Mastering the Skills for Success in Life, Business, and School, or How to Become an Expert in Just About Anything

LEARN BETTER

ULRICH BOSER

FOUNDER OF THE LEARNING AGENCY

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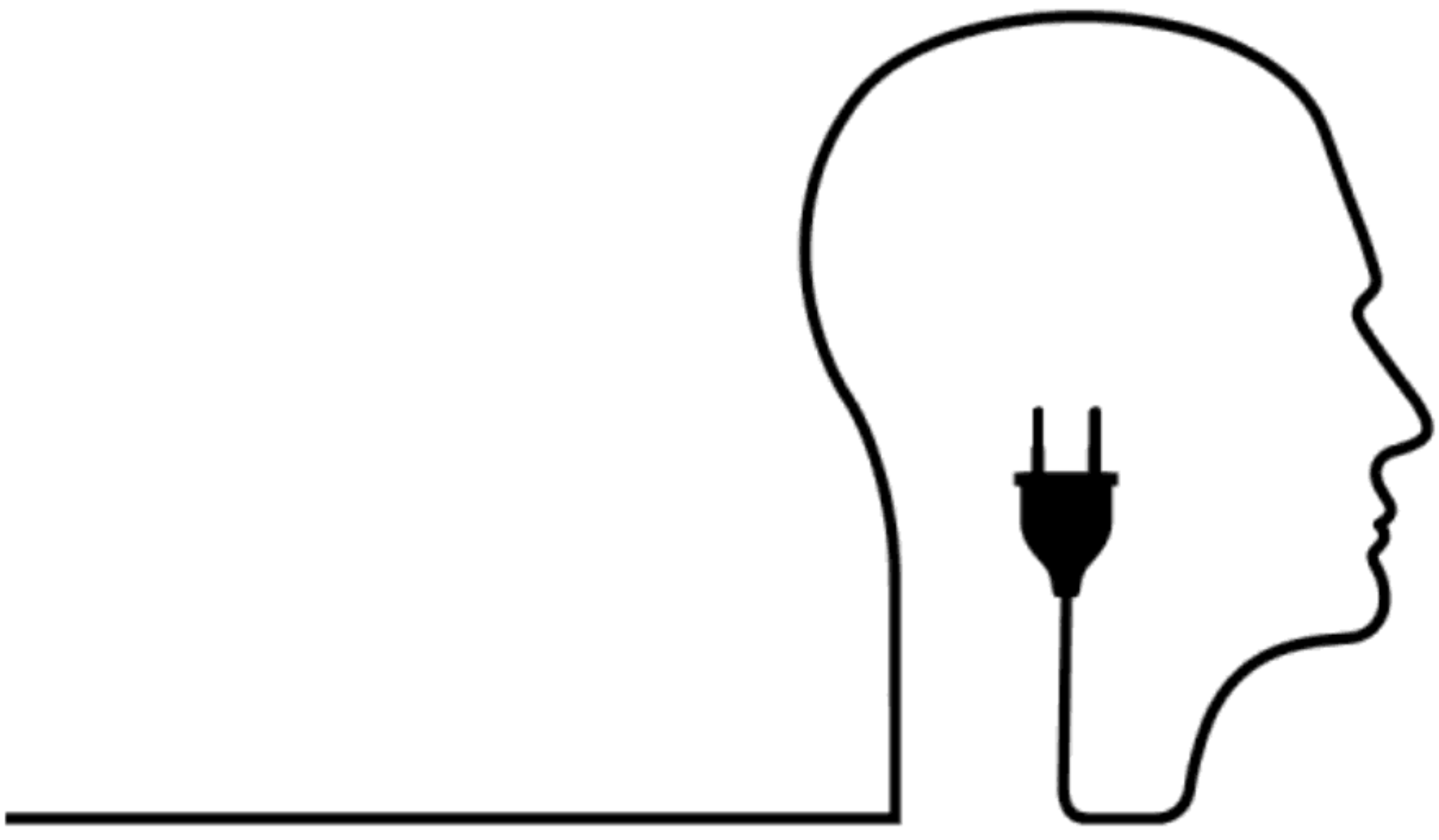

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AUTHOR'S NOTE

IN THIS BOOK, I've used text that has previously appeared in other articles, reports, or blog items that I've written. I also edited quotes for clarity and shared some portions of the text with sources to gain their feedback. If I use only a first name to describe someone, then the name is a pseudonym. If there are any errors of fact, citation, or clarity, I'll list them on my website: www.ulrichboser.com.

With regard to citations, I've found the use of footnotes in e-books distracting, and so I wrote up a notes section, which includes source material, notable asides, and further reading. With regard to conflicts of interest, I have some—don't we all?—and I've done work for different organizations and foundations that I mention in this book. Again, see the notes section.

When it comes to writing about my own history, especially as it relates to events that occurred years ago, I wanted to write "to the best of my knowledge" at the end of every sentence. I did not, but please consider the caveat.

