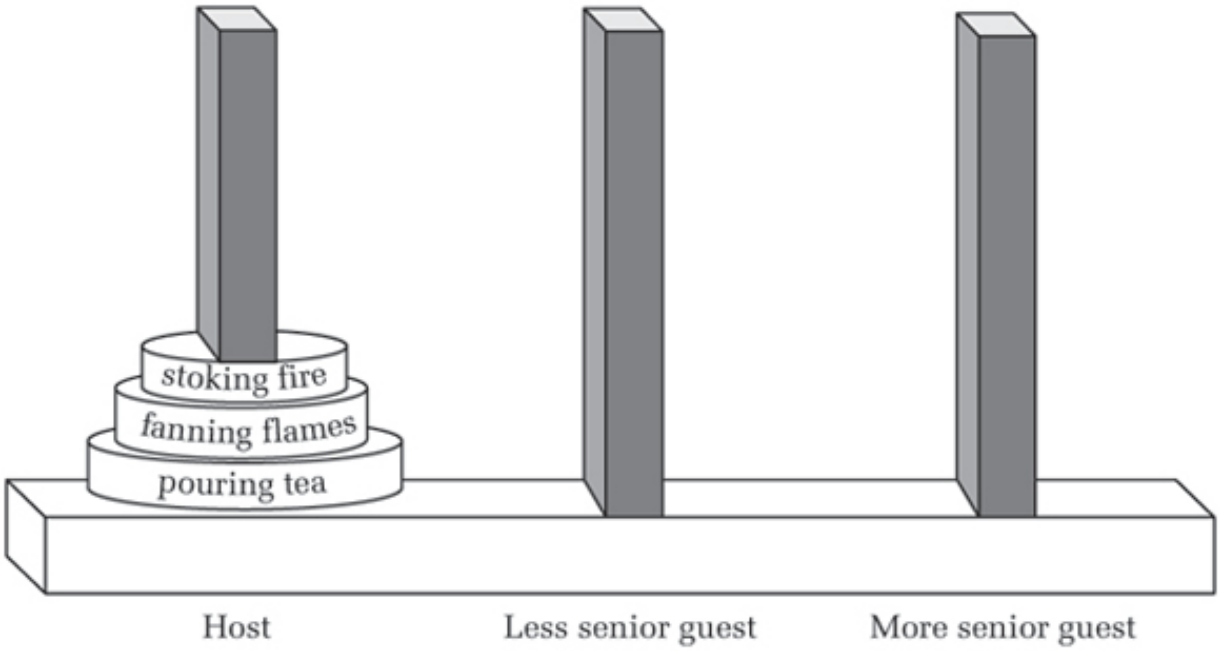


Diagram of mind playing Tower of Hanoi: © Anne Carlyle Lindsay

Figure 4

The tea-ceremony problem, depicted to show the analogy to the disc-and-pegs problem.



Tea ceremony problem: © Anne Carlyle Lindsay

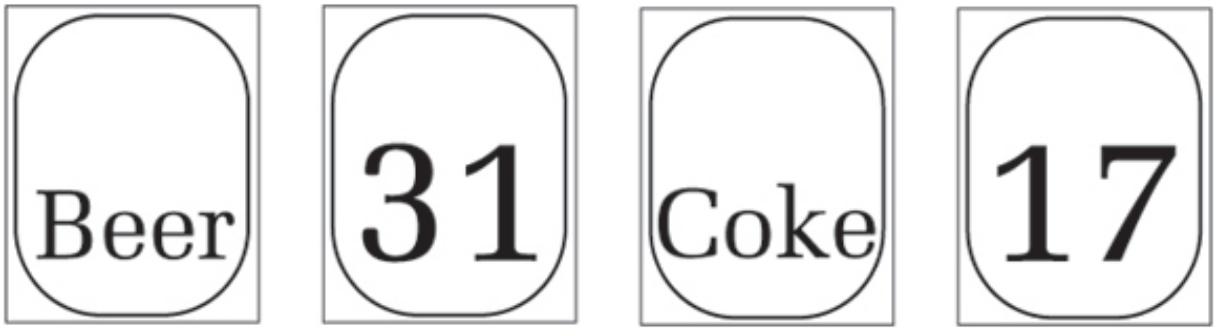
Figure 5

Each card has a letter on one side and a digit on the other. There is a rule: *If there is a vowel on one side, there must be an even number on the other side*. Your job is to verify whether this rule is met for this set of four cards, and to turn over the minimum number of cards necessary to do so. Which cards would you turn over?

