SHORTFORM

Summary of Ultralearning

Original book by Scott Young

The modern workplace is constantly changing, requiring professionals to continually master new skills and knowledge. But not everyone has access to formal education and the upgraded skills required in the workforce are not easy to pick up as you go. In *Ultralearning*, Scott Young teaches you how to create self-directed learning projects to give you a competitive edge at the fraction of the time and cost necessary for traditional schooling.

In this guide, we'll cover Young's core principles of ultralearning to help you stay relevant in your field, advance your career, and master any skill. We'll also connect Young's concepts with those in similar books like Jim Kwik's *Limitless* and offer tips and insights from other books like *Indistractable* and *The Willpower Instinct* to supercharge your ultralearning.

1-Page Summary

In *Ultralearning,* Scott Young teaches that you can stay relevant in your field, advance your career, and master any skill with the principles of **"ultralearning"—a strategic, intensive, and self-directed approach to learning.** Young writes that ultralearning is a viable alternative to formal education, giving you a competitive edge at a fraction of the time and cost necessary for traditional schooling. (Shortform note: While the name "ultralearning" is unique to Young, other authors have also tackled this topic. Jim Kwik has a similar method called "metalearning," which he covers in *Limitless*, while Peter C. Brown, Henry Roediger III, and Mark A. McDaniel discuss effective learning strategies using cognitive psychology in *Make It Stick*. We compare and contrast these methods with Young's within this guide.)

Scott Young is a computer programmer, blogger, and podcast host who wrote *Ultralearning* as a way to share his insights into how to enhance your brain's abilities. His methods are based on research and his experiences of taking on ambitious personal projects, such as becoming fluent in four languages in a year and learning MIT's four-year computer science curriculum within 12 months.

(Shortform note: Young asserts that mastering new skills can help you get ahead without a formal education, but doesn't mention how to get employers to notice your skills without a formal educational background. To do this, experts recommend establishing a strong social media presence: Create a professional-looking profile, share certifications, and demonstrate your knowledge by reposting industry articles with your own insightful commentary. You should also connect with potential employers, but keep in mind that you might have better luck engaging with heads of smaller companies.)

Young organized his book into nine principles, but a few of them overlap in theme and we've thus distilled them into seven overall principles.

The Principles of Ultralearning

According to Young, there are several principles critical to successful ultralearning. We'll explore each of them in detail.

Principle 1: Learn How to Learn

The first principle of ultralearning is to figure out *how* to learn a subject or skill, or what Young calls "metalearning." To determine this, you can ask yourself three questions:

1. What is my learning goal, and why have I chosen this? Young explains that your motivation will generally be either *external* (characterized by the desire to achieve an extrinsic result), or *internal* (characterized by the desire to learn something for personal enjoyment). For example, wanting to learn user experience design to give you a competitive edge in marketing is an external motivation, while wanting to learn how to play the cello purely for enjoyment is internal motivation.

2. What do I need to learn to achieve this learning goal? Break your topic down into *information* (what you simply need to memorize), *ideas* (what you need to understand at a deeper level than facts), and *processes* (what you need to practice to understand), and list everything relevant to learn in each category. Use this information to identify critical areas of focus for your learning.

3. What strategies have other people used to learn this? Now that you know the information, ideas, and processes relevant to your chosen skill, you can come up with a plan for *how* to learn them. Young advises

that you find people who've already mastered the skill and pattern your strategies after the methods that worked for them.

Metalearning and the Limitless Learning Model

Jim Kwik has a similar definition of "metalearning"—learning how to learn—and details his own model in *Limitless*. While Kwik and Young share some similarities in their approach, they also have some differences:

- While Young writes that you should determine whether your motivation is internal or external, Kwik takes it a step further by explaining *why* this is important: Learning new skills is challenging, and **your motivation can keep you going, especially when you don't feel like doing the work**.

- Both authors write that it's important to know *what* your goal is and *how* to achieve it. The key difference is that **Young recognizes that different skills require different learning strategies**, so he recommends not only determining the information you should learn but also the learning strategies that have proven effective for other people. On the other hand, Kwik's version of metalearning offers general strategies that can be applied to *any* skill you want to learn: Learn how to study, take good notes, and train your memory.

- Young doesn't mention anything about your mindset, but Kwik writes that it's a key component of limitless learning—**you must have a growth mindset,** rid yourself of self-limiting beliefs and assumptions, and truly believe that you *can* learn.

Principle 2: Develop Concentration Skills

The second principle of ultralearning is to develop concentration skills and create successful learning habits. Young writes that **deep learning requires deep focus**, so you should confront the three main obstacles to focus:

1. Procrastination: *Procrastination* is knowing you need to do something, but avoiding it or doing something else instead. Young says that you can overcome procrastination by using deliberate methods for resisting the impulse, like setting a timer, pushing yourself to work until that point, then steadily increasing the time. (Shortform note: This urge to procrastinate may stem from a lack of willpower. In *The Willpower Instinct*, Kelly McGonigal writes that you can circumvent this lack by scheduling your tasks for when your self-control is at its peak—for most people, it's in the morning, before exhaustion sets in from the mental challenges of the day.)

2. Distraction: Your environment, the complexity or difficulty of a given task, or your own negative thoughts, emotions, or circumstances may keep you from giving your full attention to learning. Young recommends practicing mindfulness to maintain a relaxed mental state because having anxious thoughts can keep you from focusing on the task at hand. He also says you should take note of what environment is most productive for you so you can create it deliberately. (Shortform note: Aside from practicing mindfulness and managing your environment, as Young suggests, Nir Eyal offers another way to avoid distractions in *Indistractable*: Create "precommitments," which act as a fail-safe when you're tempted to give in to distraction. For example, use an app to block access to social media apps while you work.)

3. Poor Optimization: You might not give your task the *right amount* of focus. Young explains that focus is

influenced by arousal (how alert and energized you are). An environment that induces *low* arousal is typically better suited to complex tasks because it keeps your mind relaxed enough to take in new information. On the other hand, *high* arousal is effective for simple activities requiring lots of energy, like sports. You can thus improve your focus by adapting your environment to give you the optimum level of arousal for the task at hand. For example, if you're trying to learn complex concepts from a book, you'll have more success doing it in a quiet environment (low arousal) than a noisy one (high arousal).

(Shortform note: Young's assertion is based on the Yerkes-Dodson Law, which states that you perform better with increased mental arousal (or stress), but only up to a certain point. While some stress can help you focus, too much of it can impair performance. To reduce stress to an optimum level of arousal, experts recommend: 1) increasing your control over your work—for example, choosing to learn a relatively simple concept on high-stress days—and 2) having a pre-performance routine, a tactic that athletes use to improve attention and reduce anxiety.)

Principles 3 and 9: Practice Effectively

Young devotes two principles of ultralearning (his Principles 3 and 9) to going beyond theoretical learning and putting your skills into practice. He recommends doing this in two ways: **Practice *experientially*** (or what he calls "directness"), **and practice *creatively*** (or what he calls "experimentation").

How to Practice Experientially

Young says that practicing experientially means devoting time to actually *doing* what you want to master. You can do this through these four tactics:

1. Create learning projects. Young explains that projects are more valuable than classes because a project requires you to create a result, and this requires a deeper understanding of what you're learning. For example, if you want to learn animation, create an animated short film. (Shortform note: Research shows that project-based learning leads to better outcomes than traditional instruction. By *applying* concepts through projects instead of just reviewing information, students increase memory retention, improve critical thinking skills, and gain a better appreciation for learning, consequently improving performance.)

2. Immerse yourself in real-life scenarios. Practice your new skill or knowledge in scenarios that you would never encounter in a classroom. For example, you might learn techniques for decorating cakes by working at a bakery.

(Shortform note: Immersion may not be the *only* way to master a skill, but it is the fastest way. In *Outliers*, Malcolm Gladwell asserts that it takes 10,000 hours of practice to master a skill. That means that if you practice a skill for one hour every day, it will take more than 27 years to master it. However, if you immerse yourself so that you're practicing for 10 hours a day by default, you'll master the skill in under three years.)

3. Simulate scenarios. Sometimes, you won't be able to directly access or replicate the real-life scenario you intend to use the skill in. In this case, Young recommends replicating the aspects of the experience with the strongest influence on performance. For example, if you want to learn a language but can't surround yourself with native speakers, try watching TV shows in your target language—a tactic that RM from the K-pop group BTS used to learn English.

(Shortform note: Simulations offer many advantages, but some argue that they also have a major disadvantage: Simulations, no matter how realistic, are not the *actual* environment. When you know that you're performing in a safe space, you may behave differently—you might not take the exercise seriously enough or take risks that you wouldn't take in a real-life scenario.)

4. Set stretch goals. Find out how you want to use what you're learning and what environment you want to use it in, then practice in an environment that will demand the highest proficiency level of the skill you're mastering. This helps you to learn at a deeper level long-term. For example, if you want to master playing an instrument, try out for your city's symphony orchestra. If you know you're going to be auditioning in front of seasoned musicians, you may push yourself harder to learn.

(Shortform note: Setting stretch goals may force you to improve, but goals that are overly ambitious may end up making you feel intimidated or discouraged. To avoid this potential pitfall, consider starting with more realistic short-term goals.Reaching these milestones can help you build your confidence and push you to reach your big, long-term goals.)

How to Practice Creatively

Aside from practicing experientially, Young also recommends **intensively practicing a skill from as many angles as possible to unlock mastery**. He offers three methods to help you incorporate creative practice into ultralearning:

1. Replicate others. Replication gives you a place to start as you seek to broaden your understanding of a skill and helps narrow down further avenues of exploration to personalize evolving skill sets. For example, if you're an aspiring actress, make a list of the actresses you admire and practice with material from their filmography. (Shortform note: Experts caution that copying others—or "faking it till you make it"—isn't effective if you don't have the competencies to back it up. So, it's important not to use replication as your only method of ultralearning; make sure you use it together with other principles to truly master a skill.)

2. Create constraints. Constraints force you to move outside your comfort zone to learn in new ways, and this enhances your proficiency. For example, if you've reached proficiency in a new language by practicing with a bilingual tutor, add the constraint of practicing with speakers who don't speak your native language. (Shortform note: Research shows that constraints force you to be more innovative and focused. There are different ways you can impose constraints, such as giving yourself tight deadlines and restricting your resources.)

3. Diversify your skills. Young recommends selecting an additional skill to practice that is seemingly unrelated to a skill you've already become proficient in. Proficiency in both skills can give you a competitive advantage. For example, if you're a nurse, you might take up painting, creating a niche for yourself that intersects health with the arts. (Shortform note: Aside from giving you a competitive advantage, learning an unrelated skill can stoke your creativity and lead to new ideas and unique connections. In *Think Like a Rocket Scientist*, Ozan Varol writes that Albert Einstein used this method, called "combinatory play," by combining his knowledge of science with his interest in music to yield new insights into both fields.)

Principle 4: Address Your Weak Points

Young's fourth principle of ultralearning is to **isolate a weakness in your learning process and concentrate intensively on it,** or what he calls "drilling." The aspect you isolate will be an integral component of the overall skill or subject, and in mastering it, you unblock areas of learning that are impeding progress. By addressing the most difficult aspects of the process, you reduce delays, learn to confront your weaknesses, and improve overall proficiency.

For example, if you want to be a successful YouTuber, you might have developed your video-editing skills. However, if you haven't learned how to speak in front of a camera in a natural, engaging way, you still might not be able to attract subscribers. Thus, your speaking ability is impeding your progress, so you should focus your learning efforts on improving that particular skill.

Young advises using the previous principle—practice experientially—in tandem with this principle of focusing on a specific aspect of a skill you're learning. First, practice your skill in the context you want to apply it in; then, identify your weak links and concentrate on improving those; finally, practice again, integrating the improvements you've made.

> **How to Isolate Your Weak Points**
>
> Young writes that it's important to address any bottlenecks in your learning process, but he doesn't give specific tips for isolating these weak spots. To this end, it might help to view your learning process as a system based on Donatella Meadows's tips in *Thinking in Systems*:
>
> - **Make a diagram of your learning process.** Doing this allows you to see how each area of the skill you're learning connects with one another. Having a visual cue makes it easier for you to spot areas that could be causing blocks, impeding your progress in connected areas.
>
> - **Get feedback from reliable sources.** Show your illustrated process to credible people (such as others who've mastered the skill you're trying to learn) and ask them for their input. They may be able to see barriers that you aren't seeing.
>
> - **Make adjustments based on what you've learned.** Similar to Young's method of practicing, addressing a weakness, then practicing again, you should incorporate any helpful feedback you receive. This might mean realigning your process with your learning goals or adding a missing component. Once you've made the necessary changes, practice your skill again.