INTRODUCTION

THE ELEMENTARY SCHOOL stood at the end of a cul-de-sac. It was a low-slung red-brick building some ten miles north of New York City, tucked away among ribbons of suburban streets, surrounded by solid ranchers and brawny Colonials. It was January 6, 1986, a cold morning, just above freezing. Parents pulled in front of the school in a convoy of cars, their children slipping out, laughing, talking, letting out the occasional raucous scream.

Shortly after 10:30 a.m., a young boy tucked himself into a chair in one of the school's classrooms. He was green-eyed with a big bowl of dirty blond hair. It was a few days before the boy's 11th birthday, and he almost certainly wore a turtleneck sweater and corduroy pants. Pages of schoolwork stuffed his backpack, most likely mixed together with some *Dungeons & Dragons*–inspired drawings.

The green-eyed boy had a difficult time learning, and that morning was no different. Class began with the teacher discussing how to subtract one fraction from another, and the boy strode to the blackboard to answer a problem from his homework. But the boy wrote down the wrong equation and had to redo the problem.

Then the boy became distracted, twisting around in his seat, contorting like an aspiring Houdini, and the teacher scolded him: *Please focus.* The other children answered questions. They solved problems. But the green-eyed boy remained bewildered. So rather than work through the math problems, the boy simply cheated, copying down solutions from a friend sitting nearby.

Then, some twenty minutes into the class, the teacher called on the boy to answer a division problem: *What's 770 divided by 77?* The boy didn't know. Another division question. Another confused grimace. Eventually, the class wound down. The teacher discussed homework assignments, while the green-eyed boy nattered on to a friend—sports, books, recess, who knows. The teacher scolded the child one last time before the class let out.

In many ways, the boy with the green eyes is everyone. A lot of kids make a mess of their homework. It's easy to get distracted. But that child was me. I lumbered along in my classes. My grades were weak. I floundered on exams. Teachers complained about my inability to learn, one telling my mother I would probably become a cook. So one morning, in January 1986, a school psychologist slipped into my 4th grade classroom to observe me in class.

While I've tried to recall the day, I don't have the slightest scrap of a memory. But for decades, I kept the psychologist's detailed report—a single-spaced black-and-white typewriter-created document. It describes how I managed to cheat, neglect my work, and forgo all focus during the one hour-long class. "Frustrated," "inattentive," and "distracted" are among the words the school psychologist used to describe me.

Kindergarten was probably my first academic challenge. I was the youngest in my class, and I ended up repeating the grade because I couldn't keep up. In elementary school, teachers sent me for special testing, where I filled in the bubbles of a long list of unpronounceable psychological exams that sound today like a bit of Psych 101—the Bender Visual-Motor Gestalt Test, the Zeitlin Coping Inventory, the Projective Figure Drawing exam. For a few years in middle school, I spent a few hours each week in special education, a holding pen for cranks and misfits, social oddities, and academic outliers.

Different theories about the cause of my difficulties floated around, vague potential explanations. One account held that I was slow to learn because my immigrant parents spoke German at home. Others claimed that I had an auditory problem, that my brain wasn't wired correctly when it came to listening. Still others believed I lacked intelligence, that almost magical ability to think through issues and solve problems.

There's a bit of accuracy to each of these theories. My parents have lived in this country for decades, yet they still sometimes slip into German while speaking English. I do, indeed, have a learning disorder that makes it difficult to follow auditory details, and I still sometimes struggle tracking spoken details. And let's be clear—I'm no genius.

There's another perspective on what happened, though, and when I look back now, it seems that I didn't know how to learn. I didn't have ways to think about my thinking. I didn't ask myself questions or set goals or even know what it meant to know something. The ability to learn appeared beyond me, and it left me "lost," as the school psychologist wrote in her evaluation.

With the help of some teachers, I eventually developed a few basic learning strategies. I would ask myself questions like: Do I really know this? Did I understand the underlying logic of what I was learning? I also came to terms with the idea that people learned at different rates, that I might need to put in more effort than my peers. Over the years, I discovered better ways to focus, becoming a devotee of anything that promoted silence, and even today, I buy earplugs by the box.

Eventually, my academic confidence began to tick upward, and so did my grades. Student government became an interest. So did sports—track, basketball, cross-country. I did well on my college admissions exams, and then, with a bit of luck—and a lot of work—a thick envelope from an Ivy League college arrived in the mail.

My academic experiences are not the basis for this book. In fact, if you compare my experience to the experiences of those stuck in dead-end colleges or bad corporate training, I had it great—supportive parents, well-funded schools, generally caring teachers. Plus, my auditory disability makes me less than representative.

But in the end, my experience drove an interest, one that developed into a career, and today I believe that a lot of people are like an early version of me—they don't think much about the best way to gain new knowledge and skills. People will often reread material, for instance, even though it's a weak approach to learning, or they'll use highlighters, which have a very limited research base. People also won't reflect on their skills or track their progress, despite the library of evidence on these learning approaches.