Wason card problem: © Anne Carlyle Lindsay

Figure 6

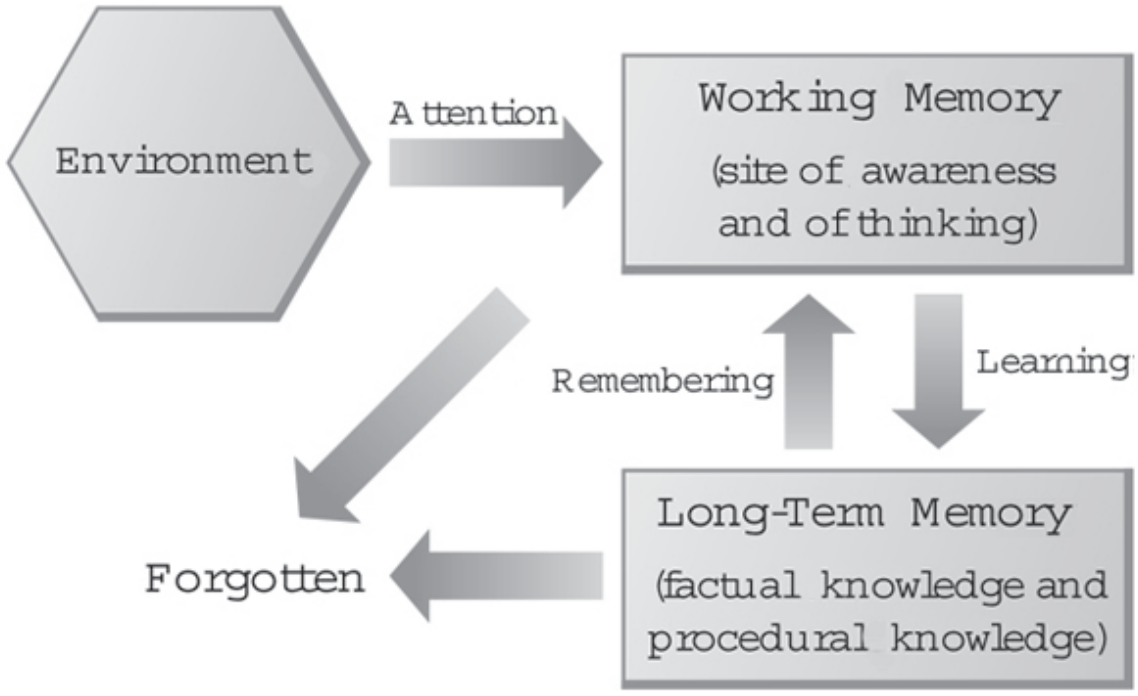
You are to imagine that you are a bouncer in a bar. Each card represents a patron, with the person's age on one side and their drink on the other. You are to enforce this rule: *If you're drinking beer, then you must be twenty-one or over*. Your job is to verify whether this rule is met for this set of four people. You should turn over the minimum number of cards necessary to do so. Which cards would you turn over?



Beer version of Wason problem: © Anne Carlyle Lindsay

Figure 7

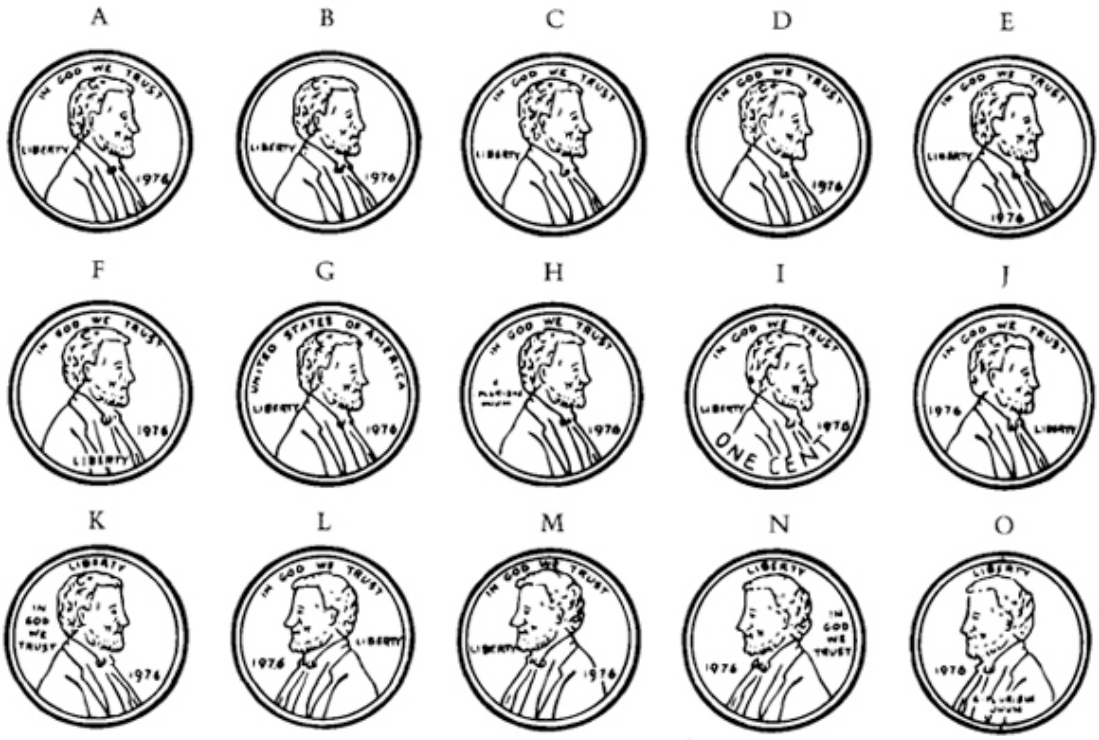
A slightly modified version of our simple diagram of the mind.