Principles 5 and 7: Strengthen Your Memory

Young discusses techniques for enhancing your memory in two different principles (his principles 5 and 7), which we'll discuss together here. To improve your memory, particularly your long-term memory, he recommends self-testing, excessive studying, and spacing out your learning periods.

(Shortform note: While Young asserts that retaining information is a crucial element of ultralearning, research suggests that *forgetting may be just as important for healthy brain function*. Scientists theorize that the ability to forget clears your brain of clutter, which helps you process new information more effectively.)

Test Yourself to Encode Information

Young writes that, when learning new information, you should go beyond just reading or listening to a lecture and instead use self-testing: **Ask yourself questions to recall the information you learned**, through tactics like flashcards or free recall (writing down everything you can remember from what you just studied). The process of forcing your brain to retrieve information on its own, without the source material, helps you commit the information to memory. (Shortform note: Research suggests that self-testing is more effective than other methods such as rereading material and concept mapping because the testing process clarifies what you know and don't know—when you can't recall an answer to a question, it's a clear indication that you haven't committed the information to memory yet and should thus fill that gap in your knowledge.)

When testing yourself, Young writes that it might be more beneficial to give yourself time between study and active recall. He cites research suggesting that this small delay makes it more difficult to recall information, giving you a mental challenge that effectively improves learning. (Shortform note: One way to give yourself time between study and active recall: Take a nap. This not only gives you a small delay, as

Young recommends, but it may also help you remember more. Matthew Walker explains this phenomenon in *Why We Sleep*: During sleep the brain moves facts from your hippocampus—your short-term memory bank—to the cortex, which stores long-term memories, enabling you to retain information.)

Study Excessively

Research shows that *overlearning* something even by just a small amount results in 1-2 weeks of further recall. Young says you can overlearn by selecting a simple learning task (for example, changing a tire), practicing the task until you're able to do it correctly once, then practicing it multiple times after that.

(Shortform note: Overlearning is a well-acknowledged tactic in the field of psychology, but it does have its downsides. In *Atomic Habits*, James Clear writes that overlearned behavior can turn into mindless actions, which can then lead to stagnation—when you do something without thinking, you may no longer think about how to improve your performance. To keep improving, he suggests finding ways to increase the degree of difficulty of the task as you repeat it. For example, once you've mastered changing a tire, try making it more challenging by changing it in various scenarios, such as in the rain or at night.)

Allow Significant Time Gaps Between Learning Periods

Young recommends *spaced repetition*—multiple learning periods spread out over time—because taking a break before revisiting what you've learned better supports long-term memory retention. (For example, if you want to learn how to play a song on a guitar, it's better to devote an hour to the task every couple of days than to learn the whole song in one go.) Once you've reached proficiency and no longer have to practice intensively, Young recommends practicing semi-regularly to refresh your memory.

(Shortform note: Young suggests that through his techniques of ultralearning, you can master new skills in a short period of time. However, some argue that achieving mastery with spaced repetition like he recommends here requires the same amount of time and effort as it would with traditional schooling. In short, there may not be any shortcuts to *sustained* mastery.)

Principle 6: Pursue and Filter Feedback

Young's sixth principle of ultralearning is to aggressively pursue feedback and then filter it to take in what's most useful. Feedback builds on the previous principle of self-testing: While testing yourself is a highly effective way to learn new information, **feedback gives you the opportunity to find out if what you've learned—and how you're applying it—is correct.** Young says you should seek out feedback by putting yourself in real-world situations where others will tell you what you need to work on. For example, if you're learning how to write fiction, you might submit your work to an online writing community for critiquing.

How to Be More Receptive to Feedback

While Young writes that feedback allows you to correct what you're doing wrong, he doesn't discuss the fact that many people avoid feedback because it can be uncomfortable to hear. In *Principles*, Ray Dalio writes that this discomfort comes from your ego or your underlying desire to be seen as capable; experiences that threaten your ego, such as receiving feedback that points out your weaknesses, can cause you pain.

To become more receptive to feedback, Dalio writes that you should change your mindset. Be *happy* instead of ashamed when someone points out your errors because it gives you an opportunity to get better. Learn to bear and reflect on the pain that comes from other people's comments, and use it to move forward.

Young writes that the least valuable type of feedback is feedback that appeals to your ego—praise can make you feel good but it may not be a constructive assessment of your skills. On the other hand, negative feedback can feel discouraging and impede learning. **The most valuable type of feedback is *corrective* feedback,** which tells you what you're doing wrong *and* how to fix it.

How to Ask for Corrective Feedback

Young doesn't give specific tips for asking for corrective feedback. To get specific, actionable comments instead of vague feedback, Jack Canfield recommends asking two questions in *The Success Principles*:

1) In what ways do you see me holding myself back? Canfield says that people who know you well can help expose your blind spots, pointing out habits or behaviors that may be holding you back from progress. You can also consult people who've mastered the skill you're learning, because they'll likely have a better sense of the areas you need to work on.

2) On a scale of one to 10, how would you rate (BLANK)? Ask others to evaluate different aspects of the skill you're working on. For example, if you're aiming to become a good public speaker, ask a practice audience to rate you on your voice, pace, and body language.

Principle 7: Seek a Deep Understanding of Ideas

The seventh principle of ultralearning is to seek a deep, detailed understanding of ideas and principles (what Young calls "intuition"). Young asserts that having a deep knowledge gives you a solid foundation. This enables you to *build* on that knowledge so that you're able to understand more complex ideas related to your target skill, ultimately leading to true mastery. For example, you must have a deep understanding of algebra before you can master calculus. (Shortform note: Having this deep knowledge can be likened to "principles-first thinking," which Ozan Varol describes in *Think Like a Rocket Scientist*. Aside from being able to perform a skill more proficiently, he writes that having a thorough understanding of the fundamental components of a topic can lead to more creative thinking. This is because you're able to pare down to the core concepts and build new connections from there.)

Young writes that there are three rules to developing deeper knowledge:

1. Let yourself struggle. Young says you should exert effort to face the difficulties that come with mastering a skill, instead of shying away from them. (For example, instead of skipping an algebraic equation that you find challenging, keep working on problems until you understand the concept.) This deliberate struggle leads to a deeper understanding of ideas and concepts. Young says you can encourage this by setting a timer for 10-15 minutes and pushing yourself to work on a difficult problem at least until the timer goes off. (Shortform note: Getting stuck on a problem can be discouraging, so Ryan Holiday recommends breaking down intimidating problems into more manageable steps. In *The Obstacle Is the Way*, he writes that you should focus on what you have to do now, going step by step, instead of thinking about the end goal.)

2. Challenge your understanding. Young says that when you think you understand something more than you actually do, you keep yourself from learning. You should frequently question yourself to avoid the cognitive bias which leads you to overestimate your knowledge. Always ask, "Do I understand this well enough to explain how it works?" (Shortform note: To check if you understand something correctly, Ray Dalio suggests that you seek out smart people and listen to what they have to say. In *Principles*, he writes that you should recognize that you have blind spots and should thus be open-minded enough to accept the

possibility that others might know something better than you do.)

3. Use concrete examples. The human brain understands abstract information better when it's connected to concrete examples. Additionally, when you *personalize* those concrete examples, you retain information at a deeper level. (Shortform note: Barbara Oakley and Terrence Sejnowski explain why using personalized concrete examples can help you gain a deeper understanding of a subject. In *Learning How to Learn*, they explain that thoughts are based on neural connections, and new information becomes easier to retrieve when it's connected to existing information stored in your brain—like familiar, concrete situations or personal details about your life.)

Putting It Into Practice: Create an Ultralearning Project

Now that you've explored Young's principles of ultralearning, you're ready to create your first ultralearning project. Young outlines five steps.

Step #1: Research How to Learn the Material

Conduct research on the best way to learn the material. By the time research concludes, Young says you should know what you want to learn and why, the materials you'll need, your learning benchmarks based on what others have done before, and ways you'll practice what you've learned.

How to Choose a Skill to Learn

If you're having a difficult time deciding *what* to learn—particularly if your goal is to get ahead in your career—experts recommend asking yourself three questions:

- **What skills can help my organization?** Identify the areas that have an impact on your company's growth and figure out what you can do to contribute to those areas. For example, if your company's social media presence is underutilized, you can learn social media management.

- **What am I good at?** Compare the list of areas that you've identified with your strengths. Look for overlaps and narrow your choices down to those skills.

- **What do I *want* to learn?** Determine which skill gets you excited or which will give you the greatest personal benefit.

Step #2: Create Your Schedule

Think about the amount of time you're willing to devote to the project, and plan accordingly. A schedule can help you manage your pace so you don't feel pressure to learn too quickly or frustrated with scheduling conflicts down the line.

(Shortform note: To carve out time for learning when you already have a packed schedule, consider Stephen Covey's tip in *First Things First*. Classify all of your tasks into four zones: significant and pressing, significant but not pressing, pressing but not significant, and neither significant nor pressing. Prioritize the tasks that are significant but not pressing—such as learning—because these are the ones that help you reach your goals. Then, limit the time you spend on other tasks that aren't significant.)

Step #3: Start Learning

Review the key points of each ultralearning principle and determine whether you've maximized your use of it. With metalearning, for example, you might ask: "Have I completed enough research to determine the best ways to learn this skill or topic? Is there anyone I can get new insights from?" Make modifications wherever necessary and possible.

(Shortform note: At this point, experts recommend considering whether you've chosen the optimal learning style. You may have mapped out a learning plan based on your perceived abilities—for example, your primary method of learning might be to listen to lectures because you're an auditory learner. However, the authors of *Make It Stick* argue that it's more important to match the style of instruction to the subject of the lesson, rather than your preferences.)

Step #4: Analyze Your Progress

After you complete your project, Young says you should identify areas of success as well as areas that need improvement. For successful projects, repeat the things that worked, and for weak projects, identify where and how to improve. (Shortform note: The authors of *Make It Stick* caution that evaluating your own performance can inhibit your progress because people are generally poor judges of their own abilities. To get a more accurate view of your progress, you should learn alongside others—whether they're seasoned veterans, fellow professionals, or students learning the same skill.)

Step #5: Create a Plan for Long-Term Retention

Much of what we learn decays with time, so determine your plan of action for remembering information right after you reach the learning goal. To help you retain what you've learned, Young recommends finding a way to incorporate it into your day-to-day life, taking a class to refresh your memory, or immediately beginning a new learning project that supplements your original learning goals. (Shortform note: Another way to retain what you've learned is to teach it to another person. One study shows that students who taught others what they learned remembered more than those who didn't teach the material.)

Chapters 1-3: The Benefits of Ultralearning

Going to college to get a bachelor's degree used to be sufficient to find a good job, but now it's not enough. Many modern careers demand a skill set that you can't pick up as you go, and most organizations increasingly ask for greater knowledge from their employees than is supported by access to formal education. In *Ultralearning,* Scott Young teaches you how to stay relevant in your field, advance your career, and master any skill you desire with the principles of "Ultralearning."

Ultralearning is a strategic approach to learning that is intensive and self-directed. What does all of this mean?

- *Intensive learning* is learning as deeply as possible at an accelerated pace (in contrast to *leisure learning*, done at a relaxed pace).
- A *strategy* is an approach to solving a problem or achieving a goal.
- A *self-directed* learning strategy is a method for achieving a learning goal that works best for you.

There are many variations of ultralearning, but ultralearners share several characteristics:

- They work independently (but not necessarily alone).
- They're obsessive about improving their learning process.
- They're motivated primarily by a love of learning (in contrast to being motivated by the prestige of credentialed achievements).
- They constantly push the limits of their intellectual comfort zones.

In this summary, you will learn how to use the nine core principles of ultralearning to create and engage in self-directed learning projects for the purpose of enhancing your existing skills, or exploring new skills and subjects (either for personal enjoyment or professional advancement).

Ultralearning is often time-consuming, tiring, and uncomfortable. Why bother?

Benefit #1: Ultralearning Increases Your Competitive Advantage

Mastering Ultralearning will help you quickly acquire new skills and perform at the level of your competitors, which is more critical than ever because of *skill polarization*—new technology and globalization have reduced the need for medium-skill-level jobs. Low-skill jobs generally can't be outsourced, and most prefer to keep high-skill jobs (like product design) "at home," but medium-skill jobs are outsourced regularly. Remaining jobs require either an advanced skill set (for example, that of engineers) or lower-level skills (for example, those of retail). Therefore, modern success requires you to upgrade your skill level or take jobs requiring less skill.

