Make It Stick PDF (Limited Copy)

Peter C. Brown

MAKE IT STICK

The science of successful learning

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Make It Stick Summary

"Harnessing Science for Effective, Lasting Learning Solutions."

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About the book

Unlock the secret strategies of effective learning with Peter C. Brown's insightful book, "Make It Stick." This engaging introduction to the psychological principles of memory shows readers how to transform their approach to learning, whether cramming for exams or mastering skills at work. Brown weaves together fascinating stories and ground-breaking research to illuminate why traditional methods of studying often fail us, and reveals more productive techniques that enhance retention and understanding. Within its pages, you'll discover how to make knowledge stick in a way that's not only durable but accessible when you need it most. Curious about unlocking your full learning potential? Dive into "Make It Stick" and start reshaping the way you think about gaining and maintaining knowledge for a lifetime.

About the author

Peter C. Brown is a respected author and writer with a keen interest in the fields of education and cognitive science. With an academic background that enriches his inquiry into how humans store and retrieve knowledge, Brown collaborated with Harvard University psychologists Henry L. Roediger III and Mark A. McDaniel to pen "Make it Stick: The Science of Successful Learning." This book is a testament to Brown's dedication to bridging the gap between empirical research and practical application, as it delves into effective strategies for learning and memory retention. His writing is celebrated for its clarity, engaging narrative style, and ability to translate complex psychological concepts into accessible insights for educators, students, and lifelong learners alike. Brown's commitment to enhancing the learning experience is evident throughout his work, making him an influential voice in contemporary discussions about education and cognitive methodology.

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Summary Content List

Chapter 1 Summary: Learning Is Misunderstood

In the early stages of his career as a pilot, Matt Brown experienced a critical situation while flying a twin-engine Cessna, which serves as a compelling illustration of the book's central theme: the true nature of learning. Matt faced a drop in oil pressure in his plane's right engine while flying at night, prompting him to make a series of informed decisions based on knowledge he had previously learned. Much like Matt's ability to manage his flight, learning involves acquiring skills and knowledge that can be readily accessed from memory to resolve future challenges.

The book argues that effective learning is built upon some foundational elements. First, memory is essential for learning, allowing us to recall information when it's needed. Second, learning should be a lifelong pursuit. Whether in school, the workplace, or later stages of life, ongoing learning and remembering are crucial. Third, learning is a skill in itself, and effective learning strategies often defy intuitive methods.

The narrative challenges several commonly held beliefs about learning, underscoring the contention that deep, long-lasting learning requires effort. Strategies that feel easy and efficient—such as rereading and massed practice—often result in temporary gains. Instead, more demanding approaches like retrieval practice, spacing, and interleaving lead to better retention and application of knowledge. The book refers to research

indicating that strategies requiring learners to recall information (retrieval practice) or solve problems before being taught solutions are more effective for learning.

Additionally, the book discusses the misjudgments learners and educators often make, such as wrongfully favoring familiarity, like fluency in reading, as an indicator of mastery. The text emphasizes the importance of self-quizzing and elaboration—whereby learners connect new information to existing knowledge—for developing durable learning. In contrast to the simplistic repetition of information, true mastery links foundational knowledge to skills that aid in problem-solving and creativity.

The book highlights the shift from viewing tests as mere assessments to recognizing them as vital learning tools. Testing not only identifies knowledge gaps but also strengthens memory by recalling information, which mitigates forgetting.

Moreover, the misconception that one's intellectual capacity is fixed is addressed, explaining that learning leads to changes in the brain, enabling further intellectual growth. This perspective champions the idea that failure is not an indictment of ability but a signal for deeper exploration and strategy adjustment.

Ultimately, the book suggests that empirical research in cognitive

psychology offers evidence-based strategies for better learning that contrast sharply with traditional wisdom. These findings highlight the limitations of intuition, lore, and theory-driven learning methods. Through the insights gained from research on learning—to be elaborated upon in the following chapters—the book promises to offer practical strategies that are universally applicable, be it through spaced practice, self-testing, or varied engagements with learning material. The book seeks to reshape our understanding and approach to learning by embedding these strategies into our practices, ensuring long-term retention and skill development.

