A Mind For Numbers Summary

By Barbara Oakley

Do you have a mind for numbers?

A Mind for Numbers shares the secrets of learning math and science. All of us have what it takes to excel in these subjects, and understanding them doesn't have to be painful. We're shown straightforward, effective, and efficient techniques that researchers know about learning, and we're taught how to have fun in the process.

If you're convinced that you don't have a knack for math or science, you may find this hard to believe – there's hope! Professor Barbara Oakley, argues that there's nothing special about math and science. We all have the potential to learn these subjects, but not all of us know how to learn.

Barbara Oakley is a passionate professor of engineering. However, math and science were not always her forte. She flunked algebra and physics in school, and after school, Oakley joined the army. During this time, she worked alongside West Point Engineers and was intrigued by their powerful problem-solving techniques. She noticed they had a 'mind for numbers,' and wanted to know what they knew about solving complex problems. Oakley didn't yet believe that she had a mind for numbers, but she had a spirit for adventure, and a love for learning. She especially loved learning new languages. So while calculus and physics looked like hieroglyphics for our author, this was a language she wanted to learn.

This wasn't an easy journey, but Oakley went on to graduate and excel in the field of engineering. However, if she knew then what she knows now,

about "how to learn," she believes her student years, could have been a more comfortable rite of passage into the working world. Fascinated by how we can learn, and learn complex subjects, she reached out to top professors and asked them how they learn and what they teach others about learning. She turned to neuroscience and cognitive psychology, and through all of this, she found central keys to learning effectively. In her book *A Mind for Numbers*, she invites readers on an adventure on learning, how, to learn.

Oakley explores how our brain processes information, and how we can optimize this processing power to unleash our cognitive potential, and master just about anything, not only calculus and physics. For those who already have a "mind for numbers," this book offers skill-building exercises to help broaden your enjoyment, creativity, and equation solving elegance. So whether you're a novice or an expert, if you're looking for proven strategies to enhance your ability to learn, retain, and recall complex information, then this is the ideal book for you.

We'll briefly look at how our brains learn best. Then we'll dive into practical tips on preventing procrastination, keeping our focus, and improving our ability to remember and recall complex information. But first, let's explore our brains a little more.

Two Ways of Thinking: The focused and the diffuse mode

Picture a torch with two settings. We can intensely focus a beam of light on one small area, or we can zoom out, and shine the flashlight less powerfully, but more broadly. Our brains operate in the same manner. The focus mode can be compared to a tightly focused beam of light,

versus a wide beam representing the diffuse mode.

The focus mode is concentrated attention. We direct our attention to solving problems and, in doing so, rely on rational, sequential, and analytical thought. Diffuse mode is relaxed attention. We allow our brains to wander and consider a wide range of things. It's like daydreaming – where we don't think about any one thing in particular. Neurologically, while in focus mode, we're operating in a small area in front of the brain, called the prefrontal cortex. However, in diffuse mode, multiple brain regions light up. So the focus mode helps us get to grips with the problem, and unpack the details, while the diffuse mode gives us the big-picture perspective.

To learn, we need to be both analytical and creative in thought. To fully grasp both the detail and the big picture of what we're trying to learn, we need to direct our attention, and then let it wander. So, focused thinking, and diffuse mode thinking are fundamental for successful learning.

We're in focused mode when we're intently focused on a problem and try to find the solution. For example, our brain's in focused mode because it already has an ingrained mental path on how to solve a particular problem. It then makes quick and similar attempts at solving the problem, such as when you practice multiplying numbers (assuming you already know how to multiply). The Diffuse mode on the other hand, comes into use when we get stuck, or are working on a problem we've never seen before. When we're using the diffuse mode of thinking, our brain can jump from idea to idea, concept to concept, and connect new knowledge, with previously learned information.

Here's a practical example to differentiate between the two modes of thought. Consider the following sentence: Thiss (spelled T H I S S)

sentence contains threee (spelled T H R, E E E) errors.

Are you able to spot all *three* errors?

The first two spelling errors may be easily noticeable using a focused mode approach. But you might still be wondering about the third error? The third error is that the sentence is untrue, because there's no third error. This out-of-the-box way of thinking only becomes apparent when we use the diffuse mode to consider the sentence more abstractly.