Benefit #2: Ultralearning Is an Effective Alternative to Formal Education

Ultralearning is an effective solution whether you need to fill in gaps from your existing education, or you need an alternative to traditional higher education. The new requirements for high-skill work have made a college education more important than ever, but higher education costs have skyrocketed. Debt for new graduates is now the norm, and because the rate of increase in costs exceeds the rate of inflation, college may not be worth it unless you're studying something that will guarantee you high-paid

work upon graduation. If you can afford college, even the most prestigious schools are not necessarily equipped to support you to thrive in the new "high skill" environment.

Benefit #3: Ultralearning Is Time Efficient

Being self-directed, Ultralearning allows you to tailor your learning schedule to align with your availability and focus on the skills you most want to acquire. The energy it takes to learn rapidly is of greater long-term value than toiling away at a job where you use a repetitive skill set. And, because the economy is so unpredictable, industries are always changing at a rapid pace, which means staying relevant requires constant learning and upgrading of skill sets.

A Note on Time Commitment

While ultralearning often requires a time commitment, you can still accomplish a lot of learning even if you have a busy schedule. There are three strategies for this:

Strategy #1: Practice ultralearning on a part-time basis.

The key aspects of ultralearning are efficiency and intensity. You can apply these aspects whether you're able to devote five hours or 50. You can even learn at a leisurely pace, as long as you're using the most efficient techniques during your study periods.

Strategy #2: Practice ultralearning during breaks (from school or work).

Breaks can be anything from a two-week Christmas break from school, a sabbatical from work, short-term unemployment, and so on. Again, as long as you use strategies that are ruthlessly efficient, you can use any gap of time successfully.

Strategy #3: Integrate ultralearning into existing habits.

You already have personal hobbies and skills you seek to learn. You can apply ultralearning strategies to these existing habits or needs. For example, if you're using Duolingo for Spanish in your free time, you might as well apply ultralearning methods to that endeavor.

Benefit #4: Ultralearning Increases Overall Well-Being

Using ultralearning to overcome personal limitations and pursue your potential can have a positive impact on your overall well-being (for example, by improving your confidence). Additionally, ultralearning is a tool of adaptability to combat a changing environment. The world is going to continue to change rapidly, and learning difficult skills efficiently and deeply will be critical for thriving under these conditions.

A Note on Talent

Is it talent or skill at the core of a person's success? Author Young believes talent is undeniable and an important factor in performance, but strategy is also important. Using ultralearning, you can develop a strategy that enhances your learning regardless of talent or intelligence.

The Nine Principles of Ultralearning

The easiest way to demystify the process of ultralearning is to break it down into principles. Ultralearning has nine core principles, which we'll explore in depth throughout this summary.

Principle #1: Metalearning—Learn how to learn by conducting research and make use of existing knowledge.

Principle #2: Focus—Develop concentration skills and create successful learning habits.

Principle #3: Directness—Practice experientially and start with what is most challenging.

Principle #4: Drill—Aggressively focus on your weak points, deconstruct challenging skills, and reconstruct after mastering the broken down components.

Principle #5: Retrieval—Test yourself while you're still learning and push yourself to learn actively rather than passively.

Principle #6: Feedback—Aggressively pursue raw feedback and filter feedback to take in what is most useful.

Principle #7: Retention—Understand your areas of weakness (what you forget easily) and focus on long-term memory.

Principle #8: Deeper Knowledge—Follow your intuition or engage your curiosity and prioritize deep understanding over shortcuts or memorization.

Principle #9: Experimentation—Push yourself beyond your comfort zone.

None of the principles is meant to be followed rigidly. Part of learning is breaking the rules or reconstructing them to best work for you. Develop your own understanding of what you want to learn and how you want to learn it. This summary will conclude with a step by step guide to designing your first ultralearning project, where you will have the opportunity to put principles into practice.

Chapter 4: Principle 1—Metalearning

The only risk of self-directed learning is selecting a poor method of learning. *Metalearning* (learning *how* to learn) lessens this risk. This chapter teaches you how to build a learning roadmap so you can start your learning project off on a solid foundation. A map shows you how a topic is constructed, what types of skills or knowledge will support growth, and which strategies will support you to achieve efficient proficiency.

For example, let's say you're learning freestyle dance. You might research popular freestyle dancers who have achieved your desired skill level and determine how they each reached it.

How Do You conduct Metalearning Research?

Metalearning research is the first step of any ultralearning project. When you have an advanced understanding of what you need to learn and how best to learn it, you accelerate what would normally be a longer process in a formal education setting. In this case, you personalize the learning process, bypassing the challenges of the poor teacher-to-student ratio typically found in a class setting. As you complete more learning projects, metalearning skills naturally improve, as does your awareness of your capacity for comprehension, your best methods for problem-solving, and your most efficient scheduling structure.

For each specific project, ask three questions: Why, what, and how?

Why?

Asking why gives you clarity of purpose, and this enables you to tailor your learning to what is most important to you. Any learning project you undertake is going to be rooted in one of two core motivations.

Motivation #1: Instrumental

This type of learning is motivated by the desire to achieve some kind of (usually external) goal or result. Often, this is a professional goal. For example, if the advancements in technology make some of your professional skills obsolete, you might use an instrumental learning project to learn new skills that will keep you relevant in your field.

When learning for an instrumental reason, valuable questions to research are: "What is my goal?" and "Will learning this skill or topic support me to achieve that goal?" You don't want to waste time or money learning a skill that won't benefit your goal. For example, if your goal is to get a well-paying job, and you want to go back to school to increase your chances of achieving that goal, make sure you select a degree that will lead to a well-paying job.

Another method you can use to conduct your "why" research is to talk to people who have already achieved your goal. For example, if you want to be a lawyer, talk to successful lawyers and get a sense of what that world entails and what their path to success has been. If you can, set up a brief face-to-face meeting (and be clear on the purpose of the meeting).

Motivation #2: Intrinsic

This type of learning is motivated by personal desire, not achievement-oriented desire. For example, if you want to learn freestyle dancing for the purpose of your own enjoyment, you have intrinsic motivation.

Asking why is valuable here because you want to be sure you're focusing on learning what is most valuable to you, not what the industry finds most valuable. For example, if you want to learn freestyle dance for your

own enjoyment, your learning goals and methods are going to be different than if your goal were to become a professional freestyle dancer.

What?

Now that you know your motivation for a learning goal, get a clear sense of *what* you need to learn. Start by breaking down your skill or topic and placing the aspects into three categories:

- **Facts** constitute anything you might need to commit to memory. You don't need to have a deep understanding of facts—it's just necessary to be able to access them when you need them. For example, to learn a language, there are certain elements of grammar or punctuation that you only need to memorize, versus deeply understand.
- **Concepts** are ideas that can't simply be memorized and require flexible understanding. For example, if you're studying law, you'll file law principles into this column.
- **Procedures** constitute anything that requires practice. Conscious thinking is not necessarily required. For example, learning how to rollerskate is almost entirely built on practice with little conscious thought. There are many skills that can fit this category, though some may also require memorization of facts or understanding of deeper ideas. For example, learning a new language falls under both "facts" and "procedures."

Highlight the sections you expect the most difficulty from. This gives you clarity in advance on problem areas, which gives you a chance to prepare strategies and materials for overcoming those obstacles as they arise. For example, let's say you're learning how to draw portraits, and you know that a large part of successful drawing is placing facial features accurately. To prepare, you might use a portrait photo for reference and superimpose the image over each of your drawing attempts to check that your skill for drawing facial features is improving.

How?

The purpose of this step is to figure out *how* best to learn what you need to learn. There are two methods for this.

Method #1: Benchmark

Benchmarking means determining commonalities in the methods of those who have learned what you want to learn. Researching how others approach learning is a good way to build a foundational approach for yourself. For example, if you want to learn business, research the curriculum of the most notable business schools, study their course list, and/or study the syllabi for the most relevant courses. Taking the time to do this now saves time later by streamlining your learning approach.

Method #2: Emphasize and/or Exclude

Once you've made a list of materials, regularly evaluate it to see if it needs to be revised or upgraded. Determine the aspects of what you're learning that are most critical to your goals, then evaluate your learning strategies and emphasize or exclude areas of focus by order of priority. For example, if you're studying Spanish and your learning goal is to speak Spanish on a fast-approaching trip to Spain, you might prioritize pronunciation and vocabulary and delay the study of spelling until later in the learning process.

When Should You Stop Researching and Start Intensive Learning?

Research is an important part of the process. However, too much research can turn into procrastination and a way to avoid the discomfort of the actual learning process. Use the following strategies to evaluate if

you're doing too much or too little research.

Strategy #1: The Rule of 10%

Calculate how long you expect the learning process to be, then calculate 10% of that time. For example, if you plan to spend three months on your learning goals, averaging about two hours a week, your total learning time will be roughly 24 hours. 10 percent of that is roughly 2 ½ hours spread out over about one week. Fewer than 2 ½ hours might not be enough research, and more than 2 ½ is likely too much.

Strategy #2: The Information Balance

The Law of Diminishing Returns states that the longer you invest your time in something, the more the benefits diminish. This means there will be a "sweet spot," or a point where more research is no longer valuable and switching to active learning is best for growth. Check if continuing your metalearning research is a valuable use of time by noting its efficacy in practice. Spend a couple of hours doing the research, and then a couple of hours engaging in active learning. Which feels more beneficial? If it's research, you can afford to spare more time for it. If it's active learning, you've likely completed enough research to move forward to practice.

Long-Term Benefits of Metalearning

You may not initially see the benefits of metalearning, but the more learning projects you complete, the better your metalearning skills will become, and the more benefits you'll see. With each completion, you develop new strategies, new approaches to finding material, more efficient time management habits, and improved self-discipline. You also develop greater confidence (a core purpose of ultralearning), which inspires you to initiate new and more challenging learning projects.

Exercise: Learn How to Learn

This exercise is an opportunity to think about a potential learning project and explore the questions "why," "what," and "how?"

What is a skill or topic you would like to learn?

Why do you want to learn this topic or skill? Is your motivation intrinsic or instrumental? How so?

What do you need to learn in order to master your skill or topic? Make a list below of your facts, concepts, and procedures.

Review your lists. What are the areas you expect to have the most difficulty in?

Consider the benchmarking method. Who has already learned and mastered your skill or topic? What are some methods these people have used to learn? Which methods resonate with you?

Exercise: Practice the 10% Rule

Explore the optimal balance between planning and learning. Have a learning topic or skill in mind as you work through the questions.

How long do expect the learning process to take overall? What might that look like in a daily or weekly schedule?

What is 10% of that time? What might that condensed time look like in a daily or weekly schedule?

How will you spend that time to get the most out of your metalearning?

Chapter 5: Principle 2—Focus

Once you've determined how you're going to conduct your learning project, it's time to actually start. This requires focus. This chapter identifies key obstacles to focus and explores methods for optimizing focus so you can learn effectively.

Ultralearners generally need to confront three main obstacles to concentration.

Obstacle #1: Procrastination

Often the hardest part of focus is starting the process. Instead of getting to work, we find something else to do, or simply refuse to do anything at all. This can manifest in acute procrastination (avoiding specific tasks) or chronic procrastination (general avoidance).

Why do so many of us procrastinate?

On a conscious level, the desire to do another task feels rational. The rest of your impulse to procrastinate is unconscious. In truth, you either prefer to do something else, or you're simply avoiding the original task.

Solution: Crutches

After you become aware of the pattern, use mental strategies (called *crutches*) to fight the impulse to procrastinate. For example, notice when you want to avoid your tasks, set a timer for five minutes, and push yourself to work at least until it goes off. It's possible feelings of discomfort will only last a few minutes and you might find you want to keep working beyond the time stamp. If you find yourself using the five-minute "out" too much, increase your time mark to twenty five minutes, then allot yourself a timed five-minute break. As you master each period of productivity, upgrade to longer periods of time. Eventually, you'll be able to turn your productivity on and off at will, regardless of impulses for procrastination or environments that pull your attention.

Obstacle #2: Distraction

If you don't procrastinate, you may still struggle with long-term focus. Sustained concentration is just as critical as initial concentration, as you can't master difficult skills without intense focus.

There are three common reasons concentration is interrupted or impeded.

Reason #1: Distracting Environment

Many people struggle to focus because their environment is distracting. For example, there may be music playing or loud roommates in the background. The solution is to determine your optimal learning environment. Do you work best with music in the background? Do you need total silence? Make note of what does or does not support your concentration. Create an environment you will thrive in.