Critical Thinking

Key Point: Retrieval Practice

Critical Interpretation: Imagine you're faced with a moment of uncertainty, where recalling crucial information swiftly can make all the difference. 'Retrieval practice'—the act of actively recalling information from memory—serves as the cornerstone of learning excellence. Unlike passive review techniques, retrieval enhances retention by challenging your brain to 'dig deep' into your memory store, solidifying knowledge through active engagement. Embracing this approach can transform how you prepare for life's many 'tests,' ensuring that knowledge remains adaptable and accessible when you need it most. Each time you practice retrieving information, akin to flexing a muscle, you build a more robust and flexible mental repertoire. Next time you're honing a new skill or absorbing fresh content, weave retrieval practice into your routine and witness the power of durable and impactful learning that empowers you to face challenges with confidence.

Chapter 2 Summary: To learn, Retrieve

In late 2011, neurosurgeon Mike Ebersold was called to a hospital in Wisconsin to treat a deer hunter who had sustained a gunshot wound to the head. Initially believed to have stumbled in a field, the hunter had actually been struck by a stray shotgun slug, causing a severe skull fracture and brain injury. Ebersold's extensive experience and specialized training at the Mayo Clinic equipped him to handle such critical situations. His career included notable cases like treating President Ronald Reagan and Sheikh Zayed, signifying his expertise and ability to manage high-stakes operations with professionalism.

As Ebersold assessed the hunter's injury, he recognized the potential risk of a damaged venous sinus, essential for draining the brain cavity. Preparing for complex surgery, he emphasized the need for reflection on past experiences, which allowed him to innovate and execute techniques not found in textbooks. His ability to adapt, developed through years of contemplating and rehearsing possible surgical scenarios, proved crucial in managing the procedure effectively. Ebersold's impromptu technique, involving muscle plugs to seal the vein, exemplified the power of learning through reflection—a process that involves retrieving past knowledge, connecting it with new challenges, and practicing mentally and physically to ensure quick reflexive responses in emergencies.

The story of Ebersold illustrates a broader concept in learning known as the "testing effect" or "retrieval-practice effect," where retrieving knowledge from memory enhances the ability to recall it later. The act of retrieval ties memory, much like a knot in a string, preventing forgotten information from slipping away. Psychologists, since the late 19th century, have shown that humans forget information rapidly unless active efforts are made to reinforce memory through retrieval.

Studies highlight that retrieving information—like taking a test—leads to stronger retention compared to passive review. For instance, testing that involves effortful recall, spaced out over time, consolidates memory and strengthens neural pathways, making information easier to retrieve in different contexts. Despite the empirical support for retrieval practice, its application in educational settings remains limited. Surveys reveal that students often underestimate its efficacy, associating testing primarily with performance grades rather than a tool for learning.

Real-world applications, such as experiments conducted at Columbia Middle School, demonstrate retrieval practice's powerful impact on student learning. Introducing quizzes within existing curriculums led to significant improvements in students' retention and understanding across various subjects. Teachers noted enhanced learner engagement and reduced anxiety about exams, as frequent low-stakes testing normalized and diversified assessment, contributing to better retention and retrieval of knowledge.

Further studies explore nuances like feedback timing and test types, showing delayed feedback and recall-based testing enhance long-term learning more than immediate feedback or recognition-based tests. The benefits of retrieval practice are evident across different levels of education, encouraging innovation in teaching methods. Educators integrate testing with their instruction, reinforcing foundational knowledge, critical for advanced problem-solving and creativity.

Ultimately, frequent retrieval practice nurtures confident, comprehensive understanding rather than mere rote memorization. By embedding retrieval exercises into learning routines, both educators and students cultivate a resilient grasp of subjects, facilitating informed and agile thinking in problem-solving and creative endeavors.

Key Points	Description
Neurosurgeon Mike Ebersold's Expertise	Ebersold, with extensive training, applied his skills to manage critical situations like the gunshot incident with the hunter, showing ingenuity and experience in adapting surgical techniques.
Innovation and Adaptability in Surgery	Emphasizing reflection on past procedures allowed Ebersold to develop unique techniques such as using muscle plugs to seal veins, illustrating the importance of reflection and practice in learning.
The "Testing Effect" / "Retrieval-Practice Effect"	It is the concept that actively retrieving knowledge strengthens memory retention much more effectively than passive reviewing.