This happens despite the fact that most of us are constantly developing our skills and knowledge. Someone gives you some new software? You'll need to master the application. (Be sure to explain key ideas to yourself so you really understand them.) Land a new client? You'll want to present your ideas in a way that's engaging. (Don't put too many graphics on a PowerPoint slide; it overloads working memory.) Need to remember a phone number? (Use your fingers; they're a great way to store numbers for a short period of time.)

Not long ago, I grabbed coffee with one of my old special education teachers. We sat in a Starbucks, spinning out recollections. As we discussed some long-lost moments of elementary school—my issues with homework, certain teachers, other students—it made me feel like a kid again. At least my experience of being a kid—the odd shame, the addled confusion. At one point, I tried to share with her what I had learned since middle school, everything that I knew about learning.

But the words never quite tumbled out. I felt embarrassed. I didn't want to seem preening. So while I wrote this book for all sorts of reasons—to reframe the education debate, to hone my own thinking—one of my main drivers was to provide a guide to that green-eyed boy with the big blond hair—and to everyone else who might need one.

An experiment took place some years ago at an all-girls school in New York City. It was an old Catholic school, with some crucifixes hanging from the walls, looking somber and stern. The girls were in their first two years of high school, teenagers wearing polo shirts and pleated skirts, and the young women would later receive a little gift for agreeing to enroll in the study.

As part of the experiment, the girls were taught how to play darts for the first time, and the two psychologists conducting the study divided the young women into some groups. Let's call the members of the first group Team Performance, and they were told that they should learn the game of darts by trying to throw the darts as close to the center of the board as possible. In other words, the researchers informed the women that the best way to win was to rack up some points.

The psychologists also pulled together another group of young women. Let's call them Team Learning Method, and they learned to play darts very differently. The researchers had these girls focus on the process of gaining expertise, and the women started by working on how exactly to throw the darts, mastering some basic processes like "keep your arm close to your body." Then, after the women showed some proficiency, they were encouraged to aim at the bull's-eye, slowly shifting from some process goals to some outcome goals like hitting the target.

Finally, there was the control group. Their instructions? The researchers told them to simply "do their best." In other words, these young women could take any approach that they wanted to learning darts. Let's think of this group as Team Conventional Wisdom.

To learn more about the experiment, I met up with Anastasia Kitsantas, who ran the study together with psychologist Barry Zimmerman. While the experiment took place some years ago, Kitsantas still had the darts stashed away in her office at George Mason University, and on a rainy afternoon, she pulled out the little yellow missiles from an office cabinet to show them to me, laying the darts out like an important relic from some forgotten South American tribe.

Kitsantas held on to the darts because of the study's surprisingly large outcomes, and by the end of the experiment, the young women on Team Learning Method dramatically outperformed the others, with scores nearly twice as high as Team Conventional Wisdom. The women also enjoyed the experience much more. "Several of the students asked me to teach them more about darts after the experiment. They kept asking me for weeks," Kitsantas told me.

The takeaway from the dart experiment is a straightforward one, one supported by a growing number of studies, because learning turns out to be a process, a method, a system of understanding. It's an activity that requires focus, planning, and reflection, and when people know how to learn, they acquire mastery in much more much effective ways.

Indeed, the learning process turns out to be one of the most important predictors of learning. One recent meta-analysis—or a study of studies—showed that learning methods dramatically shifted outcomes in just about every field. Another meta-analysis found that the

process of learning works in lockstep with GPA. Follow-up research by Kitsantas and Zimmerman replicated the dart study in other fields, finding that dedicated strategies boosted performance in everything from volleyball to writing.

Within the typically somber community of cognitive science researchers, the recent spate of learning-to-learn studies have sparked a glee that's typically associated with the Second Coming. Some researchers have dramatically labeled their papers with titles like "How to Gain Eleven IQ Points in Ten Minutes." (The researchers recommend thinking aloud while problem solving.) Others become exhilarated during interviews. "We should be spreading this gospel," researcher Bennett Schwartz told me. (Schwartz argues for more self-quizzing.)

A lot of the excitement stems from the originality of the findings, and as an idea, a more focused approach to learning is only some twenty years old. For a long time, experts had assumed that the ability to learn was a matter of intelligence, dedicated smarts, and so researchers didn't really study the issue. They assumed, it seems, that either people had the skill of learning or they didn't. For them, intelligence—and thus the ability to gain mastery—was an immutable trait like having blue eyes, a genetic gift of the gods.

For their part, schools followed the prevailing wisdom, and despite years of education, despite years spent in classrooms, most people have never learned to learn. Generally speaking, we don't have a good sense of how to improve our expertise in a field or subject.

As an example, consider the word "studying": It's a remarkably vague expression. Does studying mean rereading a textbook? Doing sample problems? Memorizing? All of the above? For another example, take the word "practice." Does practice mean repeating the same skill over and over again? Does practice require detailed feedback? Should the practice be hard? Or should it be fun?