Reason #2: Task Difficulty

Some tasks are more difficult to concentrate on than others. For example, you might have an easier time focusing on a YouTube video than on a book. Address this by doing your best to tailor your learning materials and strategies for optimal concentration. For learning tasks that require a specific approach that you can't modify to best fit you, brainstorm creative solutions. For example, let's say you're a kinesthetic

learner, but you need to read a book. Try taking notes as you read to support your kinesthetic needs.

Reason #3: Mental Blocks

You are most focused when your mind is clear. If your mind is anxious, concentration suffers. To the extent that you can, prioritize addressing negative thoughts or feelings before learning. When this isn't possible, use mindfulness. Mindfulness research shows that avoiding negative thoughts or feelings is a common reaction to them, but being present with them and allowing them to pass is more valuable for both mental health and learning. Be present with them, then kindly redirect your attention back to your learning task. When you work with intense emotions instead of letting them derail your focus, you develop better discipline for future concentration.

How long should a person focus?

Studies suggest that 50 minutes to an hour is an optimal time frame for concentration and retention. If you need to work for longer periods of time, take a very short break after preset periods of study or switch tasks. The optimal time period will vary from person to person. Some will find that 20-minute periods are best, while some will have the ability to sustain focus for a full day. Do what works best for you.

Obstacle #3: Poor Optimization

Focus is heavily influenced by arousal. Arousal is your "feeling of energy and alertness" and is determined by your nervous system. When arousal is high, your blood pressure rises, you sweat more, your pupils dilate, and your heart rate increases. In other words, you're more alert. When arousal is low, you're less alert. High arousal is good for simple tasks that require a lot of energy or alertness (like sports). High arousal environments include coffee bars or parks. However, too much arousal makes you distractible (like when you drink a lot of caffeine and develop anxiety).

Research shows the best environments for complex tasks are environments that induce low arousal, like working in silence or listening to quiet, soothing music. Low arousal is most effective for complex tasks because mental relaxation expands your space of concentration to accommodate new or different ideas. For example, many people have incredible creative ideas while in the shower.

It's critical for ultralearning to develop concentration skills, but especially so if you lead a busy, overwhelming life that leaves only small chunks of time to focus on learning. Identify your optimal focus conditions and construct your study environment accordingly.

Exercise: Overcome Learning Obstacles

Consider a skill or learning topic (either the same you've used for previous exercises or a new one) and explore potential obstacles in the learning process, as well as determine the characteristics of an optimal study environment.

What strategies can you use to overcome procrastination?

What kinds of distractions do you expect to struggle most with? Environment? Stress?

What kinds of solutions can you apply to overcome your distractions?

Will you be learning complex or simplistic tasks? How might you create the optimal learning environment for yourself?

Chapter 6: Principle 3—Directness

Another critical component of self-directed learning is the ability to learn directly. *Directness* is the idea that you best learn a skill when you practice it in the environment you plan to use it in. For example, if you want to be a great public speaker, rather than buying a book on public speaking, find opportunities to practice public speaking.

We avoid being direct in our learning because we either don't want to step outside of our comfort zones, we're uninspired, or it's time-consuming. For example, we download an app or buy a book because, although this method doesn't produce long-lasting results, reading about a skill provides a sense of satisfaction without the need to practice it. But if you want to truly master a skill or topic, always immerse yourself in opportunities for direct practice.

Is Learning Transferable?

Transfer occurs when you can use a skill you've mastered in contexts beyond the original context. This is the ideal outcome for learning of any kind. Without transfer, we would have little ability to function in our lives, as we would have to learn everything as an isolated skill right down to the minutia.

There used to be a widely accepted theory called *formal discipline theory,* which suggests the brain is like a muscle, and expanding its capacity for memory, focus, and reasoning improves overall learning. However, new research indicates this theory is too broad, and what we learn is nowhere near as transferable as expected, at least not over long distances.

For example, studies show if a student takes an intro to psychology class in high school, it doesn't help them if they take an intro to psychology class in college. In a separate study, fresh graduates were quizzed on economics topics, and those who had studied economics had the same results as those who hadn't even taken a class. Yet another study found that students who learn by studying specific example solutions are frequently unable to find solutions for problems that differ from those examples.

How Does Directness Affect Transfer?

While it's difficult to transfer learning over longer distances, when you learn something in a way that applies directly to the area you want to use the knowledge for, the knowledge will not need to transfer as far. For example, if you learn yoga, then learn gymnastics, that knowledge will transfer more easily than if you learn yoga and then attempt to learn computer coding. Both yoga and gymnastics require flexibility, strong core muscles, and balance. Computer coding is far more mental than kinesthetic.

Even when we are isolating what we're studying, there are always details learned that can be applied to a number of experiences that may on the surface have nothing to do with the topic or skill studied. This is why it's so important to practice what you're learning in real-life situations, as opposed to the controlled environment of a classroom. Regardless, we need to embrace the reality that the learning environment we choose impacts our ability to transfer knowledge. Learning a new language by immersing yourself in it will always better support you to master the language in practice than studying it in a classroom will. It's much more difficult to learn something in an artificial environment and then attempt to transfer those skills and knowledge to a real-life scenario.

How Do You Practice Direct Learning?

Direct learning is difficult and requires more discipline than taking a class or learning from a book, but when you persist, you become an overall better learner than those who stick to traditional methods.

Use the following tactics to practice directness.

Tactic #1: Learning Projects (Instead of Classes)

Projects are more valuable for ultralearners than classes because a project requires you to create a result. If you need to create something, it forces you to learn better how to do that. Classes can provide a lot of information, but without practicing that information directly, you may not actually learn anything of significance. For example, say you want to learn animation. You could take a class, but you will learn it more deeply if you create an animated short instead.

Tactic #2: Immersion

To immerse yourself means to place yourself directly in the environment that requires the skill or subject you're learning. Immersion involves more practice than anything else and will help you to learn by exposing you to unpredictable, real-life scenarios that you would never encounter in a traditional learning setting like a classroom. For example, you learn a new language by spending three months in the native country of the language.

Tactic #3: Simulation

Sometimes you will not be able to directly access or replicate the real-life scenario you intend to use the skill in. In this case, replicate the "cognitive features" of the actual experience. Cognitive features are the knowledge and tools that you will use to make choices in real-life situations.

For example, if you want to win a trivia-based game show, you won't be able to go on the show over and over again to practice the actual experience. You'll need to somehow replicate it in isolated exercises and activities. This might mean finding out what questions have been asked on the show in the past, studying them, then practicing with a buzzer in front of an audience of your peers. With this approach, you expose yourself to the cognitive elements you'll experience when you participate in the real show: the question-asking structure, the pressure of an audience, and the sound element of the buzzer.

Tactic #4: Overachievement

Practice what you're learning in an environment that will demand the highest skill level. It may be overwhelming at first, but once you push through your discomfort, you set yourself up to learn at a deeper, higher level. You also hone a skill that will support your long-term learning.

One of the ways you can do this is by planning to take an exam, creating a way to publicly share your learning results, or setting a benchmark that's well above your skill level. For example, if you want to master painting, rent a studio for an art exhibition. If you know you're going to be putting your paintings on display, you may push yourself harder in your learning process than if your results were only going to be viewable by you.

Exercise: Practice Direct Learning

Reflect again on the task or topic you're learning (you may select a new one if you'd like). Use this exercise to explore direct learning methods that best suit your needs as a learner and support your learning goals.

Of the four tactics listed (learning projects, immersion, simulation, or overachievement), which might best apply to your learning goals? Why?

With those tactics in mind, what is one specific way you can practice directly learning your task or topic?

Chapter 7: Principle 4—Drill

Sometimes when we begin to learn a new skill, we have difficulty with isolated aspects of it. *Drilling* is isolating weaknesses in your learning process or skill level and concentrating intensively on them. Drills work because according to research, when you have difficulty with certain isolated components of a skill, struggling with those components slows down the process of achieving integrated proficiency for the whole skill.

Similarly, using drills to improve one aspect of a skill has a positive chain effect on the quality of the overall skill. For example, when learning a language, vocabulary is one cognitive component, pronunciation is another, and grammar is yet another. All three components are used in the overall skill, but each serves its own cognitive function.

The Benefits of Mindful Drilling

Some people think drilling is the wrong approach because they are used to the formal-education monotony of cramming before a test, or assignments based entirely on memorization. These types of tasks are exhausting because there is no deeper understanding of the purpose behind them or what role they play in the integrated learning process. When you drill with a specific purpose in mind, drilling has many benefits.

The purpose of a drill is to unblock areas of learning preventing overall proficiency by getting you into the habit of breaking down what isn't working into manageable chunks. They also teach you discipline because they require you to work through frustration and ask you to confront your weaknesses instead of relying on your strengths.

Further, drills are valuable even if you can't identify a single aspect negatively impacting proficiency. The reason for this is that your ability to focus, memorize, and concentrate energy are generally "spread out" when accomplishing a complicated task. As a result, you may get boxed in by the desire to focus on a single weak aspect, and end up mastering it at the expense of overall proficiency. The value of drills is that they allow you to break complex tasks down into multiple aspects that you can drill at the same time and easily reintegrate after intensive improvement.

For example, let's say you're learning how to pitch a baseball. With pitching, the key aspects are speed and precision. You might construct a drill where you throw a ball at a target with as much force as possible. The drill is throwing the ball at the target, but you're practicing both speed and precision, which improves overall performance, as these aspects impact all defensive gameplay.

The Challenges of Drilling

The principle of drilling and the principle of directness may seem to conflict with one another. Directness requires you to practice a fully integrated skill or engage a topic in an environment that most closely replicates the real experience. Drills break down a skill or topic so that you are intensively practicing one aspect of the overall learning goal. However, they only seem to conflict, because in reality, they are different, but equally important steps in the learning process. Ultralearners cycle between the principle of directness and the principle of drilling in a "direct-drill-direct" process:

- **Direct:** Practice your skill in the direct context you want to apply it in.
- **Drill:** Identify aspects of the skill that are critical steps, or weak links in the process, and use drills to

improve those isolated aspects.
- **Direct:** Integrate improved isolated skills by completing direct practice again, utilizing all aspects of the skill. This step allows you to properly transfer what you improved while practicing in isolation, and determine if your drill method helped you to achieve the improvement you wanted.

If you find that the drill used does not correctly isolate the aspect needing improvement, you may need several rounds of different drills. Rather than wasted time, this is valuable feedback because you're streamlining the learning process.

Drilling has a few additional challenges.

Challenge #1: Determining What to Drill

The purpose of drilling is to maximize overall improvement and minimize overall effort. If you have multiple aspects that need improvement, create drills to test each of them with the direct-drill-direct approach until you identify which aspect contributes most to the overall skill.

For example, let's say you're learning how to play soccer and you want to improve your speed. What do you drill? Running sprints is a way to practice speed in isolation, and for direct practice, you might play practice games, which allow you to see if your sprinting drills have transferred to your overall athletic performance.

Challenge #2: Constructing a Productive Drill

Sometimes you're not able to identify how best to improve a component in isolation and have that improvement translate to the overall task. This occurs most often when isolating an aspect reduces or removes the variable causing difficulty (in other words, you might find that the way you replicated it doesn't translate once it's re-integrated). For example, if you're learning how to kick a soccer goal but the only drills you run are with you and an empty net, you'll find your skills faltering when you add in the components of a live soccer game (like a goalie).

Challenge #3: Overcoming Difficulty and Discomfort

It's uncomfortable to isolate what is most challenging and relentlessly concentrate on it. Most people would rather focus on what they are already doing well. Here are some approaches to drills that will help you confront this pitfall:

Approach #1: Segmentation

Isolate a time segment of a task. For example, if you're a singer struggling to memorize a section of a song, sing that section of the music over and over again until you get it perfect, then add it back into the rest of the song (this is also an example of the direct-drill-direct structure). The segment should be short enough that you can practice it easily. If it's longer, try breaking it down into two segments.

Approach #2: Replication

For skills that are creative, isolating one aspect without incorporating the others can be extra challenging. To counteract, replicate the aspects of the skill you *don't* need to focus on from another source, so you can devote all your attention to the aspect you *do* need to focus on. For example, if you're learning to sing *and*

play a song on an instrument at the same time, create isolated recordings of the vocals and instrumentals and while you're drilling vocals, use the instrumental recording to accompany yourself, then use the vocal recording while you're drilling the instrumental component.