Elaborated diagram of the mind: © Anne Carlyle Lindsay

Figure 8

Can you find the real penny among the counterfeits?
People are terrible at this task even though they have seen a penny thousands of times.



True and false penny: From “Long term memory for a common object” by R. S. Nickerson and M. J. Adams in *Cognitive Psychology*, *11*, 287-307. Copyright © 1979.
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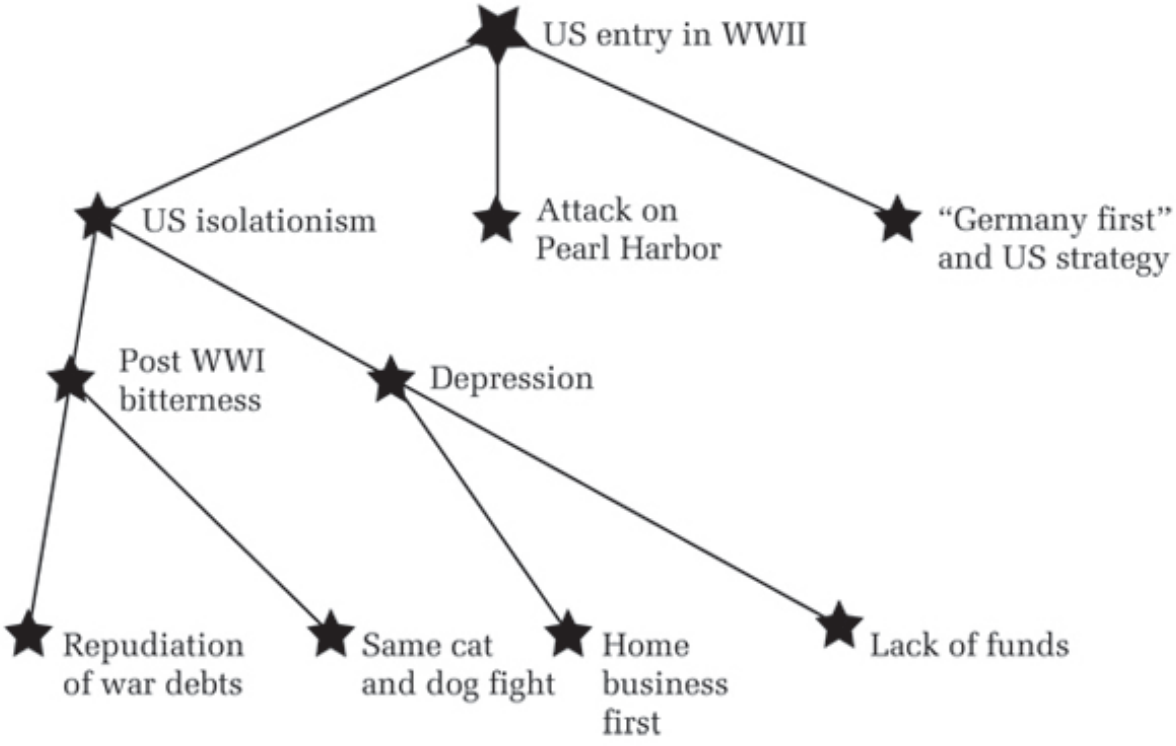
Figure 9

A tree diagram showing the typical structure of a lesson plan on Pearl Harbor. The organization is chronological.