There are a lot of other misconceptions. When it comes to learning, people believe a lot of things that aren't really supported by the research. Working with some of the nation's most respected learning experts, I recently conducted a survey to see what people knew about how to acquire a skill, and the results were remarkable. While an overwhelm-

ing percentage of Americans said that they knew the basics of effective teaching and learning, they harbored a lot of weak intuitions and false beliefs about how people learn.

Two-thirds of the public believed, for instance, that students should be praised for being smart, for instance. But the research shows the opposite, and people learn more when they are praised for their effort than their intelligence. Another 50 percent of the public said people learn effectively without much guidance. But study after study shows that learning is a dedicated, engaged process. And while there's no research supporting the notion of learning styles—the idea that someone learns better kinesthetically or visually—more than 80 percent of the public believe that learning styles exist.

There's also a lot of good news here, though, because it doesn't take much to develop the learning process. Many of the improvement strategies that have been tucked away in sterile research studies show large gains with little additional effort, and on the day I visited with Anastasia Kitsantas, she pointed out that even small tweaks would dramatically improve outcomes. In the dart experiment, for instance, about half of the subjects on Team Learning Method recorded their scores after each throw, and even that task was enough to boost performance. "It's phenomenal when you think about it," she said.

But, of course, most of us rarely do.

The value of the learning process extends far beyond the recent science. It also reflects the nature of society today—and the shifting nature of expertise.

Recall for a moment the last bit of information that you typed into Google. Maybe you were looking for the address for a local pizza place or hunting for the hometown of pop star Michael Jackson. According to a series of studies by researcher Betsy Sparrow and her colleagues, you're more likely to remember where the information was online than the details of the actual information.

So if you searched for the hometown of Michael Jackson, you're more likely to remember the Wikipedia page of the King of Pop than the

actual information (Gary, Indiana). If you found the address for the pizza place on a Web site, then you're more likely to remember the URL (greatpizza.com) than the actual address of the restaurant. "We are becoming symbiotic with our computer tools," write Sparrow and her colleagues, "growing into interconnected systems that remember less by knowing information than by knowing where the information can be found."

There are a few crucial implications from this line of research. For one thing, our brain—and its various quirks—are at the heart of learning effectively, and our brain will often "offload" information, storing it in places other than its own neural folds. In this regard, our smartphones, iPads, and laptops have become a type of "prosthetic brain" in the words of one writer, and recent research shows that we're less likely to remember a painting at a museum if we take a photo of the painting. Our brain, it seems, believes the image is stored on the digital device.

But there's a second, more important lesson here that gets to a broad truth about the Digital Age: Facts have lost a lot of their value. Details are no longer as important as they once were. For just about all of us, what matters today is not the data itself—what matters is how we can think better with that data. More exactly, how do we acquire new skills most effectively? How do we better grasp complex problems? And when should we store memories in our heads—and when should we store them on a computer?

If you lived just a few decades ago—or near the end of the Ice Age—it wasn't this way. Take the man known as Ötzi. He lived in the Italian Alps around 5,000 years ago at the start of the Bronze Age. He was a small man by modern standards—just over 5 feet tall, with a thick, matted beard carpeting his face. His forehead hung low over his eyes. His nose had once been broken, giving him the visage of an aging boxer.

Ötzi died deep in the Alps, trekking up a high mountain pass, falling behind a boulder, a sprawl of clenched fists and tired legs. An arrow had gored his shoulder, blood spilling from his back, killing him quickly. For centuries, Ötzi's murdered body stayed among the rocks until some wanderers found his corpse in 1989, perfectly mummified in the snow and ice.

Ötzi had developed an important type of knowledge, according to the archaeologists who've studied him over the years. A collection of half-built arrows hung around his shoulders, meaning that Ötzi had studied the foundations of archery construction. Filaments of metal coated his hair, suggesting Ötzi understood the basic procedures of metal smelting. And from the awkward attempts to mend his clothes with bits of grass, it appeared that Ötzi had developed rudimentary sewing skills.

But the knowledge that makes Ötzi so impressive is not the same sort of knowledge that we need today. From the time Ötzi left the Alpine valley until just a few years ago, information was both highly static—and very expensive. For centuries, we sought out experts, who could pass along invariable details like how to build a bow and arrow, a form of technology that would not change for another 4,000 years.

At the same time, we worshiped data, which for a long time could be found only in rare, hand-calligraphed manuscripts and then, after the invention of the Gutenberg press, in faded books. When many of us were kids, writing school papers meant spending hours in the library going cross-eyed as we scrolled through microfiche. Acing tests meant studying page after page of details, memorizing dates, and learning equations by heart.