Approach #3: Concentration

Focus for longer periods of time on a singular aspect of the skill more so than you would normally. It's best for situations where you're building a skill from scratch and are not able to isolate any components. For example, let's say you want to improve your research skills. You might spend the bulk of your work time researching. Though there is more time invested upfront with this method, the long-term benefit is that you build new patterns and enhance existing skills.

Approach #4: Chaining

Chaining is doing drills for skills you know you need improvement on. Shoot for higher than your proficiency level, or choose a skill you know you'll fail at initially. When you fail, work backwards and master each element of the process. For example, say you're learning a song on the piano and practicing a segment of music that is played very quickly. You know which keys you need to play but can't do so at speed. Make note of the sections you have the most difficulty with and try playing those sections at speed regardless of whether or not you hit the correct keys. Practice until you can play at speed without mistakes. You may feel overwhelmed initially, but the time invested will pay off because deliberately confronting your weaknesses supports deeper learning.

Exercise: Create a Drill

Consider your learning goals and review the drilling methods available to you (segmentation, replication, concentration, and chaining) to determine solutions for any areas of your process that need work.

Which aspects of what you're learning are most challenging? Which are most important to the overall skill or topic?

Of the drilling methods (segmentation, replication, concentration, and chaining), what are two you might select to address the aspects? Why?

Describe how you'll apply one of the drilling methods in practice today.

Chapter 8: Principle 5—Retrieval

Long-term proficiency is only possible if you are able to retrieve the information you learn. *Retrieval* is the process of recalling information we've stored in our memory. Typically we use the traditional study method (reviewing existing material) to retrieve learned information. However, research shows that testing yourself from memory alone (also known as self-testing) is the study method that best serves retention (the long-term storing of information). The purpose of self-testing is to efficiently maximize the amount of information you're able to retrieve.

Why Do So Many Prefer Traditional Studying?

Though self-testing is the most effective way to study, many still choose the traditional reviewing of material instead. Research indicates this is because we develop a perception of our learning progress by getting feedback from the study process. If the process feels easy, we think we're doing well. If it's not easy, we feel the opposite. Students often choose passive review because they aren't confident in their ability to recall on their own. When you review information passively, it's easy to recall it right afterward, giving you the impression you've learned it. However, on the day of the actual test, you'll likely recall far less than expected.

Benefits of Self-Testing

Self-testing is the most direct way to learn the information as long as it is the closest replication of the environment it will be used in. Self-testing is also effective because by asking yourself questions and checking your answers afterward, you give yourself feedback.

Traditionally, you test to evaluate how well you understand what you're currently learning. The concept of retrieval, however, indicates that tests can be used to improve future learning. Research shows it's easier to learn new information when you are in the habit of testing yourself on information you've studied previously. In other words, practicing retrieval through self-testing makes you a better learner before you even have new material to test (this is called the *forward testing effect*) and helps you develop learning methods that integrate automatically when you come across old information again.

How Can You Maximize Your Study Results?

An important tool influencing retrieval is delay, which improves retention. You are more likely to retain information if you give yourself some time between study and active recall. The reason for this is that answers are a little more difficult to recall after a small delay, and this added challenge improves learning retention. Keep in mind the following rules:

- Low-intensity learning = easier to recall info, low retention rate
- High-intensity learning = harder to recall info, high retention rate
- Too much delay = forgotten knowledge

You want retrieval to be challenging but not so difficult that you can't access the information at all. Experiment until you find the middle ground and use directness to train yourself to identify the information most necessary to your overall learning goal. For example, if you're studying Spanish, and you need to

speak in full sentences, memorize vocabulary. Without that need, vocabulary might not be the priority.

What Are the Best Ways to Self-Test?

There are five effective methods for self-testing.

Method 1: Flash Cards

Use visual association cues for learned information. This works best for pairings between a straightforward association and response (for example, if you're learning basic medical terminology). However, when you try to use flashcards to remember something too complex, this limits the method. For example, it's useful to make flashcards for memorizing vocabulary for a new language or the periodic table of elements. It's less useful to make flashcards for complex concepts like quantum theory.

Method 2: Free Recall

After you study a piece of information, practice writing down as much as you can recall in a notebook. Free recall is challenging, so you won't remember as much as you want, but forcing yourself to try makes that information easier to recall later.

Method 3: Questions

Instead of taking notes in the traditional way, reconstruct what you want to write into targeted questions to test yourself on later. This allows you to create methods for later retrieval while studying the information you will want to recall. For example, instead of writing, "Obama became president in 2008," write, "Who became president in 2008?"

The one caveat is that not all questions will be useful. Only write questions that encapsulate the main principles or ideas of a subject or section of information. This encourages deeper thinking. To deepen and focus the process further, challenge yourself to write only one question per section of information studied. This trains you to focus on the most important information.

Method 4: Personal Challenge

If what you're learning is complex or you need to practice a skill, upgrade the previous method by creating "challenges" to solve. For example, if you're learning survival skills, you might set up outdoor activities that mimic the conditions of the skills you're learning (like starting a fire with sticks from your yard or making a shelter). A long list of challenges gives you methods for later practice and study because resolving the challenges strengthens your retrieval capacity.

Method 5: Blind Retrieval

When you're self-testing, don't allow yourself to search for hints on what you're learning. This reduces your reliance on looking up information, and helps develop your mental reference book. For example, if you're studying anatomy, don't allow yourself to look at the textbook or source material at any point during the testing process.

Exercise: Test Yourself

Reflect on your chosen topic or skill (or something you're interested in learning) and contemplate which aspects are most important to retain long-term.

What information do you think is most valuable to retrieve? Why?

What are some ways you might test yourself? Flashcards? A project?

Practice recall below by writing everything you know about your topic or skill so far.

Chapter 9: Principle 6—Feedback

Effective feedback is a crucial component of ultralearning. The difference between ultralearners and traditional learners is that ultralearners seek an intense level of feedback. For example, if you're trying to master public speaking, practice speaking in front of the most challenging audiences immediately (like middle schoolers, who tend to be brutally honest). People often avoid feedback because of how uncomfortable it is to receive it. However, the anticipation of negative feedback usually feels worse than actually receiving it. So, it's fear that stagnates the learning progress, not the negative feedback itself. Throwing yourself into the deep end of feedback may seem harsh initially, but it trains you to work with fear, which teaches you confidence, resilience, and commitment to your learning process.

What Is the Most Valuable Type of Feedback?

Feedback is valuable unless you process it with a bias or it lacks genuinely constructive information. There are two challenges to be prepared for when receiving feedback:

- **Overreaction**—Take all feedback with a grain of salt. Sometimes you'll receive feedback that is not useful to your learning process. Be careful not to allow this type of feedback to derail your growth.
- **Poor application**—Be discerning about how you apply feedback. Even with useful feedback, do your best to apply it in a balanced way. Too much focus on the negative will kill your motivation, but too much focus on the positive will have the same result.

The most valuable feedback informs you that you're doing something incorrectly and tells you how to fix it. There are three types of valuable feedback.

Type #1: Outcome Feedback

Outcome feedback evaluates your progress based on outcome alone and doesn't include detail about why you're where you are, or how to fix it. For example, the standard school grading system is a form of outcome feedback.

This form of feedback is easily accessible, and though it lacks detail, it's still valuable for learning progress. How? It gives you a sense of your progress when you have a specific goal you are trying to achieve. For example, receiving a grade on a test tells you immediately how well you know the material. Receiving this feedback also helps you hone in on the learning strategies that best serve your learning goal. For example, if you've been using flashcards to study for a test, and your test results are poor, but you achieve better results after using another study method, you know to prioritize the learning strategy that produces better results.

Type #2: Informational Feedback

Informational feedback shows you what isn't working but doesn't give you solutions. For example, if you're learning Spanish, get informational feedback by chatting with people who only speak Spanish. You will know how well you are speaking by how well you are understood, but your conversation partner will not be able to tell you how to improve.

You can get this feedback easily as long as you have a resource to practice with that gives you clear feedback. That resource can even be you, as long as you are engaging with the conditions necessary to learn. For example, you might learn painting through trial and error by using a 3D model or photograph to

monitor your ongoing progress.

Type #3: Corrective Feedback

Corrective feedback shows you what isn't working and helps close the gap between where you are and where you want to be. It's better than outcome or informational feedback because it gives you more detail about what is not working and how to fix it. However, it can be difficult to get because typically we get it from other people (whether it be a trusted peer or mentor). It's also not the most reliable, as the sources for the feedback may differ in perception, giving you conflicting information.

It's important to know what you are looking for from feedback, and use the form of feedback most appropriate for that goal. It's unwise to seek informational feedback for something that is best served by corrective or outcome feedback and vice versa. For example, corrective feedback should be given by someone who is an authority on what you're learning. If their level of mastery is not sufficient, the feedback can lead you astray. Ultralearners understand the difference between useful and discardable feedback. They maximize what is of use, and ignore what isn't.

What Is the Least Valuable Type of Feedback?

Avoid feedback that appeals to your ego. Praise is a popular form of feedback that makes people feel good, but it's harmful to the learning process because it is an assessment of you as a person. Even feedback not based on personal evaluation needs to be as constructive as possible and clearly applicable to the learning process.

Feedback from peers or teachers can also trigger you and impede learning. For example, if a teacher you don't get along with gives you feedback, you may be unable to understand or integrate it even if it's constructive due to your own negative bias. Or, you may be able to integrate it, but only with considerable effort. It's best to focus on seeking feedback you don't have to untangle from your biases.

How Can You Make Any Type of Feedback Work for You?

To improve feedback, consider the following four methods.

Method 1: Noise Cancellation

When you receive feedback, categorize it as noise or signal. *Signal* is any information that is valuable to your learning process, and *noise* is nonconstructive feedback that occurs for random reasons that have nothing to do with your learning progress. For example, if you post a video on YouTube and it goes viral, this is an example of noise. It would be unwise to assume that the video going viral has anything to do with quality, as opposed to unpredictable factors (like a person with a platform just happening to see the video and posting it at an optimal time for exposure).

Method 2: Deliberate Uncertainty

It's best to put yourself in situations where you're not sure if you will thrive or crash and burn. Failing gives you valuable feedback: Feedback you were expecting doesn't help you grow as much as feedback you weren't expecting. For example, if you think you're doing well, but feedback shows you your blind spots, this is more valuable than believing you're doing well and having that confirmed.

If you're failing too often, adjust your environment and scale back. If you're succeeding too often, adjust

your task or environment to upgrade the difficulty level. Avoid environments that make you feel terrible *and* environments that make you feel really good. Neither environment will best support improvement.

Method 3: Metafeedback

This method evaluates the quality of your learning approach, rather than your performance. One aspect you refine might be your *learning rate*, which is how quickly you're progressing in your learning of a topic or skill. There are two time-saving methods for refining this:

- Identify the most successful aspects of your learning approach and take note of aspects that need improvement or change so you can gear your learning strategies towards those aspects.
- Try two different learning approaches and identify the most effective of the two.

Use these methods at any time to revise your learning strategies.

Method 4: Intensive Feedback

This method is about getting lots of feedback as quickly and as often as possible. Research shows that the sooner you receive feedback, the more likely you are to achieve proficiency at something. If there's a delay, you may practice but not actually improve, or even become worse. In the short term, intensive feedback will be uncomfortable, but pushing past this reduces fear in the long-term and supports ultralearning by training you to aggressively seek improvement.

(Shortform note: To learn more working with feedback, read our summary of Thanks for the Feedback.)

How Does Timing of Feedback Impact Learning?

Immediate feedback is generally best. The faster you receive feedback, the sooner you are able to identify and address your mistakes. That being said, sometimes if you get feedback too quickly, your learning is adversely affected. For example, if you're learning how to conduct a frog dissection and looking at your source material every few minutes, you run the risk of impeding your ability to retrieve that information when you try to apply the information in practice.

Exercise: Get Feedback

Reflect on the 3 core types of feedback (outcome, informational, and corrective).

Considering your topic or skill, what is one way you can get outcome feedback (detail-less feedback based entirely on results)?

What are two ways you can get information feedback (solutionless feedback on what isn't working)?

What are two ways you can get corrective feedback (feedback that tells you both the problem and solution)?

Now consider the methods listed for improving feedback (noise cancellation, deliberate uncertainty, metafeedback, and intensive feedback). What is one method you can use to improve your feedback experience for your topic or skill? What might this look like?

Chapter 10: Principle 7—Retention

To truly become proficient in a skill, you need to retain what you learn long term. Skill and comprehension are also important, but neither of these things is valuable without proper retention. Whether or not you retain something is dependent on your recall strategies.

Why Do We Have Difficulty Recalling Information?