Key Points	Description
Psychological Evidence	Since the late 19th century, psychologists have noted that memory is reinforced through retrieval rather than being forgotten without conscious effort.
Educational Application	Studies show that retrieval, similar to testing, significantly aids memory retention, yet is underutilized in educational systems largely misperceived by students as mere performance evaluation.
Real-world Educational Experiments	Experiments in workshops like Columbia Middle School showed that incorporating quizzes into curriculum enhances student retention, understanding, and reduces test anxiety.
Additional Study Findings	Delayed feedback and effortful, recall-based testing yield better long-term learning than immediate or recognition-based testing.
Encouraging Teaching Innovations	Educators are encouraged to integrate retrieval practice within teaching to solidify foundational knowledge essential for advanced problem-solving and creativity.
Confidence and Comprehensive Understanding	Retrieval practice leads to confident, coherent understanding, facilitating informed and agile thinking for problem-solving and creative pursuits.

Chapter 3 Summary: Mix Up Your Practice

The chapter delves into the concept of effective learning strategies, focusing on contrasting traditional approaches with more nuanced methods found through research. It begins by challenging the intuitive belief that repetitive practice (massed practice), which involves focusing intensely on one task, is the best way to learn. This belief parallels how sports practice is often approached, with intensive repetition to instill muscle memory, akin to what is generally expected in educational settings. However, findings reveal that this method is less effective than other approaches.

One striking example involves a study of eight-year-olds practicing beanbag-tossing into buckets. Those who practiced on varied distances (two and four feet) but never on the target three-foot distance performed better than those who practiced only at the three-foot distance. This points to the power of varied practice, which enhances the ability to transfer learned skills to novel situations by fostering a more comprehensive understanding of different conditions and contexts.

Researchers term the repetitive and focused form of learning as "massed practice." This approach can create the illusion of competence due to the visible improvements during practice. Yet, these gains are often lost shortly afterward, as massed practice predominantly engages short-term memory. In contrast, "spaced practice," which involves spreading learning sessions over

time, is shown to improve long-term retention and mastery but requires more effort, often perceived as slower progress. This understanding aligns with observations in various fields, including education and professional training.

Spaced practice's effectiveness is exemplified by a study involving surgical residents learning microsurgery. Those who spaced out their practice showed significantly superior performance in operative tasks compared to those who condensed their practice into one session. This is because spaced practice allows for the consolidation of memory, a process where new knowledge is reinforced and integrated with existing knowledge, strengthening long-term retention.

Furthermore, interleaved practice, which involves mixing different topics or skills during learning, enhances problem-solving abilities because it requires learners to continually re-engage with and differentiate between various types of information. This method was tested with students learning geometric formulas where those exposed to mixed problem types showed superior retention and mastery over time.

The chapter also explores varied practice, as seen in the beanbag study, which applies not only to physical skills but to cognitive tasks as well. Varied practice promotes the development of a broader set of skills and better contextual understanding, key for transferring knowledge across different situations. Neuroimaging studies suggest that varied practice

involves more complex brain processes than massed practice, indicating a more robust encoding of learning.

The principles of interleaved and varied practices have broader implications across disciplines. In bird classification studies, learners exposed to varied examples within bird families showed improved discrimination abilities, a skill akin to diagnosing in medicine—a field where trainees benefit significantly from both repeated exposure to common conditions and varied presentations to hone their diagnostic skills.

Practical application of these principles is highlighted in the education strategies of medical schools and sports coaching, where real-world practice and reflection are crucial. For instance, in medical training, exposure to diverse case studies and repeated practice of routine conditions prepared students for better patient diagnosis. Similarly, in sports, alternating drills and reflecting on past games or practices improve players' adaptability and performance.

Ultimately, the chapter underscores that effective learning involves more than mere accumulation of knowledge; it requires strategic engagement through spaced, interleaved, and varied practice. These methods enhance not only retention but also the ability to apply knowledge flexibly and creatively in new contexts, fostering deeper learning and understanding.