This view of learning continues to be implemented in most schools and colleges and training programs. Just pull any thick textbook from the shelf. I recently worked with curriculum experts Morgan Polikoff and John Smithson, and we showed that over 95 percent of one widely used elementary school math textbook focused on lower order thinking like memorization and understanding procedures.

But in the Internet Age, information is fire-sale cheap, and within tenths of a second on Google, we can figure out how proteins bind with plasma. Dinner-party disputes are quickly settled with a swipe of a finger on an iPhone. What's more, mastery itself is constantly shifting. The life cycle of expertise has become ever shorter—over the past ten years, for instance, the car-sharing service Uber shot from an obscure app to a household name.

This shifts both how and why we acquire new skills and knowledge,

because practice alone doesn't make perfect anymore. We need to develop more than simple procedures in order to succeed, and the modern world requires that people know how to learn—and develop the thinking skills that matter.

It's easy to go too far here, so let's be clear. Facts still play a crucial role. Knowledge serves as the bedrock of learning. Memorization also remains a powerful learning tool, and what you know is often the best predictor of what you're able to learn. I call it the Knowledge Effect, and it's a theme that we will revisit often in this book because expertise demands fluency in the basics.

But knowing the facts is just the start, and when people engage in learning, they also need to understand relationships, to identify cause and effect, to see analogies and similarities. In the end, the goal of learning is about shifting how we think about a fact or idea, and when we learn, we aim to learn a system of thought.

So if we study microeconomics, we want to learn how to think microeconomically. If we learn knitting, we aim to learn to think like an expert knitter. Want to go scuba diving? Then try to learn to reason like a world-class diver. As educational psychologists argue, "Think of learning as figuring out the parts of an organized and intelligible system."

There's a lot riding on this new approach to learning—and the reason is sitting right there in your smartphone. After all, recent technological advances have decimated the jobs that require procedural knowledge. To a degree, this is an old headline. With the rise of online travel Web sites, the demise of travel agents is basically complete. ATMs have destroyed bank-teller jobs, while countless cashier spots are gone due to the advent of self-checkouts.

This shift is happening faster than even the most sanguine experts could have predicted. Some ten years ago, for instance, Harvard economists Richard Murnane and Frank Levy published *The New Division of Labor,* which made all sorts of predictions about which jobs will continue to exist in the future. For them, secretarial jobs would soon be gone—replaced by computers. Same with anything having to do with factory work—gone.

But computers will never be able to drive a car. For the two economists, piloting an automobile was simply too sophisticated, too complicated, to be done by any sort of device. Most of their predictions turned out to be accurate—secretarial jobs have more or less disappeared. Same with a lot of factory work. But on self-driving cars, the economists clearly missed the mark: Companies from Google to Tesla have already rolled out driverless cars, and self-driving taxis already roam the streets of cities like Singapore.

Not long ago, I met up with Murnane at his house outside of Boston, and when he came to the door, he seemed every bit the Harvard economics professor. He had a white beard and wore glasses and a National Bureau of Economics Research sweatshirt. There was a small hole in one of his socks.

As we sat in his living room, Murnane argued that the self-driving car prediction was the exception that proves the rule. Technology is changing the world much faster than most people think, and he argued that people needed "expert thinking skills" to succeed. In practical terms, this means people need to know how to solve "unstructured problems." If you're a computer engineer, you need to be able to tackle technical issues not outlined in a technical manual. If you're a speech therapist, you need to be able to help children who have not-easily-defined language issues.

At the same time, people need to be better able to create understanding out of new information, according to Murnane. So if you work for an advertising company, one of the key skills might be explaining how a client can take advantage of what's in the news that morning. If you're a stockbroker, it's making sense of how weather changes might impact the sales of grain.

The audience for this book, then, is much wider than the nation's students, and in the pages that follow, I also discuss ways to help people engage more effectively in any type of knowledge work. For a tough problem, for instance, people should look for analogies outside of their field. If you have a film-development problem, for instance, examine the music industry for innovative clues. If you have a difficult marketing problem, look at journalism for some creative sparks.

POP QUIZ #1

What's the most effective way to learn key ideas?

A. Circling key points in the passage.
B. Rereading the passage.
C. Taking a short practice test on the material presented in the passage.
D. Highlighting the crucial ideas in the passage.

I also discuss how people can improve their ability to solve new problems, and when working on an issue, people should develop a pithy summary of the situation. By clearly defining a problem, we are often better able to crack a persistent riddle or issue. In this book, we will also cover various management ideas—like the value of peer learning and postmortems. After all, a lot of leadership boils down to helping people grow and develop.

More broadly, though, we have to realize that in a world filled with data, when facts and figures flow as freely as water, when even cars are driving themselves, we have to be able to acquire new forms of expertise quickly and effectively. Learning to learn is what experts call the "ultimate survival tool," one of the most important talents of the modern era, the skill that precedes all other skills. Because once you know how to learn, you can learn almost anything, and as a society, we need much richer forms of education, where information and knowledge work to foster the problem-solving skills that ultimately matter.