Researchers know that forgetting information after learning is a common issue for anyone in an environment that requires retrieving complex information. For example, the farther a doctor gets away from his medical education, the more likely he or she is to forget what was learned, even when working long practical hours in the same field of study. This is because of *the forgetting curve*, which suggests that the rate of retention initially increases after information has been learned, then plateaus and tapers off.

There are three primary theories for why we have difficulty recalling information.

Theory #1: Decay

This theory suggests memory inevitably weakens over time (though, there is evidence to indicate this isn't the case across the board, considering how many people have memories from when they were young children). Additionally, there is ample evidence that less prominent memories decay faster than more vivid ones.

Theory #2: Interference

This theory hypothesizes that memories that are similar compete for dominance in your mind. This is a result of both proactive and retroactive interference.

Proactive interference occurs when things you've already learned impede your ability to learn new things with similar characteristics. For example, the psychology term "negative reinforcement" refers to the attempt to influence positive behavior by removing the incentive for a negative behavior (like if your partner stops buying ice cream to help you with your healthy eating goals), but because the word "negative" is often associated with the word "bad," people tend to confuse the concept of negative reinforcement with the concept of punishment.

Retroactive interference occurs when the new information you're learning takes the place of an old memory. For example, if you study Italian for four years and then learn Spanish, if you go back to practicing Italian later, you might accidentally speak Spanish when you're trying to speak Italian.

Theory #3: Forgotten Cues

This theory suggests that anything we can't remember is just hidden away somewhere we can't consciously access. We access most memories when they're cued by certain mechanisms or associations in the brain. If we can't access a memory, it's possible the cue has somehow been removed or disabled. For example, it's common to have the experience of trying to remember something that is "on the tip" of your tongue, which indicates that given the right trigger, the information would rise to the surface.

Though the full explanation for long-term memory mechanisms is still unclear, all three theories give us valuable pieces of the puzzle.

Is Memory Loss Preventable?

Memory loss isn't necessarily preventable, but ultralearners can use a number of methods to reduce loss. When it comes to recall, focus on two goals:

- Creating a successful learning strategy for the early stages of learning so information is not forgotten by the end of the project.
- Learning in such a way that you still retain the information years later.

To achieve these goals, use a retention strategy that is easy to commit to and supports longevity. The most effective strategies for this are overlearning, spacing, proceduralization, and mnemonics.

Strategy #1: Overlearning

Overlearning is practicing something more than what is necessary for proficiency. Once you practice something enough to do it correctly, you may not improve performance with additional practice, but you *do* increase the likelihood of storing the skill in your memory. Studies show that even just a small amount of overlearning practice results in 1-2 weeks of further recall.

How it works in practice:

- Select a moderately simple learning task for yourself (for example, changing a tire).
- Practice this task until you are able to do it correctly once. This is the "learning" stage.
- Practice the task multiple additional times. This is the "overlearning" stage.

Overlearning works in tandem with the principle of directness, as directness asks you to intensively practice the core skills of whatever you're learning (in the most applicable environment). There are two main approaches.

Approach #1: Core Practice

This is the standard form of practice, focusing on improving a skill's core aspects. The approach is most effective after the first stages of ultralearning have commenced and when utilized in tandem with an immersive (experiential rather than intellectual) project. The shift is from "learning to doing." For example, if you want to become a good soccer player, after you learn the rules of the game, you might play a practice game with other beginners at your level.

Approach #2: Advanced Practice

Once you've gotten the hang of a core skill, upgrade the level you're practicing it at. This automatically facilitates overlearning of the lower level of the skill. For example, if you've learned some basic conversational skills in a Spanish class, start practicing with native speakers in organic environments. Not only does this improve the skill, but it also increases the likelihood of retention.

Strategy #2: Spacing

Spacing is engaging in multiple learning periods with significant time gaps in between. This strategy discourages you from cramming to learn information. When you learn over spaced-out time periods, you may initially see discouraging results, but spacing will ultimately support long-term retention and overall better performance. For example, if you need to learn something in 14 hours, it's more effective to spend one hour a day for 14 days, or two hours a day for seven days, than 14 hours in one day or seven hours in two days.

Your practice needs to be evenly spaced and consistent, and you must balance efficiency and retention. If you don't space your practice sessions far enough apart, you won't learn efficiently. However, the more space you have between study sessions, the less information you will retain, so if you space your practice sessions too far apart, your retention rate will be lower. Experiment to find the right spacing for each task.

Many ultralearners balance efficiency and retention with a spacing process called SRS, or spaced-repetition systems. Essentially, spaced-repetition systems are study periods (often automatically integrated into the technology of online programs like Duolingo and the flashcard-like Anki) that are spaced in such a way that you're able to review information at the perfect moment—right at the cusp of forgetting the information, but before you've actually forgotten it. The space between review intervals can also be increased over time, as your memory of the information gets stronger. For example, reviewing flashcards at increasingly longer intervals is a low-tech version of SRS.

SRS are most effective when used to study questions and answers (trivia, vocabulary, word definitions, and so on). As an alternative to flashcards, you might type out a document with questions on one side and answers on the other. Or, you might create spaced out mini-projects that allow you to refresh your memory on prior learning. For example, if you want to maintain your Spanish studies, periodically write a short story in Spanish and read it to native speakers.

Strategy #3: Proceduralization

Proceduralization is the process of committing a skill to muscle memory. *Procedural knowledge* is knowing the "how" of something (for example, skills like riding a skateboard). The goal for most learning is to develop procedural knowledge. *Declarative knowledge* is knowing the "what" of something (for example, facts and intellectual information). Most learning starts out declarative and evolves to procedural with enough practice. For example, when you first learn piano, you memorize the locations of each key and their corresponding note. This is declarative knowledge. With practice, you no longer need to think about where to place your fingers (this becomes procedural skill). Additionally, when you try to play a previously learned song, you may have trouble remembering the tune or the lyrics, but once you actually place your fingers on the keys, procedural memory kicks in. Declarative knowledge (the conscious memory of the song) is lost, but procedural knowledge (how to play the song) has been stored in long-term memory and is retrieved intuitively.

This suggests that it may be valuable to practice certain components within a learning project more frequently than others in an attempt to evolve that knowledge from declarative to procedural. That being said, it's likely that there are some things you cannot fully proceduralize. There will always be skills that require deliberate recall strategies (for example, when learning complex topics like physics or trigonometry). This means you retain some knowledge easily over time, while other knowledge is less likely to stick. **Set goals to proceduralize specific knowledge by the conclusion of a learning project, or commit to more practice upfront for certain tasks for the purpose of creating cues for later review (or building of new knowledge).** For example, if you're learning karate, which has many levels, spending extra time proceduralizing foundational karate techniques supports you to better learn and retain advanced techniques later.

Strategy #4: Mnemonics

Mnemonics is an area of study focusing on memory improvement. There are countless approaches to mnemonics, but they all share two qualities:

- They help you remember patterns of information, such as lists, acronyms, numbers, and poems.
- They generally involve translating information into images, which are easier to remember than

words or numbers.

One method of mnemonics, called the "keyword method," uses a word from a language you're learning and associates it with a similar-sounding cue word in your native language. Then, you take that word and create an image that associates the cue word with the original word. For example, if you're learning the Spanish word "comer" (which means "to eat"), you might use the phrase "come here" as a mnemonics cue for recall. Then, you might create an image of a mother sitting at a dinner table stacked with food to eat, and a speech bubble above her saying, "Come here!"

While it seems complex, this approach is especially effective for memorizing abstract, random, or seemingly isolated information. It converts a complicated recall maneuver into one with fewer steps by using abstract associations as cues for your memory.

There are a couple of drawbacks to mnemonics.

Drawback #1: Requires Upfront Investment

The process of building mnemonic associations is elaborate and may not be worth the time necessary to effectively create. It depends on what you're attempting to memorize. For example, if you're memorizing the periodic table of elements, the amount of time it takes to create associations for each element might not be worth it when you can just keep a copy of the periodic table with you for consultation (or Google it).

Drawback #2: Recall Is Indirect

Mnemonics creates a bridge to recalling information by creating indirect memory cues, but it doesn't support you to recall the information directly, which may not be helpful for long-term retention. Use mnemonics to memorize complicated information, structured in a very specific way, that you will need to use over a short to moderate length of time (weeks or months). You might also use it as a bridge to recall information that is difficult to memorize, but that you plan to master more directly later. For example, learning a new language, or dense medical terminology.

While forgetting is inevitable, each of these strategies go a long way in supporting the ultralearner to reduce memory loss and maximize long-term retention.

(Shortform note: For more tips on improving retention, read our summary of Make It Stick.)

Exercise: Improve Retention

Reflect on the 4 core retention strategies (overlearning, spacing, proceduralization, and mnemonics). Consider your learning goals and contemplate the strategies that may serve them best.

Choose one of the strategies that resonate with you. What is one way you can practice this strategy with your learning goals in mind?

Choose a second strategy. What is one way you can use this strategy to support your learning goals?

Chapter 11: Principle 8—Deeper Knowledge and Intuition

Beginners often fixate on surface-level aspects of a problem or learning goal. In contrast, experts delve into deeper layers and principles. This approach is more successful because it leads to a more complete understanding of the problem and its solution.

Deeper understanding improves intuition. We often think of intuition as mysterious and unexplainable, but actually, intuition is the result of deep, detailed understanding. When you have a lot of experience and knowledge related to a problem, you are better equipped to think of novel ways to solve it.

It's not enough to overlearn something—that won't deepen your understanding. There are four critical rules to developing deeper knowledge.

Rule #1: Let Yourself Struggle

Force yourself to struggle when you encounter a difficult problem or obstacle to your learning goal. Encourage this by setting a timer for 10-15 minutes and pushing yourself to work on the problem at least until the timer goes off. Either you will solve the problem during that time, or you better support yourself to solve the problem later because as stated in Chapter 6, you boost retrieval when you allow yourself to struggle to come up with answers you don't have.

Rule #2: Aim to Prove

We often think we understand things when in reality we have only a partial or rudimentary understanding. Researchers have deemed this phenomenon the "illusion of explanatory depth." For example, you might think you understand what a bicycle is and how it works, but if you were asked to draw a detailed picture of the mechanisms, you might find that you don't understand as much as you thought. We think we understand better than we do because we evaluate our understanding using indirect signals.

Always ask yourself, "Do I understand this well enough to explain how it works?" Experts don't consider something to be understood unless it is understood deeply, and they usually define that differently than those who are less proficient. Whereas a beginner might replicate the processes of others and become proficient, experts master things because rather than copy the processes and results of others, they work through their own process of achieving the result. This can cause detours and delays, but the result is that you learn more deeply. If you start with the answer to a problem and figure out your own way of arriving at that answer, you will have a deeper understanding than if you simply followed the traditional route to reaching the answer. For example, you will learn math more deeply by starting with the solution of an equation and working backwards to understand it than you will memorizing the equation that creates the result.

Rule #3: Challenge Your Understanding

When you don't know enough about a skill or topic, something known as the *Dunning-Kruger effect* can make you believe you still know more than those with proven understanding. The more you know, generally, the more you question what you know. If you don't challenge what you do know, you will consequently know less.

If you don't ask questions out of a desire to "feel good" about your knowledge level, you rob yourself of deeper learning, and your overall knowledge suffers because you convince yourself you do know enough.

Make sure your learning standards are strict and frequently question yourself. There is no such thing as a dumb question because the act of questioning supports you to gain knowledge you might have missed otherwise.

Rule #4: Prioritize Concrete Examples

It's difficult for the human brain to comprehend abstract concepts. We need to connect the abstract information to concrete associations. This works best if you create your own concrete examples, because the way you think about what you're learning directly impacts retention. If you process information by making deeper, more personal associations to it, you retain it at a deeper level. If you're not able to come up with a concrete example, you likely don't understand deeply enough.

For example, in a recent recall study, participants were shown a list of words. Half of the group was told they'd be tested on the words, and the other half was just told to study them. The groups were then split in half again, and one half was instructed to notice the words with the letter "e" in them (shallow processing), while the other was instructed to notice how the words made them feel (deep processing). It turned out that the testing motivation made no difference, but **those instructed to notice how the words made them feel retained twice as many words.** This "concrete association" method supports retention, develops intuition (deep understanding), and provides feedback because you need to understand what you're learning deeply in order to create a concrete example.

Alternatively, say you're studying the periodic table of elements (abstract information), and using flashcards to do so. Connect the abstract information to something concrete by imagining something you'd do with each element. For example, if you're learning about copper, imagine making a penny out of copper.