Chapter 4: Embrace Difficulties

Embrace Difficulties

Introducing Mia Blundetto:

Mia Blundetto is a determined and accomplished young woman, serving as a first lieutenant in the U.S. Marine Corps. At 23, she was assigned to a prestigious logistics position in Okinawa, a role that required her to undergo jump school despite her distaste for falling. Her commanding officer offered an alternative, but Mia's ambition and pride in her platoon's work pushed her to accept the challenge. Mia had a strong support system and background, with her family, including her father Frank and her siblings, all serving actively in the Marines.

Jump School Training:

Mia's training at Fort Benning's jump school was a model of learning through desirable difficulties—a concept from psychologists, Elizabeth and Robert Bjork. The training emphasized learning by doing, with stringent testing to ensure proficiency in parachute landings. Students had to master techniques such as the parachute landing fall (PLF), performing it from various heights and in simulated real-world conditions. The training process

depended heavily on practice interspersed with progressive challenges, requiring participants to adapt quickly.

Facing Real Jumps:

During her actual jump exercises, Mia encountered a potentially dangerous situation when she landed on another soldier's parachute. Thanks to her rigorous training, she managed the incident smoothly, embodying confidence and composure under pressure.

Learning Principles:

The chapter delves into learning mechanisms that utilize desirable difficulties—effortful tasks that enhance long-term memory. **Encoding** involves the brain forming mental representations of newly acquired skills, much like jotting down notes that need strength and clarity. **Consolidation** reorganizes and stabilizes these traces for long-term storage, weaving them into existing knowledge. In **retrieval**, recalling and practicing these memories under challenging circumstances strengthens them further. This underscores how challenges, even failures, are critical in robust learning.

Desirable Difficulties in Practice:

Mia's jump training illustrates desirable difficulties: tasks that are effortful

and complex foster better learning outcomes. For instance, the Cal Poly baseball team experiment demonstrated that interleaved practice (mixing different training elements) leads to superior skill retention compared to repetitive practice.

Broader Implications:

Effortful practice contributes to building sophisticated mental models—comprehensive, adaptable frameworks that underpin expert performance across diverse fields. Different practice approaches, like interleaving and varying methods, refine discrimination and induction abilities, enhancing versatility. The principles apply beyond physical tasks, extending to conceptual learning and problem-solving abilities.

Handling Errors and Failures:

Contrasting with prior learning theories advocating errorless methods, modern understanding acknowledges mistakes as fundamental to mastering new material. The reflection and analysis of failures often lead to innovative breakthroughs, as seen in stories of entrepreneurial pivots and scientific advances. The chapter emphasizes that willingness to face difficulties, evaluate outcomes, and persist can turn challenges into learning milestones, ultimately fostering resilient and adaptable thinkers.

In summary, the chapter highlights that embracing challenges with curiosity and effort leads to deeper understanding and mastery of skills. By integrating effortful retrieval and varied practice into learning procedures, individuals can bolster memory retention and expand their ability to apply knowledge flexibly and effectively in new contexts.

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Chapter 5 Summary: Avoid Illusions of Knowing

In "Avoid Illusions of Knowing," the chapter delves into the cognitive mechanisms influencing our judgment and decision-making, primarily through the lens of metacognition and the systems of thought described by Daniel Kahneman. Metacognition refers to the awareness and management of one's cognitive processes, which helps individuals identify errors in judgment and develop strategies to improve decision-making. This chapter stresses the importance of becoming accurate self-observers to avoid being misled by perceptual illusions, cognitive biases, and memory distortions.

The narrative begins with an anecdote about a group of criminals in Minneapolis, showcasing how poor judgment and failing to learn from mistakes can lead to predictable and preventable consequences. This story illustrates how individuals and even groups can easily overestimate their capabilities, a phenomenon that hinders personal and professional growth.

The chapter further explores the dynamics between Kahneman's System 1 and System 2. System 1 is our intuitive and automatic thought process, fast but prone to error and illusion. System 2, in contrast, is deliberate and analytical, helping to correct and control the impulses of System 1. These systems are illustrated through examples, such as police work and aviation incidents. For instance, the near-disastrous handling of China Airlines Flight 006 highlights how reliance on faulty intuition without cross-verifying with

analytical tools can lead to catastrophic results.