Still skeptical? Just Google it.

In many ways, my interest in the process of learning was rekindled with an email. At the time, I was laboring over a project that attempted to answer the question: What sort of outcomes does a school district produce relative to its spending? We aimed to provide the results for just about every district in the country, and it took months. The data was weak. There were statistical issues. If you want to figure out how

effective a district is, for instance, how do you take into account that kids in low-income areas often arrive at school without having had any breakfast?

Late in the project, an email flashed into my inbox. My research assistant had flooded a statistical application with data and confirmed a pattern that we had been seeing all along: Spending did not line up with outcomes. In a few places, the relationship between spending and outcomes was so noisy that there was a small but negative relationship between money and test scores. In other words, if you were Billy Bean of *Moneyball* fame and looked at our data, it seemed like money spent on some schools actually predicted lower outcomes.

How is this possible? There are a lot of reasons, of course, and I'm not arguing that schools should get less money. Quite the opposite. But over time, I also came to believe that one of the biggest issues within education was the quality of learning itself. In too many areas, at too many levels, institutions were not set up to help people gain skills. Put more directly, in too many places, money is simply not being spent on what matters.

As concrete evidence, step into any lecture hall, with hundreds of students passively listening to a lecture. The research is overwhelming that the they'll-get-it-eventually approach is ineffective. Students in traditional lecture-based courses are 50 percent more likely to fail, according to one recent study. One Nobel laureate told me that he thought that traditional lecture courses were simply "unethical."

For another example, consider a practice like testing yourself. The evidence is conclusive that the strategy can dramatically increase outcomes, sometimes showing 50 percent higher outcomes. But students rarely use the approach, preferring to just leaf through their textbook again. (When it comes to quizzing, I tried to make this book an exemplar, and you'll find a lot of "pop quizzes" in these pages. I slipped the questions into the text to help you better remember what you've read. The answers are at the end of the book.)

To a degree, this book is a product of my work at one of the nation's leading think tanks. Since my confused days in elementary school—or, perhaps more accurately, because of my confused days in elementary

school—I became fascinated with learning. After graduating from college, I aimed to provide students with better educational opportunities and worked as a researcher at the trade publication *Education Week*. Then I covered education—and other social topics—at *U.S. News & World Report*.

Eventually, I became a senior fellow at the Center for American Progress, a Washington, DC–based think tank. Working with a dedicated group of researchers and policy wonks, I examine education issues, and my research has had some impact over the years, from inspiring quips on *The Tonight Show* to sparking changes in education policy.

But more than that, this book rests on the work of the many scientists and researchers who've been studying the science of learning. Over the past few decades, the field has gone from an obscure topic to a well-established field. Still, most of the research findings have remained buried in dusty academic journals and obscure government reports. Far too little has reached the public. Far too little has changed how people learn.

This book is not another "what's wrong with the American education system" tome. There have been enough of those sorts of policy stem-winders. Rather, I hope to outline the process of learning, to detail how we learn best. The rest of this book will map out this notion in greater detail, outlining a general method for gaining mastery that's come out of the research.

Not every learning activity requires a step-by-step approach. If you want to learn how to, say, change the tire on your car, you don't need to follow each idea outlined below, although it might help. But if a skill is worth knowing deeply, then it's worth knowing well, and we need to take a systemic approach to developing expertise, as follows:

Value. It's impossible to learn if we don't want to learn, and to gain expertise, we have to see the skills and knowledge as valuable. What's more, we have to create meaning. Learning is a matter of making sense of something.

Target. In the early part of gaining mastery, focus is key. We

need to figure out what exactly we want to learn and set goals and targets.

Develop. Some forms of practice make people more perfect than others. In this stage of learning, people need to hone their skills and take dedicated steps to improve performance.

Extend. At this point, we want to go beyond the basics—and apply what we know. We want to flesh out our skills and knowledge and create more meaningful forms of understanding.

Relate. This is the phase where we see how it all fits together. After all, we don't want to know just a single detail or procedure—we want to know how that detail or procedure interacts with other facts and procedures.

Rethink. When it comes to learning, it's easy to make mistakes, to be overconfident, and so we need to review our knowledge, reconsider our understanding, and learn from our learning.

Across these steps, there are some themes that we'll return to again and again. Learning is often a form of mental doing, for one, and the more someone is actively engaged, the more they learn. If you're reading some new text, ask yourself questions: What's this text about? What point is the author trying to make? Is there anything here that seems confusing?

At the same time, manage your learning. Have you gotten feedback? Have you benchmarked your performance? If you're giving a speech, videotape yourself. If you're writing an essay, ask a friend to read it over. If you're learning Spanish, talk with a native speaker. When it comes to learning, we need to target our learning and figure out what exactly we're aiming to know.