U.S. entry in WWII: © Anne Carlyle Lindsay

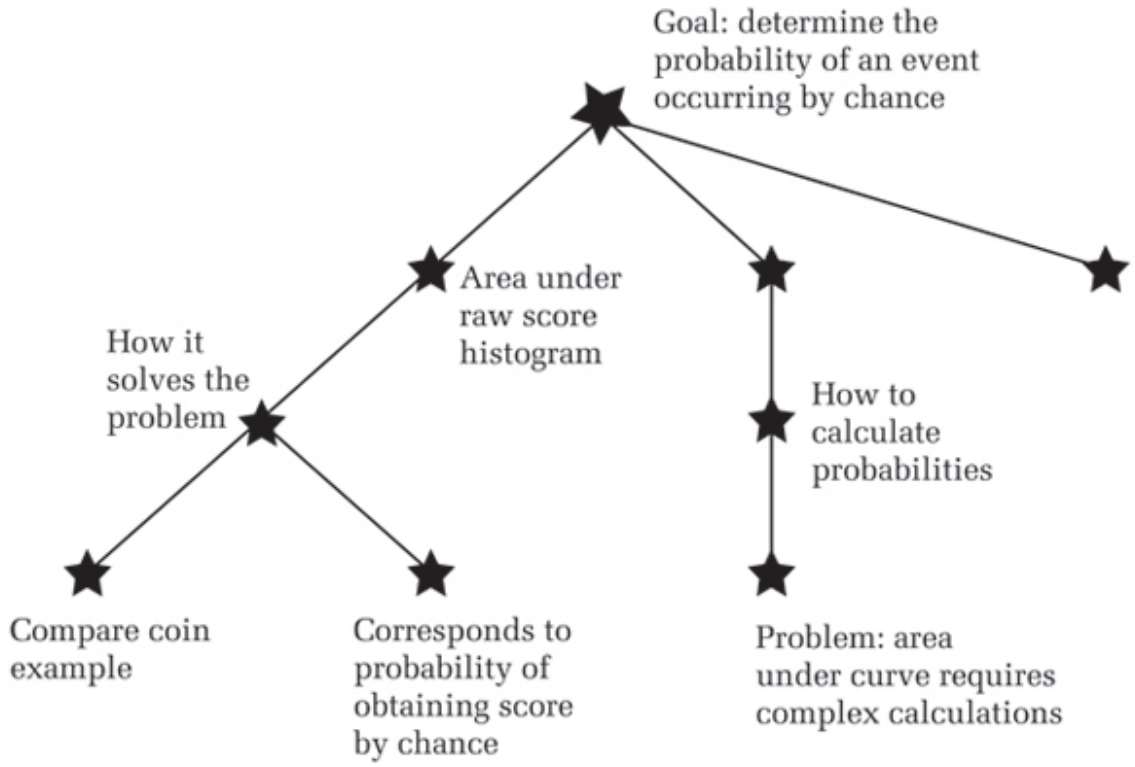
Figure 10

Alternative organization for a lesson plan on Pearl Harbor. From a storytelling point of view, Japan is the strong character because she takes actions that move the story forward.

Alternate lesson, U.S. entry in WWII: © Anne Carlyle Lindsay

Figure 11

Part of the organizational scheme for a lesson plan on the Z-score transformation for a statistics class.



Hierarchy for Z scores: © Anne Carlyle Lindsay

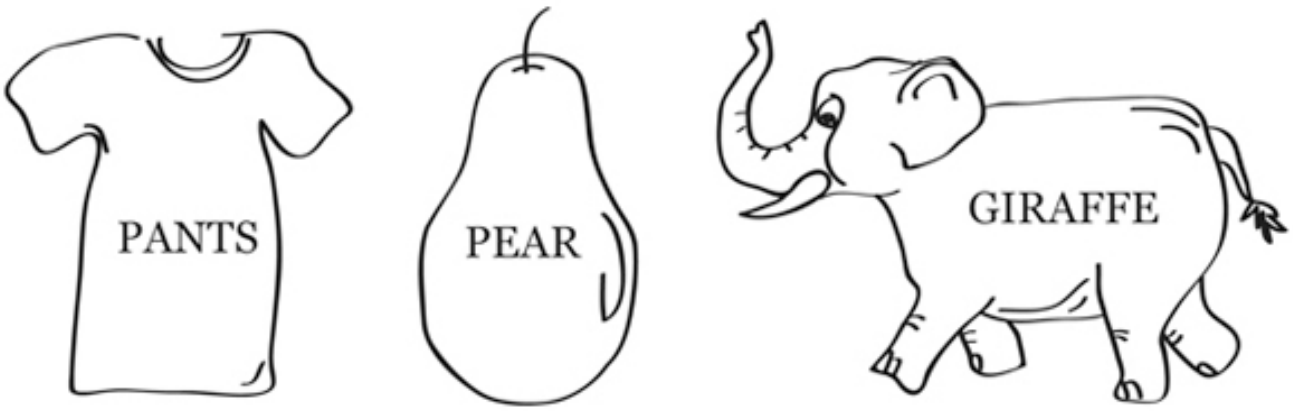
Figure 12

Common mnemonic methods. Mnemonics help you to memorize meaningless material.

Mnemonic	How It Works	Example
Peg word	Memorize a series of *peg words* by using a rhyme—for example, one is a bun, two is a shoe, three is a tree, and so on. Then memorize new material by associating it via visual imagery with the pegs.	To learn the list *radio, shell, nurse* you might imagine a radio sandwiched in a bun, a shoe on a beach with a conch in it, and a tree growing nurses' hats like fruit.
Method of loci	Memorize a series of locations on a familiar walk—for example, the back porch of your house, a dying pear tree, your gravel driveway, and so on. Then visualize new material at each "station" of the walk.	To learn the list *radio, shell, nurse* you might visualize a radio hanging by its cord on the banister of your back porch, someone grinding shells to use as fertilizer to revitalize the dying tree, and a nurse shoveling fresh gravel onto your driveway.
Link method	Visualize each of the items connected to one another in some way.	To learn the list *radio, shell, nurse* you might imagine a nurse listening intently to a radio while wearing large conch shells on her feet instead of shoes.
Acronym method	Create an acronym for the to-be-remembered words, then remember the acronym.	To learn the list *radio, shell, nurse* you might memorize the word RAiSiN using the capitalized letters as cues for the first letter of each word you are to remember.
First-letter method	Similar to the acronym method, this method has you think of a phrase, the first letter of which corresponds to the first letter of the to-be-remembered material.	To learn the list *radio, shell, nurse* you could memorize the phrase "Roses smell nasty," then use the first letter of each word as a cue for the words on the list.
Songs	Think of a familiar tune to which you can sing the words.	To learn the list *radio, shell, nurse* you could sing the words to the tune of "Happy Birthday to You."