The Feynman Technique

Physicist Richard Feynman, known for his eccentric approach to learning, inspired an ultralearning method for developing deeper knowledge. It's a valuable tool when you want to understand an idea intuitively. The method has three steps:

Step #1: Grab a piece of paper and document the issue or idea you're seeking to understand.

Step #2: Underneath the idea, write an explanation of the idea as if you're teaching another person.

- If you're exploring a problem, give a detailed description of how to solve it, and explain why it's the best approach.
- If you're exploring an idea, describe it with the assumption that your reader has no knowledge of the idea.

Step #3: As you're completing step #2, stop whenever you don't feel able to clearly explain, and review your learning resources to get clarity. Then continue with your explanation.

This method helps you overcome the illusion of explanatory depth (which makes you think you know something better than you do) by making you describe what you're learning in detail.

There are three significant scenarios this method can benefit.

Scenario #1: Lack of Understanding

When you don't understand something at all, apply the method while going back and forth between it and

your learning materials. This allows you to slow down and make sense of an idea until you understand it deeply enough to describe it to others.

 Scenario #2: Problem-Solving Difficulties

When you come across a problem that feels unsolvable, or you're struggling to master a skill or method, use the Feynman technique to create a standard explanation summary, but as you're doing so, break the problem down step-by-step (in even greater detail than the summary). This keeps you from writing your explanations only in summary form, which may cause you to lose key details for your understanding. You invest more time upfront, but you save time later by solidifying your understanding in one practice session. For example,

 Scenario #3: Intuition Development

Try developing your deeper understanding of an idea by exploring it in a wide variety of ways. For example, create abstract, visual representations rather than putting each detail into words, (the intention being to create examples that learners with less understanding will easily grasp).

Exercise: Practice the Feynman Technique

Reflect on your topic or skill and identify an aspect you have some confidence in your understanding of.

How well do you feel you understand this aspect? Write about your understanding of it in as much detail as possible.

Now write about the aspect again, but this time, write about it as though you are teaching it to someone else.

If possible, draw a visual representation of the aspect below.

Compared to the beginning of this process, how deeply do you feel you understand the aspect now?

Chapter 12: Principle 9—Experimentation

If you wish to go beyond proficiency and achieve mastery of a skill or topic, experimentation is the best way to accomplish that. There is ample evidence that experimentation unlocks mastery. Van Gogh was one of the most eccentric painters in history. Notable in his learning approach is a diverse set of self-directed, experimental methods, perspectives, and materials. Using so much variety, he was able to explore until he found his own unique style. Of further note was his intensive strategy for learning, obsessively producing countless paintings in spite of being criticized by others for lack of skill. This intensity supported him to overcome impediments in his environment and proficiency level, which allowed him to create the classic works he is so well known for today.

Van Gogh chose to address any skill or element he struggled with by intensively practicing it from as many angles as possible, resulting in hundreds of creations. Once he finished with one element, he'd start with a new one, understanding that he needed to catch up with the skills of other painters. This process not only made van Gogh into a skilled painter, but it also turned him into one of the most unique painters of his time. In addition to his intensive practice, he also absorbed as much learning as he could from peers, mentors, and fellow painters by incorporating ideas from each into his practice. This included techniques, tangible resources, ideologies, and philosophies. For example, he often cycled back and forth between bold styles of impressionism and older, more traditional approaches.

Further evidence of experimentation's value:

Evidence #1: Experimentation Leads to Personalized Learning

When you first learn something, follow in the footsteps of someone who has been learning it longer. This metalearning allows you to set yourself up for initial progress. But at a certain point, you will not be able to follow the examples of others and will need to determine your own learning style. This experimentation is inevitable because as you gain proficiency, there will be fewer people who have something to teach you, and you will naturally find your own unique path to mastery.

Two people who are new to learning something will have more in common than two people who have achieved mastery. Experts have their own unique priorities and styles. For example, Laszlo Polgar, the father of chess genius Judit Polgar, taught all three of his daughters well-enough that their skill eventually surpassed his. This forced each of them to develop their own motivation and focus for further growth, allowing them to define their own unique styles of play. Alternatively, consider child stars who grow up doing the same kinds of films and television shows (for example, Disney stars), and, as they get older, graduate from this basic style of acting, branch out, and begin selecting projects more personal to them.

Evidence #2: Experimentation Leads to Efficiency

When you first start learning something, your priority is gathering as much knowledge as possible. Once you're proficient in a skill or subject, you may want to achieve mastery, in which case your focus will be refining your learning and practice process through experimentation. This generally involves editing and modifying your strategies for achieving eventual mastery. This is essentially a process of "unlearning" ineffective strategies and almost always involves taking exploratory risks to determine new, better ways of solving problems. Newcomers know how to problem-solve, but masters know the most efficient way to problem-solve. This is because they have unlearned the least valuable information and learning methods.

For example, a newcomer might successfully make it to the end of an obstacle course, but a master will make it to the end of the course in record time because they've practiced long enough to experiment and find the fastest route.

Evidence #3: Experimentation Leads to Originality

Proficiency is not the only important aspect of mastery. Originality is another marker, and originality requires creativity, which requires experimentation.

There are three main types of experimentation.

Type #1: Resources

This involves experimenting with materials, strategies, and other learning resources. Experimenting with different resources helps you to determine, not just the resources you can use to learn, but which resources work best for you personally. For example, if you're learning to draw with pencil, you might take some time to experiment with charcoal or pen. The differences between the materials can lead to valuable learning insights.

The critical element here is setting boundaries around your exploration. Identify the resource you want to experiment with and give yourself a time constraint for intensive exploration. Once the time is up, analyze your experience and determine whether or not it's valuable to continue experimenting. If not, pick a new resource to explore.

Type #2: Technique

Shift your technique from focusing on "How can I learn this?" to "What should I learn next?" Determine a subtopic or sub-skill and spend time intensively learning it, then analyze your results. For example, if you are learning how to box, and you want to develop more of your own style, you might experiment with intensively learning freestyle dancing or gymnastics, and then reviewing the impact of that study on your boxing.

Type #3: Style

There is no "right" style. All styles have their pros and cons. Evaluate your personal strengths and weaknesses and experiment with various styles to see which ones complement and which clash. Study those who are masters of what you are learning. They will all have their own style to what they do. Do your best to explore through replication or integration and pay attention to what fits for you. Some skills need to be conducted in a specific way, but others will vary. For example, writers with equal proficiency can write in many different styles. When you are proficient enough, you get to choose your unique expression of that proficiency.

The Experimentation Mindset

When you have an *experimentation mindset*, you have an implicit belief in your capacity for growth. When you have a *growth mindset*, you see an expandable capacity for improvement. There are significant parallels between the experimentation mindset and growth mindset. If you don't believe in the possibility of growth, you have a *fixed mindset*, which is the polar opposite of a growth mindset. You cannot experiment when you have a fixed mindset because experimentation requires a growth mindset.The growth mindset supplies the self-confidence you need to learn, while the experimentation mindset supports your active pursuit of

learning.

Bottom line: If you believe you have a capacity for growth, and you pursue growth, you will experience growth.

Use the following avenues to explore experimentation.

Avenue #1: Replicate

Replication gives you a place to start as you seek to expand and helps narrow down further avenues of exploration. For example, van Gogh once knew so little about painting that it was most beneficial for him to learn and explore by copying the methods or styles of other artists. Once he gathered enough information this way, he was able to narrow down the twists and turns on his learning path.

Beyond that, replication allows you to study how an approach actually works. This gives you insights into why a particular approach might be so effective for a peer learner and also helps you identify aspects of your skill or topic that hold less importance than you initially thought. For example, if you're an aspiring actress, make a list of the actresses you admire and practice with material from their filmography. In doing this, you learn which genres to specialize in (perhaps you're better at comedy than drama or have a knack for historical pieces).

Avenue #2: Compare

Try two different approaches and vary a single component between the two. This will give you immediate information about the impact of that component, and consequently, which approach is best for you to use.

The core advantages are twofold.

1. Testing one factor in multiple ways improves efficiency.
2. Trying to solve a problem in a variety of ways expands your level of experience and supports you to step outside your comfort zone.

Avenue #3: Constrain

Constraints force you to move outside your comfort zone to learn in new ways, and this enhances your proficiency. Once you've gained knowledge, the pitfall is thinking you know more than you do. Fight against this by giving yourself new rules that require you to come up with new ways to learn.

For example, if you've reached proficiency in a new language, but you've been practicing with bilingual mentors, give yourself a constraint by practicing with speakers who do not speak your native language.

Avenue #4: Diversify

Select an additional skill to practice that is seemingly unrelated to a skill you've already defined or mastered. Proficiency in both skills can give you a competitive advantage. For example, if you're a nurse, you might take up painting. You may not be a master at either, but you will open yourself up to niche opportunities that might not have otherwise been available. For example, maybe you are the perfect person for a new job combining healthcare and art.

It's possible it will take multiple learning projects for diversification to become valuable. The more projects you complete, the better you will understand how various skillsets can influence one another.

Avenue #5: Explore

Because there are so many skills and topics with aspects that can be used in bold ways, doing so deliberately gets you thinking outside the box (where creativity thrives). Get out of your comfort zone by deliberately exploring the extremes of your chosen skills or topics. It may be tempting to explore in comfortable ways or at a scale that feels safe, but operating like this can limit your understanding of what is possible for your growth. The more complex the layers in a skill, the more likely it is that you can push those aspects to an extreme. For example, if you're learning to paint, explore color by trying out bold shades or unusual color combinations, allowing you to push the boundaries of the materials available to you. Even if you end up retreating back to moderation, you will have gained experience and expanded your awareness of your learning capacities.

Learning is an uncertain process. If you stay stuck in comfortable, predictable routines, you don't experience the discomfort you need to grow. Experimentation runs through all nine ultralearning principles because it forces you to put yourself in unfamiliar environments, dig deep to solve problems as they arise, and discover the best possible methods for your learning.

Exercise: Experiment With Replication

Reflect on the 1st avenue of experimentation, "Replicate."

Think about your chosen topic or skill. What's one method from others who have mastered your topic or skill?

Select one method and spend 20 minutes practicing it. How did practicing that method impact your understanding of the topic or skill?

Select a second method and spend another 20 minutes practicing. How did the practice impact your learning? Did it have a different effect than the previous method? If yes, how so? If not, what is something valuable you can take away from the experience?

Exercise: Explore Extremes

Reflect on the 5th avenue of experimentation, "Explore the Extremes."

Consider your topic or skill, and identify the most common ways of approaching or practicing it. What are some "outside the box" ways you can alter that approach?

Select one of the new approaches and practice it for 20 minutes. What are some insights you discovered from the experience?

Chapter 13: Create Your First Learning Project

Now that you've explored the nine principles of ultralearning in depth, you're ready to create your first ultralearning project. We'll cover the five steps to successfully create and complete a self-directed project.

Step #1: Research

For every ultralearning project, your first step will always be to conduct metalearning research. This will save you time and boost efficiency by allowing you to create the learning structure most appropriate for your learning goals. By the time you finish this step, you should have clarity on five components.

Component #1: Learning Goals

First, determine what you want to learn. Is your motivation instrumental? Perhaps you wish to start a business, or develop skills to boost your advantage for a promotion at work. Or is your motivation intrinsic? Perhaps you want to learn a new language or how to play the guitar.

Select a simple learning goal for your first project. You can always expand upon it, but be realistic initially.

Component #2: Resource List

Next, create a list of core materials to support your learning. This can include podcasts, books, video content, YouTube "how-to" videos, friends, colleagues, coaches, and so on. Additionally, use this research as an opportunity to figure out where you intend to start. For example, let's say you want to learn Spanish. Your plan might be to learn Spanish using Rosetta Stone software. Make sure you have all your materials before you get started.

Component #3: Learning Benchmarks

Another critical component is knowing what successful learning looks like for your specific goals. Take this opportunity to research what others may have used to achieve the same or similar goals. You don't need to replicate what worked for others, but the information serves as a guideline, both for common pitfalls as well as things that work.

Component #4: Practice Activities

Brainstorm how you will put what you are learning into practice. It is ideal that this practice be direct and begun as quickly as possible. If you realize at this stage that you're not able to practice directly, come up with ideas for activities that will strengthen whatever components will be necessary to master the skill or topic.

Component #5: Alternative Resources and Activities

This is where you identify practices and materials to use as a backup if your core tools are no longer useful, or as a way to build on existing resources.

Step #2: Create Your Schedule

A time investment is necessary to be successful in your learning goals, and while an excessive routine is not required for proficiency, different learning goals will vary in their time requirements. Determine how much

time you're willing to spend now so that you don't run into pressure or frustration down the line. By setting a schedule in advance, you support yourself in two ways.