Also be sure to think about your thinking. Do you really understand? Have you accounted for the inevitable forgetting? In this regard, spreading learning over time is crucial. After all, we often fail to recall certain facts and details, and by some estimates, we lose about half of what we learn within an hour. This means that people should make sure

to review what they know days, weeks, even months later. As we will find out, just making larger piles of flashcards—and thus doing more to space out our learning—can improve outcomes by 30 percent.

Emotions also play a crucial role. We often think that learning is purely rational, a matter of deep logic and focused reasoning, but our brains don't quite work that way. The process of gaining expertise is often just as cognitive as noncognitive. In this regard, we can't learn if we don't believe that we can learn. Like an engine that requires both oil and gas in order to run properly, our brains need both reason and emotion to perform at any sort of high level.

To gain expertise, people also need to look for connections, and effective learning often boils down to seeing relationships within a body of knowledge. So ask yourself: Is there an analogy that helps explain the idea? Are there links to other fields or subjects? If you're learning about something—like, say, the physics of a black hole—what conceptual similarity can you envision? Are black holes similar to sinkholes? A waterfall? A trash can?

In the end, there are better, more effective ways to learn, and we need to do much more to give everyone the skills they need to succeed. The goal in today's world isn't just to be smart or to memorize lots of facts. That simply is not enough anymore. Rather, the goal is to become an effective learner, one who can take advantage of all the tools of the 21st century. I hope this book shows you how—and sparks great change, so that we can all take full advantage of our deep capacity to gain new skills.

Chapter 1

VALUE

JASON WOLFSON ISN'T sure how many Lego sculptures he's created. Standing in the basement of his house, he's surrounded by dozens of his creations—a Lego dragon, a Lego airplane, a giant Lego moth with six-inch Lego wings. In boxes, in small plastic bags, on the table in front of Wolfson, there were still more constructions—a half-built lunar module, a Leaning Tower of Pisa, a cowboy—all made from Legos.

Some of Wolfson's constructions are finished—large artful works of bricks, part Warhol, part toy, part real-life fantasy. Other sculptures are half-built designs, creations in the making, like an artificial heart sculpted out of Legos. Along the walls, along the floor, pushing against the top of the room, are all of Wolfson's raw materials—hundreds of thousands of plastic bricks.

"Ah, these meteors are awesome," Wolfson tells me, plucking out a little gray meteor from the plastic box and showing it off to me in his palm like some sort of rare diamond.

Without question, Wolfson is an unlikely Lego devotee. He loves movies and vacations in Florida and does CrossFit on weekends. He grew up outside of Philadelphia and ran track in high school and helped head up his college fraternity. Today, he works as an engineer and lives with his wife, and he hangs a large American flag out in front of the house each Independence Day. Like many forty-somethings, his hair is thinning a bit. He often quotes films from the 1980s. I don't know if I've ever seen him wear anything but blue jeans.

But in many ways, Wolfson's interest in Legos makes all sorts of sense. When he toured me through his basement, he kept spinning out little stories, a way of explaining why each sculpture mattered. When Wolfson pointed out his true-to-size replica of the muppet Gonzo, he explained that his wife loved the Jim Henson–created puppet. As Wolfson showed me the blue police box made from the small bricks, he began to talk about his devotion to the TV show *Doctor Who*. Or the dragon-like Jabberwocky that Wolfson had once fashioned out of hundreds of Legos? Wolfson always loved *Alice in Wonderland*.

At first, Wolfson's stories seemed cute and charming, something to tell the writer in his basement. But the stories turned out to be a crucial part of his devotion. They made Wolfson's Lego sculptures something of value, something of substance, something that had meaning.

After all, Wolfson wasn't interested in any pile of little plastic bricks. He didn't care about some old box of dog-chewed Legos. Rather, he was fascinated by the pile of bricks that he had transformed into a scene from his favorite novel or an iconic phone booth from his favorite TV show.

To a degree, we're all part Wolfson. We may not have a burning passion for *Alice in Wonderland,* Muppets, or Legos, but in our mind, we all see the world through the frame of meaning. We engage in activities that we believe have value.

When it comes to learning, this idea is crucial. Motivation is the first step in acquiring any sort of skill. It's hard to learn something if we don't see any meaning in it, and we'll start this chapter by examining how value drives motivation.

But meaning is important for another reason—it's the very first step of understanding. If we're making a connection to a bit of expertise, we're starting to make sense of it. We'll cover this idea in the second half of the chapter and discuss the crucial role of uncovering significance in what we want to learn.

The value of meaning has its roots in the brain, and for all its rich complexity, our mind works as a type of storyteller. Like a film director, we're always creating some sort of narrative, some type of understanding, some sort of meaning. If you walk into a room for the first time, for

instance, you will immediately formulate a value-laden story that explains the room's purpose. If it's a large space with a long, well-polished table, you might think: *a meeting room*. If there are a few barbells on the ground: *gym*.

The same thing happens in two dimensions with optical illusions. Sometimes we will see a beautiful young woman in a drawing, sometimes an older lady—but we're always seeing some sort of meaning in the image. It's never just a bunch of random, meaningless squiggles.