Figure 13

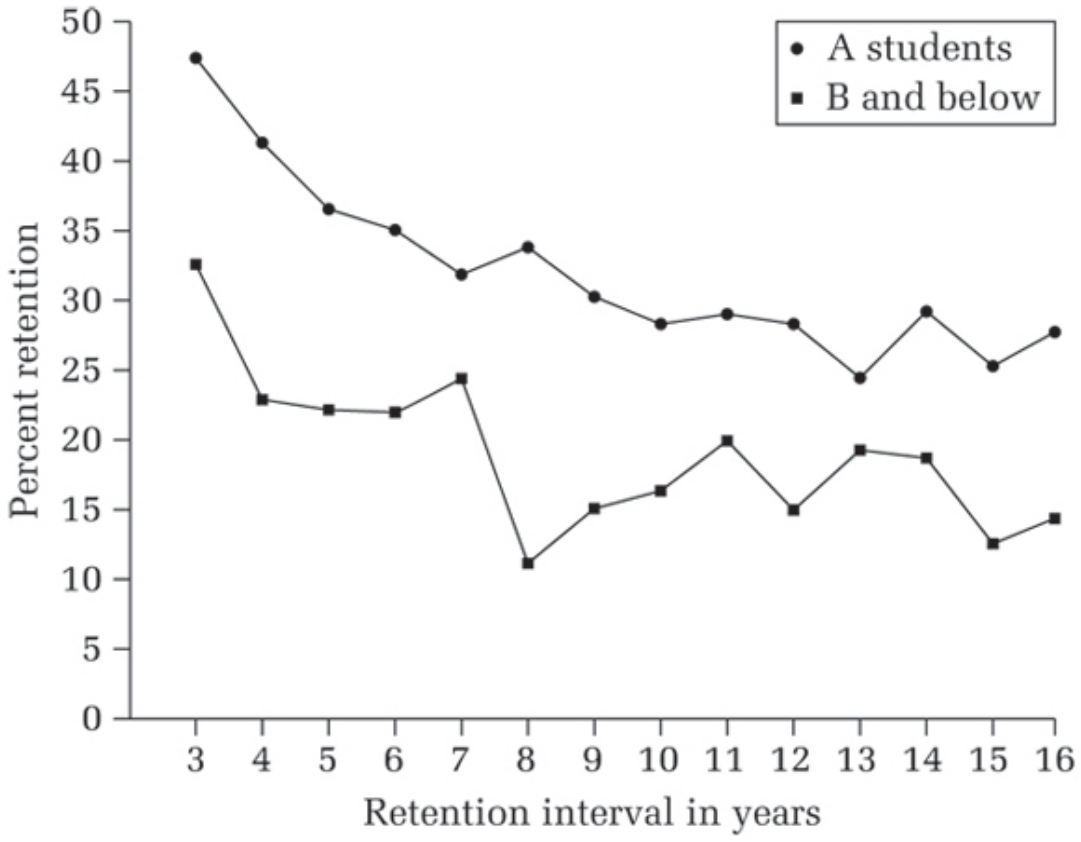
Name each picture, ignoring the text. It's hard to ignore when the text doesn't match the picture, because reading is an automatic process.