- You solidify in your subconscious that you are committed to the project. This will automatically set you up to prioritize it.
- You bolster your motivation in the face of tempting distractions because you have a plan to stick to.

To do this step successfully, make three decisions.

- How much time are you willing to devote to the project?
- What do you want your learning schedule to look like?
- What is your overall time benchmark for the project?

The best schedules are consistent because that steadiness helps you to develop healthy study patterns and consequently save energy in the long-term. If your schedule needs to be flexible, it's best to learn in shorter increments at spaced out intervals. In some cases, you might prefer long stretches of study (for example, if you're writing and need the time to get into a good flow).

It's often easier to dedicate energy towards short-term rather than long-term commitments. So, even if you have a large learning goal, split it into short-term goals that support the long-term benchmark. If you have a longer-term project, do a test run of it for a week. This gives you an opportunity to spot any flaws or impediments and make modifications before you officially begin the project.

Once you determine all of this, immediately document it in your calendar or planner. Doing this detailed scheduling in advance will support you to notice possible obstacles (like other time commitments), and keeps the commitment to the project at the forefront of your mind. If you have difficulty demonstrating your commitment at this stage, it's a sign you're not mentally prepared to start.

Step #3: Actualize Your Plan

This is when you put your project into action. Be mindful throughout the process of whether or not your actions are aligned with ultralearning principles and your overall learning goal.

One strategy is to construct questions for yourself for each principle to check your progress.

- **Metalearning:** Have I completed enough research to determine the best ways to learn this skill or topic? Is there anyone I can get new insights from?
- **Focus:** Am I able to concentrate during my learning sessions? Am I working in an optimal environment for focus?
- **Directness:** Am I practicing my skill in an environment similar to the real one? How else can I practice directly?
- **Drill:** Do I feel overwhelmed by the components of what I'm learning? How can I break down more complex concepts?
- **Retrieval:** How often do I check my notes when practicing recall? Am I easily able to recall old learned information or only recently learned information?
- **Feedback:** What is the status of my learning progress? How do I know what to improve? Is there any feedback I'm considering that I shouldn't?
- **Retention:** Am I using deliberate spacing to encourage long-term retention? Am I practicing overlearning?
- **Intuition:** How deeply do I understand what I'm learning? Can I write a fictional story or short essay

about what I'm learning? Can I easily explain it to someone else?
- **Experimentation:** Am I stagnant in my learning approach? Do I need to explore new avenues of learning? How can I go beyond proficiency to achieve personal mastery?

Make modifications wherever necessary and possible.

Step #4: Analyze Your Results

Regardless of your success, it is always valuable to analyze your results. For successful projects, repeat the things that worked, and for weak projects, identify where and how to improve. Beyond just mastering a skill or subject, the overall goal of ultralearning is to become a deeper, more effective, and efficient learner.

Step #5: Determine Your Post-Project Plan

Much of what we learn decays with time, so determine your plan for retention right after you reach the learning goal, using three core strategies.

#1: Maintenance

This approach involves practicing what you've learned just enough to maintain the proficiency level you achieved by the end of your project. One way of doing this is to get into the routine of practicing regularly. This doesn't have to be rigorous, but consistency is key. Another way is to figure out how to incorporate what you've learned into your day-to-day life. This is less predictable or consistent, but it ensures that what you've learned continues to be usable.

The longer you maintain your knowledge of something, the more likely it is to be retained. You can eventually reduce the frequency and intensity of your practice without worrying about losing a majority of the information or skill.

#2: Relearning

If you don't want to do regular maintenance, come up with a plan for relearning the skill or topic when you need to. The first go-around when learning something is usually harder than relearning. The information, while not easily accessed, is still accessible with proper recall cues. Relearn by taking a class or designing a series of activities to relearn on your own.

#3: Mastery

You may not be satisfied with proficiency and will want to deepen your learning further. If you practice regularly at a less intense pace or immediately begin a new learning project that supplements the original learning goals, you will put yourself on the road to mastery.

Mastery is generally an incremental path, and once you've reached proficiency, you can proceed with further study at a slower pace. However, if you're learning something particularly challenging, you can also reach mastery through the more intensive ultralearning pace.

Chapter 14: Ultralearning at Home and at Work

This final chapter explores methods for raising a child to become a proficient ultralearner (whether it be in one or multiple disciplines), using chess prodigy Judit Polgar sisters as a case study. The chapter then pivots to how to apply ultralearning strategies in your work and home environments.

The Polgar Family Strategy

One of the most famous examples of a child ultralearner is Judit Polgar, the best female chess player in history. Trained with her sisters from a very young age by their father, Laszlo Polgar, Judit eventually became a grandmaster, and the 8th-best chess player in the world, shattering long-held gender barriers and becoming the only woman ever to compete in the World Chess Championship.

Judit and her two sisters were all raised from early childhood to become chess masters. Their father believed genius was a result of education rather than genetic factors. He began his daughters' chess education by teaching them the basics, then taking them with him to play practice games in local chess clubs. While her siblings developed incredible chess skills, Judit was the most obsessive and ambitious of the three. She became skilled enough to develop a rivalry with chess king Garry Kasparov, losing their first game together and winning the second. His eventual defeat marked a positive change in the chess world's attitude towards female chess players and proved the efficacy of Laszlo Polgar's ultralearning strategies.

How to Raise Successful Ultralearners

Through the lens of the Polgar family's story, consider how you can apply the following ultralearning principles with young learners.

1. Metalearning

Laszlo Polgar explored and identified the best ways to learn chess and created optimal learning conditions for his daughters. He designed activities, built a collection of materials, developed strategies, and constructed an incremental, long-term education plan that allowed his children to learn the game slowly and deeply.

2. Focus

Laszlo made concentration a top priority in his coaching of his daughters. He gave them opportunities to increase their endurance by signing them up for marathon chess tournaments.

3. Directness

A critical part of the Polgars' chess education was direct practice. Laszlo started bringing them to live games very young, allowing them to learn how to adapt to real-life variables like differences in skill or time constraints. This made future competitions less intimidating.

4. Drill

Laszlo also took care to isolate aspects of the game or skill set for the girls to practice intensively. For example, he used games involving blindfolds to encourage quick thinking and creative problem-solving.

5. Retrieval

The Polgars often learned via the *Socratic method*, solving challenges and answering questions formulated by Laszlo rather than reciting memorized information. For example, he would ask them to explain or

practice plays without looking at the board (where the plays were documented).

6. Feedback

Judit and her sisters learned to pursue live chess play, but Laszlo set each of them up with opponents who generally matched their skill level. He made sure they were challenged, but not overwhelmed by the skill of others, and he made adjustments to the match-ups as their skills improved. In doing this, he was able to get direct and immediate feedback from the practice environment about the girls' progress.

7. Retention

To reduce the chances of lost knowledge, Laszlo had the sisters play games at an accelerated speed while using previously learned chess patterns. He also deepened retention by using deliberately spaced practice.

8. Deeper Knowledge

The Polgars developed deeper knowledge by writing articles about chess (an iteration of the Feynman Technique), engaging in chess "play" (chess-related activities with no specific goals), and coming up with creative solutions to random challenges posed by Laszlo. This unstructured creative process allowed the girls to look at the game and their gameplay from new and deeper perspectives.

9. Experimentation

Eventually, the skills of the Polgar sisters exceeded the skill of their father, and they had to continue developing their gameplay through self-directed experimentation. Each of the girls chose strategies and areas of focus that began to define their individual playing styles.

As the sisters matured into adults, they continued to embody the standard ultralearner formula (obsessive, intensive, and self-directed learning). Judit and her sister Zsuzsa became grand masters, while Zsofia achieved the title of international master.

Strategies for Successful Ultralearning in Any Environment

Ultralearning is not just limited to the experience of the individual. Ultralearning strategies and perspectives are valuable for all aspects of life and society. Broader goals might include self-sufficient students who understand how to direct their learning outside of the classroom or ambitious employees taking the initiative to improve their skill sets and contribute to the goals of their companies. Whatever the endgame, there are three strategies that will powerfully encourage an ultralearning approach in any environment.

Strategy #1: Prioritize Inspiration

Inspiration is a critical part of what motivates us to learn. That inspiration can be extrinsic, like the excitement of taking a new direction in your career, the hope that what you're learning will result in financial success, or the anticipation of a fit body. It can also be intrinsic, like taking up dancing because you've always enjoyed watching others dance and you want to learn for fun. It doesn't matter what your motivation is, as long as it's powerful enough for you to invest in. For example, if you're an educator, you might implement a lesson plan where your students get to design their own topic of study for a trimester. This allows them to get excited about a topic and pursue understanding from intrinsic inspiration.

Strategy #2: Use Competition to Your Advantage

Be mindful of how your learning environment can impact your confidence. If you have natural talent at a skill, try putting yourself in competitive practice environments with peers to encourage self-confidence. If you are of moderate or low talent, try a more creative and individualized approach to practice (this will

encourage you to measure your growth in competition with yourself rather than your peers). In many cases, you may start out with a more individualized approach and evolve to competitive environments.

Early self-confidence is an important part of the ultralearning process. It's not necessary to already be skilled at something to get invested in learning it, but it is necessary to believe it's possible to *become* skilled. For example, if your perception of math is that you're terrible at it and will never learn, you will not feel motivated to improve (it becomes a self-fulfilling prophecy). Alternatively, if your perception of math is that you don't understand it but with time and effort could gain proficiency, you are more likely to pursue that goal.

Strategy #3: Focus on Learning

Rather than using a specific end result to motivate your learning, let learning itself motivate your goals. For example, if you're an employer, give your employees work they can complete relatively easily, but regularly give them small projects requiring skills they don't yet have. Your employees get to struggle through learning new skills and this encourages a collective learning driven mentality in the workplace.

In our society, we often use learning as a means to an end, rather than making it the goal on its own. For example, you take a coding class at work not to deeply learn coding, but to complete a list of new tasks your employer wants to add to your job. The benefit of focusing on learning is that it teaches employees to work through solving difficult problems and reveals individual and organizational strengths that might have otherwise gone undiscovered.

A Note on Alternative Learning

While ultralearning strategies may be a perfect fit for you, there is still value to other learning approaches. There are two notable alternative approaches you might consider.

Approach #1: Low-Intensity Learning

Habits exist on a spectrum. On one end, habits require little to no effort, on the other, they require intensive effort (ultralearning). The majority fall into the middle, requiring moderate effort. Typically, as proficiency increases, so does enjoyment. Low-intensity learning habits (for example, practicing Spanish sporadically with no specific proficiency goals) can be enjoyable, but not as efficient or effective as ultralearning habits. They're effective when you're learning at a leisurely pace, for the purpose of enjoyment, or as a strategy for maintenance after the conclusion of an ultralearning project. For example, if you're learning a new language but aren't giving yourself time-constraints, or you are just learning for fun, you might, upon reaching basic proficiency, simply travel to the applicable country and naturally improve with immersion.

Habits are most effective when your learning process consists of a gradual addition of new pieces of knowledge or abilities. In contrast, the ultralearning approach is most effective when what is being learned is challenging, or triggers mental obstacles within the learner to be worked with and overcome. For example, if you're upgrading your skill set in the sales field, you might use ultralearning to replace out of date communication skills with new communication skills that reflect the modern sales environment (like pitching to clients digitally versus making cold calls or conducting door-to-door sales).

Approach #2: Traditional Education

As stated, ultralearning doesn't have to be done alone. It's characterized by being self-directed, and if you determine that formal education is effective for you, the use of it is still aligned with ultralearning. What is

most important is that you use ultralearning to create more opportunities for yourself. No approach is discounted.

There are a few benefits to prioritizing formal education over ultralearning.

#1: Credentials

If you're learning for professional purposes and your target profession will benefit from credentials, formal education is a smart approach.

#2: Beneficial Learning Environment

Some elements of formal education slow or impede learning, but there are other elements you *only* find in the traditional setting. For example, if you're an artist, you'll benefit from the apprenticeship-style approach of many well-regarded art schools. Other concentrations may benefit from programs that facilitate team learning experiences.

#3: Community

If you go to graduate school, you will likely have access to an entire community that lives and breathes your educational focus, which will provide you with invaluable information from specialists and access to opportunities you may not find learning on your own.

Conclusion

In the end, the ultimate benefit of becoming a well-practiced ultralearner is that you set yourself up to continually strengthen and expand your capacity for learning throughout life. Through the use of ultralearning strategies, the possibilities for developing your full potential are limitless.