If we stay in focused mode too long (such as when we're stuck on a math problem), this becomes more problematic than helpful. By intensely focusing on the problem for too long, we experience tunnel vision, and lose our ability to think outside-the-box to solve that problem.

Focused and diffuse thinking both have their purposes. To get the best of both worlds of thought, we need to effectively switch between the two modes when learning. First, we use the active, focused way of thinking to understand the basics of a topic without any distractions. Then we use the diffuse mode to passively internalize what we have learned, and make connections to other things we already knew. We then switch back to focused mode and pare down the links that we made to the most helpful ones.

Switching Between the Two Modes

How do we effectively switch between the two modes of thinking?

To get into focused mode, Oakley recommends using the Pomodoro method. Block out distractions, and commit to focusing on just one thing

for 25 minutes. Once the time is up, or you've continued past that time, but happen to hit a wall of confusion and frustration, then it's time to step away, and not feel guilty about it. Once you return from your break, you might be surprised to see how easily the solution may appear. Using the Pomodoro method is one of the most effective learning techniques that Oakley has learned to master any material.

As for diffuse mode: sleep and rest periods are crucial to refresh and rejuvenate our thinking.

For those who fell asleep during maths and science class, you'll be pleased to know that perhaps this was your brain's way of processing information. There's a reason why people say "sleep on it." Sleep plays a vital role in brain health, learning, and memory. Sleep clears away toxic products that are created in our brain during waking hours. Oakley says that reading material before we go to sleep means we have a higher chance of dreaming about it, which can further entrench our understanding of the issue.

And here's the good news, even taking a short nap can help.

Whenever Thomas Edison felt stuck trying to solve a challenging problem, he would stop, and, while still sitting in his chair, hold two ball bearings in his hand. After a few minutes, just before he was about to slip off into sleep, the two ball bearings would fall out of his hand and onto the floor, waking him up. And that was his trigger to get back to work. When he returned to his work, he'd often have a 'lightbulb' moment, which helped him to solve the issue he was stuck on.

You might be wondering how taking a break can lead to a creative breakthrough. Oakley explains that we might not feel hard at work during

rest periods, but our diffuse mode certainly is. When we switch to diffuse mode, the ideas we gather from the focus mode are allowed to bounce around the brain and access a wide range of neural regions that aren't available to us when we're in focused mode. Our mind has time to make comparisons and connections between new ideas and prior knowledge. Diffuse mode helps us to learn at a deep and creative level.

To tackle complex intellectual challenges, and learn new concepts, we need periods when we're in focused mode, and then in diffuse mode, when we do not consciously think about the issue.

Now let's explore tips and tricks to beat procrastination, hold our focus, and boost our memory.

Prevent Procrastination

Have you ever sat down at your computer to work, quickly checked Facebook, and then ended up down a YouTube rabbit hole three hours later?

We've all encountered procrastination at some point; it's like an addiction. We procrastinate because we're often uncomfortable with difficulty or fear failure, so we find other ways to feel good and avoid the pain of starting. But Oakley highlights something important. MRI studies show that the pain receptors in our brain light up in anticipation of something. So just the mere thought of studying for a test, that we may be fearful of, offsets a physiological pain response in our bodies. Interestinglyhowever, when we simply engage in the activity that we try sodesperately to avoid, the pain dissipates. This shows that it's theanticipation that's painful, not the actual engagement.

So one way to just get started is to change our mindset. Focus on the process rather than the outcome. So if you're studying for math, don't focus on getting the homework assignment done, which is the outcome; focus on just putting in 20 minutes of work. Focus on the process of putting in the effort, not the product. This helps us relax, feel more in flow, and not judge ourselves against how we should be doing. And because procrastination is a bad habit, we can combat it by forming new healthy habits. Oakley looks at four components that constitute habit formation.

The first is the cue. We need to recognize what launches us into our procrastination mode. For example, quickly deciding to check Facebook, is something that we know isn't going to be quick. We all know where this leads. So to counter this, turn off all social media notifications for a set time period.

The second component is the routine. Developing rituals can help aid us in creating a healthier routine. Maybe we tend to reach for our phone every few minutes when studying. An example of a ritual would be leaving our phone off, and perhaps in another room when we study.