This is more than a cognitive quirk because meaning is something we have to create. People find their own value in the world, with meaning serving as a matter of perspective, a frame of mind, an attitude that makes something either wonderfully important or devoid of all significance. More directly, value is the ultimate fuel of our drive to learn. We're motivated to gain expertise because of the power of meaning.

Legos remain a good example. The bricks have become popular with adults because they make it easy to uncover a sense of relevance, and today many Lego expos will have tens of thousands of visitors, while glossy online magazines like *Brick Journal* chronicle the latest approaches. There are also Lego skills classes and books devoted to Lego techniques and a professor of Lego at the University of Cambridge.

Wolfson himself has spent decades perfecting his Lego skills for this reason. Because of the meaning that he finds in the brick constructions, he has learned how to create curved Lego structures—which is difficult given that the bricks themselves are square. To create a smooth look, Wolfson also developed the skill of building Lego constructions with the studs on the inside. For one project, Wolfson even developed a new programming code so that the Lego construction would play music when someone walked by.

Before I left Wolfson's house, he showed me yet another Lego construction, a dark blue moon land set. Wolfson had built the kit when he was five years old, sitting in his grandmother's dining room, perched alongside an eight-sided wooden table, his legs tucked into a low-slung chair. As we spoke, Wolfson gently held the construction in his hand,

chapter), and a feeling of value, or meaning. The last variable is often the most crucial, according to Barron, and it's a matter of "Do I want to do the task?"

There's something familiar about this argument, admittedly. After all, we've all had teachers who have proclaimed: "This is important." My parents said it all the time about my schoolwork, too: "You'll need this later." Now I hear versions of the idea from my company's HR department: "Your retirement account is central to your future."

But the crux of this line of research is different. In short, just telling people that something is important is not enough. In fact, Hulleman has found that simply telling people that information has value can backfire. When we're told how to feel or think, we can feel threatened or overly managed.

Instead, people need to find meaning in the activities themselves. In other words, value has to go from the person to the material, from the individual to the knowledge or skill. "It's about making that connection between what people are learning and what's going on in their lives," Hulleman told me. "Value is the mechanism. For people, the question is, 'Can I see why this is valuable to me?'"

Great public speakers often take this approach, and a good presenter will ensure that the material seems relevant to their audience. Former president Bill Clinton was well-known for this type of charm. If the topic of conversation was the Maldives, a skilled speaker like Clinton might subtly ask his audience if they had visited the nation. If the topic was a battle of some sort, he might ask if someone had a relative who served in the military. Discussing a boring IT tool? Get people thinking about their own computer for a moment.

This idea also explains why we're far more motivated to learn something if we have—or will have—some experience with it. When it comes to learning, we want to understand our world. We want to fill in our knowledge gaps, to see value. Meaning, then, can be self-perpetuating. The more that we know about statistics, the more that we want to know about something like statistics.

If I know something—like, say, that Venus is the hottest planet in the solar system—the more I want to know more about that: So why exactly

is Venus so hot? Or if I know something about data analytics, I'll be more interested to understand Simpson's Paradox, in which trends are reversed within averages.

When it comes to Legos, this idea is oddly obvious, or at least it became obvious to me on the day that I stepped into the Lego convention known as BrickFair. The promoters billed BrickFair as the "grandest LEGO fan convention and expo in America." Wolfson had recommended that I attend it, and as I moved around the aisles, it was clear that people built things that held deep value to them.

One boy explained to me that he had once shot an M4A1 rifle, and so he built a recreation of the carbine to display at the convention. Another man, Bret Harris, had served in the Marines, and so he made military-themed things. And the person who created the picnic table-size recreation of the Vatican, including the two winged angels hanging next to the Oltramontano Clock? A Catholic priest from Scranton, Pennsylvania.

As I wandered around BrickFair, I ran into Brian Melick. Short with bright eyes and a booming voice, Melick had an unnerving amount of enthusiasm. While I talked with Melick, another man came by and jokingly asked his daughter, "Is your dad always this shy and negative?"

Melick is a drummer and has long been fascinated by using "found objects" to help students learn about percussion. So in his classes at local schools, museums, and libraries, Melick will first discuss some of the principles of drumming—things like shaking or rubbing. Then Melick will have people use whatever they can find—plates, pipes, even sticks—to make a shaking or a rubbing sound. The lessons help "connect us to our own environment," Melick told me.

Melick's approach stayed with me, and I ended up spending the whole day at the Lego convention, looking for ways that people connected to their bricks, making value out of their Legos. In the afternoon, there was a lecture about how to customize your Lego mini-figures. I also watched the Lego boat competition, where aspiring seafarers raced their Lego boats in the hotel pool. There was even a curtained-off room called Stay and Play, where people could create things that they saw as meaningful.

The strength of this very personal approach to motivation extends

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