The discussion extends to memory's role in judgment, emphasizing how narratives can shape our understanding of the world and lead to memory distortions. These narratives, combined with cognitive biases like the Dunning-Kruger effect, can lead individuals to misconstrue their abilities and experiences. Hence, competent decision-making demands awareness of these mental pitfalls and the diligence to consult objective benchmarks regularly.

The chapter calls for practices like retrieval practice to enhance retention and accurate self-assessment of learning. It also advocates for peer instruction and external feedback mechanisms to align personal perceptions with reality. By illustrating examples from various fields, including education, medicine, and law enforcement, the chapter suggests that adopting disciplined practices and engaging in accurate self-assessment can mitigate the risks posed by mental illusions and biases.

In summary, "Avoid Illusions of Knowing" advocates for cultivating an accurate understanding of one's cognitive processes and judgments. By recognizing the interplay between intuition and analytical reasoning, and by utilizing external feedback and structured practices, individuals can improve their decision-making capabilities and avoid the pitfalls of cognitive illusions.

Critical Thinking

Key Point: Cultivating accurate self-assessment is crucial for personal and professional growth.

Critical Interpretation: Imagine consistently embarking on new challenges, driven by the belief in your capabilities, yet frequently finding yourself baffled by unexpected outcomes. This chapter invites you to embrace the art of accurate self-assessment, unveiling a pathway to personal and professional growth. By honing your metacognitive skills, you can dismantle the cognitive illusions and biases that cloud judgment. This means practicing deliberate reflection on your learning and decision-making processes, ensuring they are grounded in reality rather than faulty intuition. The journey to becoming an astute judge of your capabilities is transformative, leading you to navigate life's complexities with clarity and confidence. Engaging in retrieval practices and welcoming external feedback collaboratively reshapes your narratives, aligning them closer to truth and bolstering your ability to make informed choices in life's myriad arenas. This disciplined approach is not just a strategy, but a philosophy that enriches, inspiring you towards lifelong learning and profound understanding. The insight gained is a catalyst for unlocking your full potential and nurturing resilience against the deceptive allure of cognitive illusions.

Chapter 6 Summary: Get Beyond Learning Styles

Chapter 6 Summary: Beyond Learning Styles

Introduction: Bruce Hendry's Unique Learning Path

The chapter opens with the story of Bruce Hendry, a self-made man who exemplifies the varied ways individuals learn successfully. Born in Minnesota, Bruce's journey from a curious, entrepreneurial child to a savvy investor illustrates the different ways people can approach learning.

Debunking Learning Styles

The widely-accepted notion that individuals have specific learning styles (visual, auditory, etc.) and that matching teaching methods to these styles enhances learning is questioned. The chapter asserts that while everyone has preferences, these styles might not necessarily lead to better learning outcomes. Instead, it introduces alternative learning differences that do matter, using Bruce's journey as a framing device.

Active Learning and Persistence

Bruce's story highlights the importance of active learning. From selling

strings and running paper routes to hitchhiking to buy fireworks, he took charge of his education early on, learning from each venture. This capacity to integrate experiences into mental models is crucial for effective learning.

Rule Learning and Structure Building

Bruce's ability to abstract rules and build mental models out of his experiences, like investing and managing real estate, is described as "rule learning" and "structure building." These attributes equip learners to distill relevant information from new experiences, differentiating successful learners from those who cannot separate significant details from the trivial.

High-Stakes Learning: Investment and Risks

Bruce's investment journey in real estate and bonds is a testament to his capacity for high-stakes learning and the application of learned principles. By honing in on essential knowledge, he effectively evaluated opportunities, managed risks, and capitalized 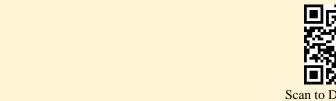on market inefficiencies. His strategic thinking acquired over the years, enabled by seeking deeper understanding and embracing iteration, is underscored.