Picture word mismatch: © Anne Carlyle Lindsay

Figure 14

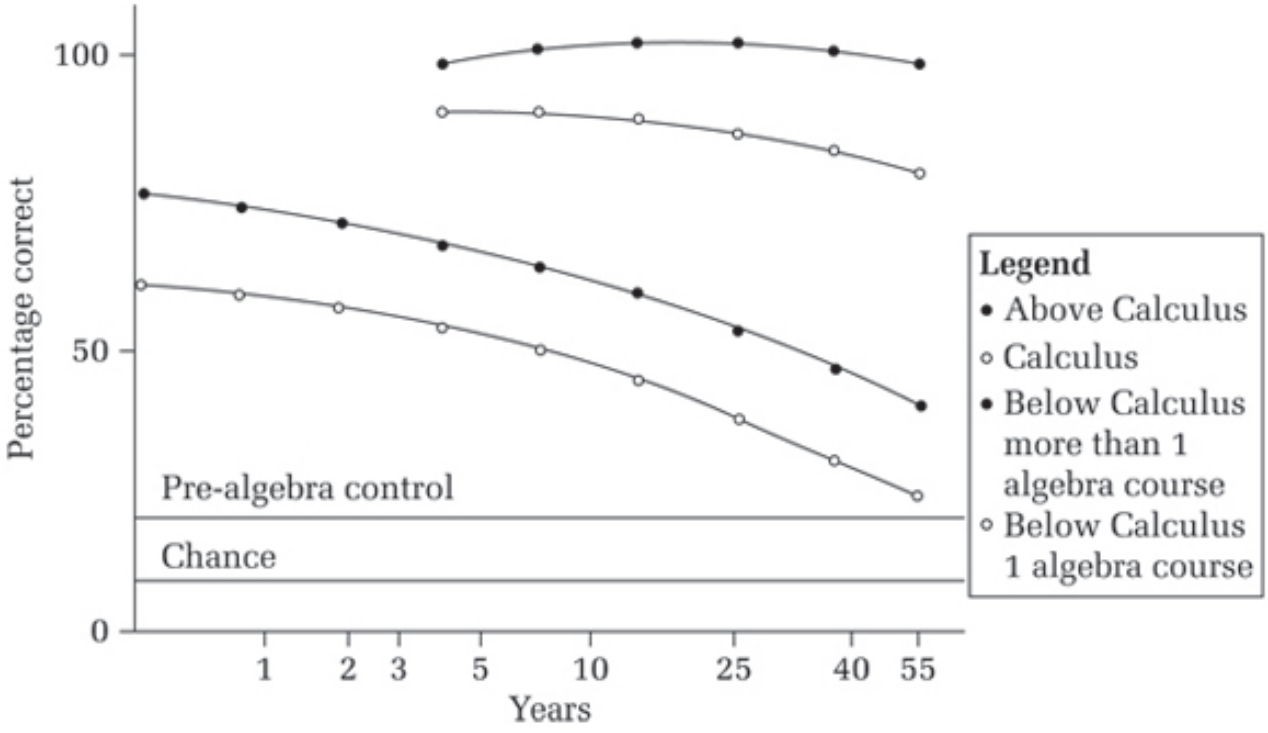
A graph showing how much students remembered of the material from a one-semester course in developmental psychology taken between three and sixteen years earlier. Separate lines show the results for students who got an A in the course and those who got a B or lower.



Graph showing forgetting of course material: From “Very long-term memory for information taught in school” by J. A. Ellis, G. B. Semb, and B. Cole in *Contemporary Educational Psychology, 23*, 419-433, Figure 1, p. 428. Copyright © 1998. Reprinted with permission from Elsevier.

Figure 15

The performance on a basic algebra test by people who took the course between one month and fifty-five years earlier. The four lines of data correspond to four groups, separated by how much math they took *after* basic algebra.



Graph from Bahrick & Hall: From "Lifetime maintenance of high school mathematics content" by H. P. Bahrick and L. K. Hall in *Journal of Experimental Psychology: General*, *120*, 20-33, Figure 1, p. 25. Copyright © 1991 by the American Psychological Association.

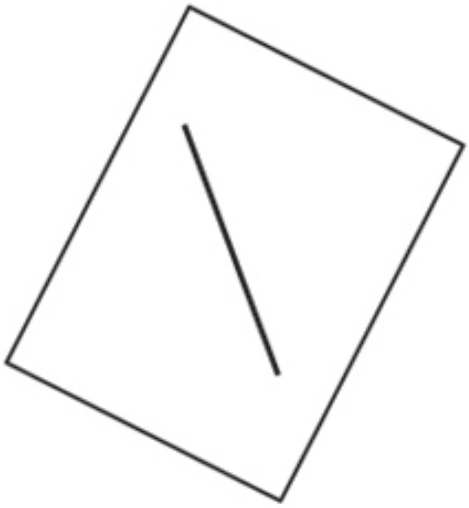
Figure 16

Some of the many distinctions among cognitive styles that have been proposed and tested by psychologists.

Cognitive Styles	Description
Broad/narrow	Preference for thinking in terms of a few categories with many items versus thinking in many categories with few items
Analytic/nonanalytic	Tendency to differentiate among many attributes of objects versus seeking themes and similarities among objects
Leveling/sharpening	Tendency to lose details versus tendency to attend to details and focus on differences
Field dependent/field independent	Interpreting something in light of the surrounding environment versus interpreting it independently of the influence of the environment
Impulsivity/reflectiveness	Tendency to respond quickly versus tendency to respond deliberately
Automatization/restructuring	Preference for simple repetitive tasks versus preference for tasks that require restructuring and new thinking
Converging/diverging	Logical, deductive thinking versus broad, associational thinking
Serialist/holist	Preference for working incrementally versus preference for thinking globally
Adaptor/innovator	Preference for established procedures versus preference for new perspectives
Reasoning/intuitive	Preference for learning by reasoning versus preference for learning by insight
Visualizer/verbalizer	Preference for visual imagery versus preference for talking to oneself when solving problems
Visual/auditory/kinesthetic	Preferred modality for perceiving and understanding information

Figure 17

Two methods of determining field dependence or independence. At left is the rod-and-frame test. The rod and frame are luminous and are viewed in a darkened room. The subject adjusts the rod so that it is vertical. If the subject's adjustment is strongly influenced by the surrounding frame, she is field dependent---if not, she is field independent. At right is one item from an embedded-figures test, in which the subject tries to find the simple figure hidden in the more complex one. Success on tasks like this indicates field independence. Like the rod-and-frame task, it seems to indicate an ability to separate a part of one's visual experience from everything else one is seeing.