Rituals can be reliable habits that form part of our routines.

The third component is the reward. Habits are powerful, as they create neurological cravings. Once our brain starts to expect the reward, the necessary rewiring will occur, which will allow us to develop new habits. Perhaps we could reward ourselves by having lunch with a friend, which would hopefully spur us into completing our set tasks.

The final component of habit formation is that of the belief. The belief is the most crucial part of changing our old procrastinating ways. We must believe that we can do it. We may very well fall back into our previous, more comfortable habits when the going gets tough. A robust approach to apply, is what Oakley calls mental contrasting. Mental contrasting is when we think about where we are now, and contrast that with where we want to be. An optimistic future vision to work towards will hopefully help us stick to our newly formed, healthier habits.

The better we get at something, the more we will find we enjoy it, and the less we procrastinate. Being able to get over procrastination is one thing. It's also imperative that once we get going, we take in and remember what we're studying.

Memory Tips That Work

Oakley believes that with a few memorization techniques, we can make learning meaningful and fun. Let's explore creative tricks to make what we learn stick.

One memory trick that may be useful is "spaced repetition." Spaced repetition is simply leaving some time before going over the information

again. An example of spaced repetition is making flashcards of information we need to learn, and waiting several days before going over them again. Gradually, we can extend the time between going over the flashcards as the material becomes embedded into our long-term memory. These help to lodge ideas into our memory. For something to move from our working memory to our long-term memory, 'it needs to be memorable, says Oakley, 'and it must be repeated.'

Here's where we get to be creative. For material to be memorable, we need to make it meaningful. Metaphors or lively visual analogies help to glue an idea in our minds. Oakley explains, 'they make a connection to existing neural structures that are already there.'

Another tip that Oakley shares is to use meaningful acronyms and abbreviations, which can allow us to simplify and chunk what we're trying to learn. For example, use memorable sentences or associate material to a unique event. You could use, 'My Very Excellent Mother Just Served Us Nine Pizzas,' as an example of memorizing the order of the planets from the sun.

It's also helpful to use stories. Integrating information that we need to learn into a personal anecdote can allow us to retain said information more easily. And, the more ridiculous the narrative, the better.

Lastly, get out the pen and paper. Oakley highlights how important handwriting notes are for retaining information. She explains that 'handwriting appears to help us more deeply encode, or convert into neural structures, what we are trying to learn.' We may also find that by writing, we summarize information more concisely, instead of merely copying down information verbatim when typing. Reading out loud also seems to enhance retention.

Now that we're equipped with tips on how to improve our memory, we can move on to the next step, which is to learn how to excel during tests.

Test for Success

Testing is itself an extraordinarily powerful learning experience.

We retain and learn far more during a one-hour test as opposed to studying for an hour. Oakley informs us that testing is a fantastic way of concentrating our minds.

When taking a test, some of us have been taught to tackle the most straightforward questions first. But it turns out that this might just be counterproductive. Oakley explains how it's essential to start with what appears to be the most challenging question. With the most difficult question loaded into our mind, we can then switch our mind away from it, effectively allowing the diffuse mode to activate. This "hard-start-jump-to-easy" technique enables different parts of the brain to work simultaneously on different thoughts.

If we struggle with test-anxiety feelings, the most critical aspect when it

comes to test-taking, is to change the way that we view tests and exams. Oakley says, "by shifting our thinking from, 'I am so nervous about this test,' to 'I am so excited for this test, and I am going to try my best,'" this can make a significant improvement to our performance. Another important tip for us anxious test-takers, is breathing. Taking some time to focus on deep breathing signals that all is okay, which helps us calm down and think more clearly.

In Conclusion

Oakley believes our brains have amazing abilities; the only problem is that they don't come with an instruction manual. *A Mind for Numbers* is a practical yet inspiring book, that's an instruction manual of sorts, to help us unleash our cognitive potential.

We can learn to stay focused, take rest breaks, and build better, healthier habits that enhance our analytical and creative capacity to learn just about anything we apply our minds to.

In "sum," it's less about what we learn, but how we learn. And by learning how to learn, we can learn just about anything. So, what is it that you want to develop your mind to do?