Learning Styles: Myth and Reality

Despite the popularity of learning styles, evidence supporting their efficacy

in improving learning outcomes is sparse. Reviews and studies have failed to substantiate the theory that teaching aligned with learning styles leads to better educational results. Instead, matching instructional methods with subject matter content is shown to be more effective.

Successful Intelligence

The concept of intelligence has evolved from traditional IQ models to include multiple intelligences, as proposed by Howard Gardner, and more empirically-supported models like Robert Sternberg's triarchic theory of intelligence—analytical, creative, and practical. Sternberg emphasizes practical intelligence and its role in adapting to life's challenges, something Bruce has exemplified through his investment strategies.

Dynamic Testing and Continuous Improvement

Dynamic testing involves assessing one's expertise level, focusing learning to address weaknesses, and continuously evaluating progress. It aligns with the notion that one's knowledge and skills are constantly evolving, and developing areas of weakness is key to achieving competence.

Structure Building: Differentiating Learning Success

Successful learning involves "structure building," or creating coherent

frameworks from new material by identifying essential ideas. Like constructing a Lego village from scattered pieces, assembling a solid mental model requires discerning relevant concepts from extraneous ones to facilitate further learning.

Rule vs. Example Learning

The chapter contrasts "rule learners," who abstract underlying principles, with "example learners," who might not generalize effectively from examples. Investigating similarities across varied examples can help improve rule abstraction, as demonstrated in how students solve complex convergence problems by seeking underlying patterns.

Conclusion: Mastery and Knowhow

The chapter concludes by emphasizing self-directed learning and the integration of various "intelligences" to pursue mastery. Using principles from dynamic testing, students should focus on continuous improvement and refining their mental models to transform knowledge into practical knowhow. By adopting methodologies like retrieval practice and reflection, learners can improve their ability to navigate challenges and capitalize on diverse learning experiences.

Critical Thinking

Key Point: Active Learning and Persistence

Critical Interpretation: Imagine a life where you actively engage in continuous learning, turning each experience into a building block for your growth. Chapter 6 of 'Make it Stick' highlights the transformative power of active learning, as illustrated by Bruce Hendry's journey. By approaching learning with curiosity and an entrepreneurial spirit, you can cultivate resilience and persistence. Embrace each opportunity to learn, no matter how small, and integrate those experiences into a cohesive framework of understanding. It's not about following predefined styles but dynamically engaging with the material and exploring beyond the traditional confines of education. By doing so, you harness your potential, paving the way for lifelong mastery and success.

Chapter 7 Summary: Increase Your Abilities

Chapter 7 of the book, "Increase Your Abilities," delves into the concept of improving one's cognitive skills and mental capabilities, using both scientific studies and personal anecdotes. It begins by discussing the famous 1970s marshmallow study conducted by Walter Mischel, where children were given the choice to eat one marshmallow immediately or wait for a second one as a test of self-discipline and delayed gratification. Findings from follow-up studies showed that children who managed to delay gratification generally experienced greater success in academics and careers later in life. The study highlights the crucial role that focus, self-discipline, motivation, and personal empowerment play in achieving success.

The chapter introduces James Paterson, a Welshman who became enamored with mnemonic devices, techniques derived from the Greek word for memory. Paterson turned to mnemonics as an attempt to effortlessly memorize academic content, which inadvertently led him to memory competitions where he thrived. His journey emphasizes that beyond simple memorization, mnemonics also enhance understanding and mastery of complex ideas.

Similarly, Nelson Dellis, a US Memory Champion, began exploring memory training after witnessing his grandmother's decline due to Alzheimer's disease. He sought to build a cognitive reserve to potentially combat such

conditions. His experiences underscore the brain's plasticity and the potential to enhance cognitive abilities through targeted exercises.

The chapter discusses the concept of neuroplasticity, asserting that the human brain is not hardwired, but rather, adaptable and capable of forming new connections throughout life. This understanding is reflected in projects like the Human Connectome Project, which maps brain connections, and through studies showing the brain's ability to adapt after injuries.

Illustrative anecdotes highlight the progression of modern science's understanding of the brain's dynamic nature. Pioneers like Paul Bach-y-Rita have shown how the brain can redirect sensory functions, as evidenced by his development of devices allowing patients to recover lost skills through sensory substitution. Emerging research also points to the possibility of IQ enhancement through genetic and environmental influences, demonstrating that mental agility and intelligence can be cultivated over time with the right stimuli and training.