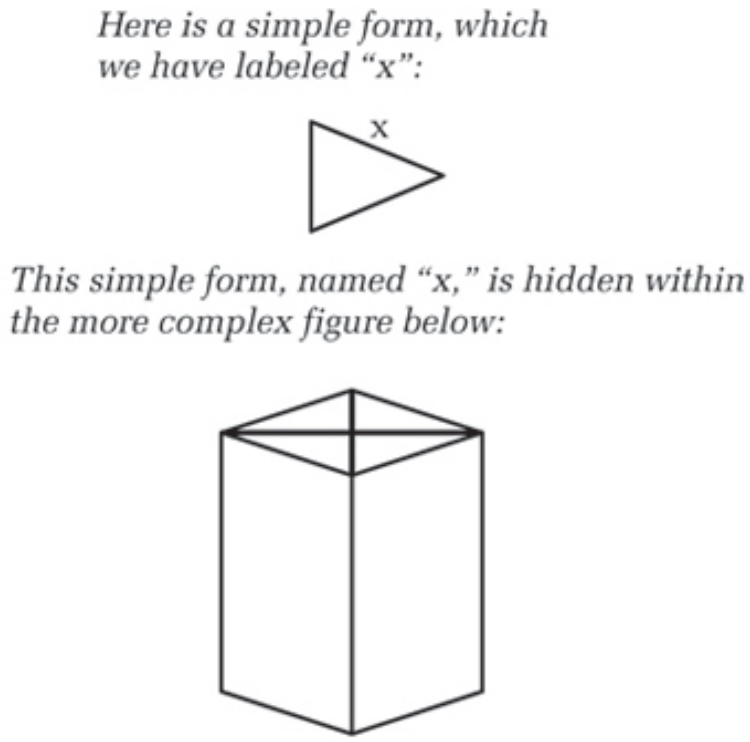


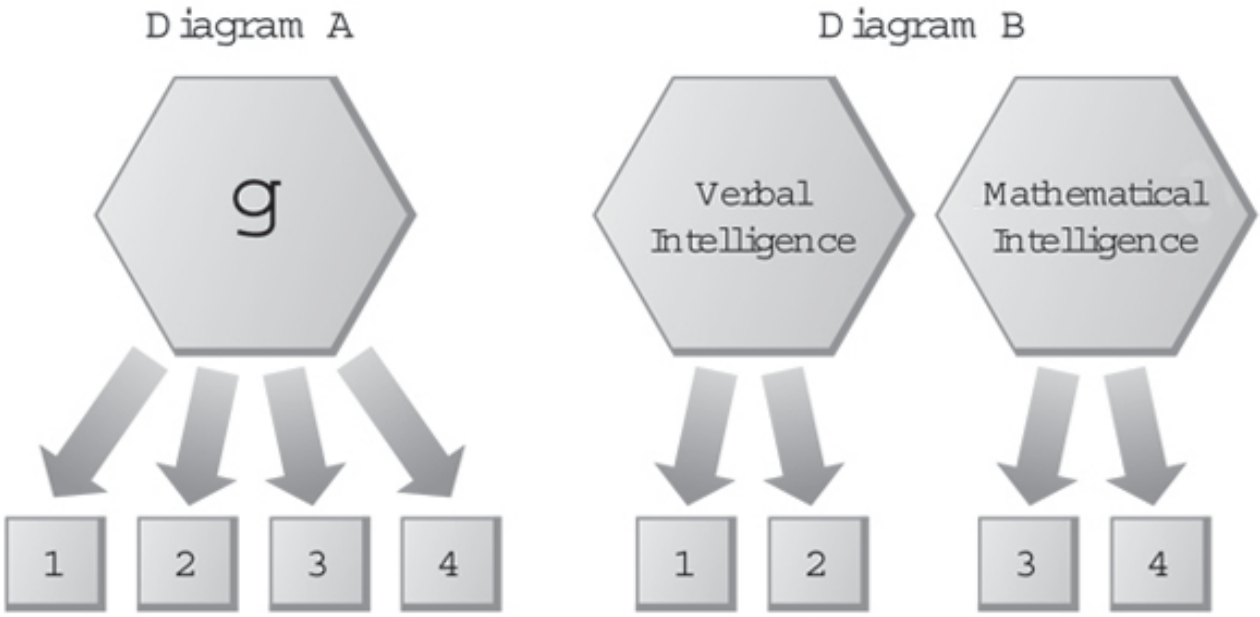
Figure 18

Gardner's eight intelligences.