In discussing the potential to enhance intelligence, the chapter addresses the debate over whether playing "brain training" games genuinely improves fluid intelligence, which involves problem-solving and reasoning, by citing studies with mixed results. Nevertheless, it acknowledges that while the brain may not be a muscle in the literal sense, deliberate training and robust habit development significantly enhance cognitive functions.
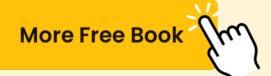
The text also examines three cognitive "multipliers"—adopting a growth mindset as articulated by psychologist Carol Dweck, engaging in deliberate practice, and employing mnemonic devices. A growth mindset positions intellectual ability as a trait that can be nurtured through effort. Deliberate practice, a concept popularized by Anders Ericsson, suggests that expert performance is achieved not through innate talent but through sustained, focused, and strategic practice. Finally, mnemonic devices offer structured memory aids, enabling efficient recall by linking new information to familiar mental frameworks.

The chapter concludes by illustrating the use of mnemonics in academic settings, particularly through the lens of students like Marlys preparing for exams. This application exemplifies how mnemonic tools can effectively organize knowledge, enhance retrieval, and alleviate exam pressures, demonstrating their relevance in both academic and real-world scenarios.

Ultimately, Chapter 7 underscores the overarching message that intellectual abilities are malleable and largely within an individual's control, contingent upon the investment of time, effort, and strategic practice. It emphasizes that discipline, persistence, and a proactive approach to learning shape our cognitive potential, offering encouragement to those seeking to unlock their full intellectual capabilities.

Chapter 8: Make It Sick

In the chapter "Make It Stick," the authors emphasize the importance of mastering learning techniques to succeed in various educational and professional environments. They address different audiences, including students, lifelong learners, teachers, and trainers, explaining how fundamental principles of learning, despite varying settings and materials, can be applied universally to enhance retention and understanding.

For students, the authors highlight key strategies: retrieval practice (self-quizzing) instead of passive review like rereading; spaced practice (distributing study sessions over time) as opposed to cramming; and interleaved practice (mixing different topics or types of problems) rather than focusing on one at a time. These techniques counteract common misconceptions that favor massed practice, such as rereading or highlighting, which create illusions of mastery but don't effectively secure knowledge.

The chapter provides several examples of individuals who have effectively implemented these strategies. Michael Young, a medical student struggling without premed coursework, used retrieval and spaced practice to rise from low performing to the top of his class. Timothy Fellows, an exemplar student in a psychology class, relied on anticipation of test questions, self-quizzing, and regularly reorganizing course content, ensuring strong retention and understanding.

For lifelong learners, the text illustrates how these strategies naturally align with continuous self-education, emphasizing that learning is an ongoing process involving exploration and problem-solving. The professional actor Nathaniel Fuller uses retrieval practice to memorize scripts effectively, adapting to new roles quickly. Writer John McPhee applies generation—the act of attempting solutions before being shown answers—by beginning his articles with a rough draft to stimulate thought and refinement.

Teachers can incorporate these strategies into their curriculum by explaining how learning works and creating desirable difficulties in the classroom, such as low-stakes quizzes and activities that require retrieval, generation, and elaboration. Mary Pat Wenderoth, a biology professor, uses strategies like "testing groups" and summary sheets to help students synthesize learning and understand it deeply, while professors like Mike Matthews at West Point integrate quizzing to keep cadets focused and engaged.

Training professionals can apply similar principles. For example, Jiffy Lube University's interactive e-learning and on-the-job practice employ frequent quizzing and feedback to ensure mastery of automotive services. Andersen Windows and Doors promotes a learning culture where production workers teach managers how to improve efficiency, demonstrating a commitment to continuous improvement through problem-solving and empowerment.

Ultimately, the chapter argues that effective learning techniques outlined can be implemented immediately by learners, educators, and trainers without the need for costly reforms. They emphasize that the responsibility for learning rests with individuals, while education and training require structural considerations, opening avenues for improvement across all learning contexts.

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