Intelligence	Description	Profession requiring high levels of given intelligence
Linguistic	Facility with words and language	Attorney, novelist
Logical-mathematical	Facility with logic, inductive and deductive reasoning, and numbers	Computer programmer, scientist
Bodily-kinesthetic	Facility with body movement, as in sports and dance	Athlete, dancer, mime
Interpersonal	Facility in understanding others' emotions, needs, and points of view	Salesperson, politician
Intrapersonal	Facility in understanding one's own motivations and emotions	Novelist
Musical	Facility in the creation, production, and appreciation of music	Performer, composer
Naturalist	Facility in identifying and classifying flora or fauna	Naturalist, chef
Spatial	Facility in the use and manipulation of space	Architect, sculptor

Figure 19

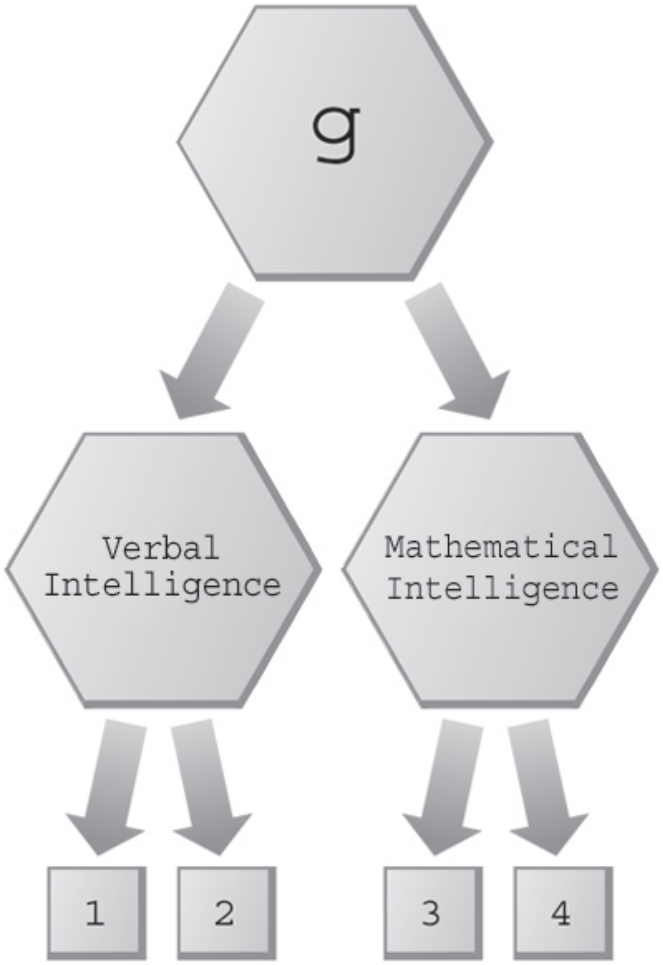
Two views of intelligence. According to the view on the left, a single type of intelligence underlies all intellectual tasks. So doing well on the vocabulary test implies that you have a lot of *g*, which implies that you should also do well on the other three tests. In the model on the right, doing well on the vocabulary test implies that you have high verbal intelligence but tells us nothing about how much mathematical intelligence you have, because the two are separate. Data from hundreds of studies show that neither of these models is correct. The model in Figure 20 is commonly accepted.



Two views of intelligence: © Anne Carlyle Lindsay

Figure 20

The dominant view of intelligence. There is a general intelligence that contributes to many different types of mental tasks, but there are also particular types of intelligence that are supported by the general intelligence processes. Almost everyone agrees that there are verbal and mathematical intelligences, although some people think these should be broken down further.



The dominant view of intelligence: © Anne Carlyle Lindsay

Figure 21

The nine principles of the mind discussed in this book along with the knowledge needed to deploy them, and the most important implication of each.

Chapter	Cognitive Principle	Required Knowledge About Students	Most Important Classroom Implication
1	People are naturally curious, but they are not naturally good thinkers.	What is just beyond what my students know and can do?	Think of to-be-learned material as *answers*, and take the time necessary to explain to students the questions.
2	Factual knowledge precedes skill.	What do my students know?	It is not possible to think well on a topic in the absence of factual knowledge about the topic.
3	Memory is the residue of thought.	What will students think during this lesson?	The best barometer for every lesson plan is "Of what will it make the students think?"
4	We understand new things in the context of things we already know.	What do students already know that will be a toehold on understanding this new material?	Always make deep knowledge your goal, spoken and unspoken, but recognize that shallow knowledge will come first.
5	Proficiency requires practice.	How can I get students to practice without boredom?	Think carefully about which material students need at their fingertips, and practice it over time.

Figure 21, continued

The nine principles of the mind discussed in this book along with the knowledge needed to deploy them, and the most important implication of each.

Chapter	Cognitive Principle	Required Knowledge About Students	Most Important Classroom Implication
6	Cognition is fundamentally different early and late in training.	What is the difference between my students and an expert?	Strive for deep understanding in your students, not the creation of new knowledge.
7	Children are more alike than different in terms of learning.	Knowledge of students' learning styles is not necessary.	Think of lesson content, not student differences, driving decisions about how to teach.
8	Intelligence can be changed through sustained hard work.	What do my students believe about intelligence?	Always talk about successes and failures in terms of effort, not ability.
9	Teaching, like any complex cognitive skill, must be practiced to be improved.	What aspects of my teaching work well for my students, and what parts need improvement?	Improvement requires more than experience; it also requires conscious effort and feedback.